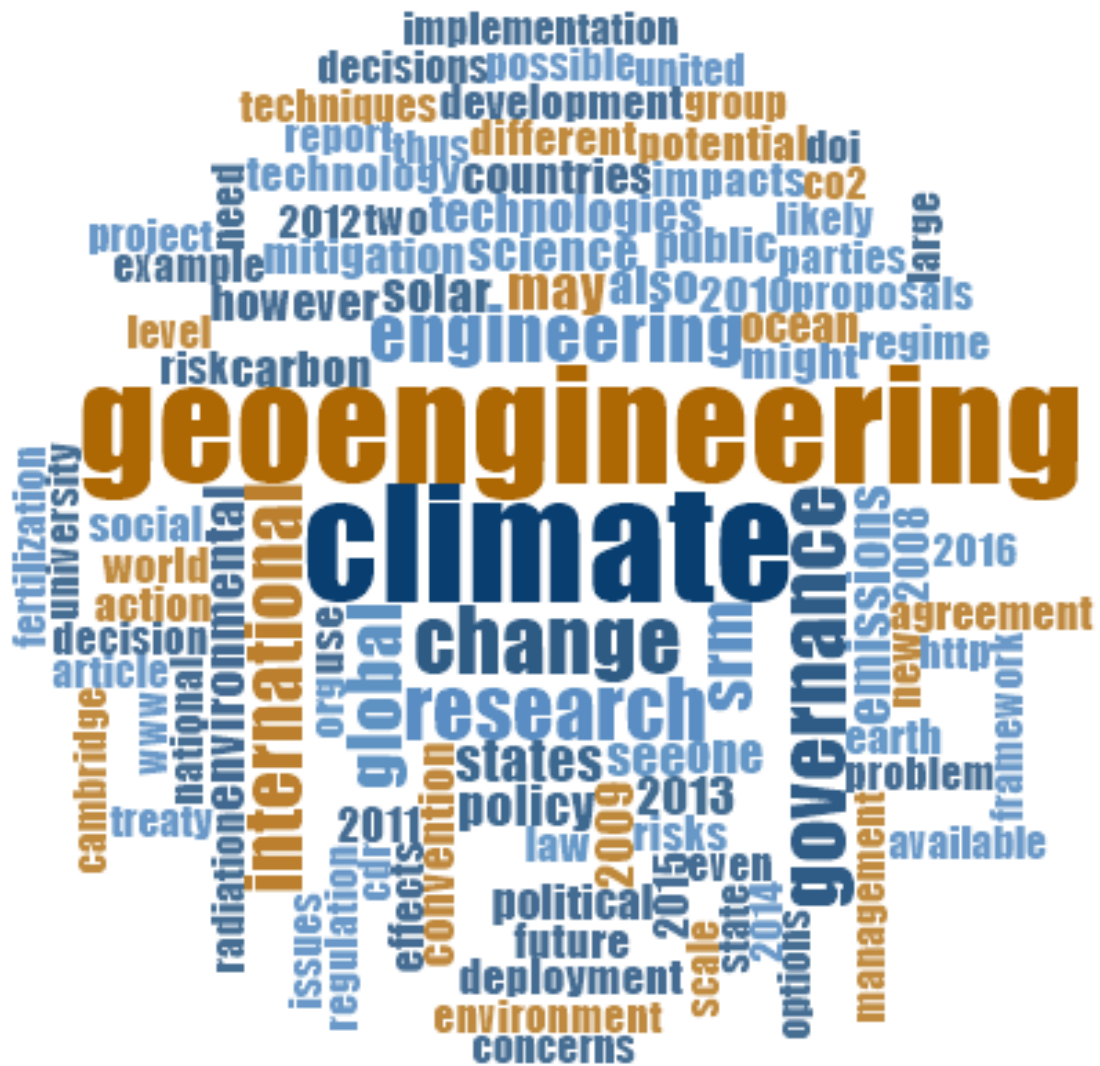


NGO discourses on international governance for geoengineering.



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Summary

Climate change and its impacts is one of the major threats that are faced by today's society. Apart from mitigation and adaptation there is a growing debate about intentionally altering the climate system in order to combat climate change, named geoengineering. The possibility of geoengineering and the emergence of this topic in the debate on climate change requires a debate on geoengineering governance. Using the concept of governance architecture this study identifies and analyse environmental and civil society NGOs discourses on geoengineering governance. Finding that there is one dominant discourse: "Ban geoengineering because there are other solutions", and two other discourses namely: Governance for geoengineering research, and Natural climate solutions. With the help of interviews this study finds that among other things their development can be understood through social, political, and scientific, developments regarding geoengineering. In combination with impending climate change and a lack of climate mitigation action. Not forgetting the influences of core beliefs, norms and principles in these discourses. Future research could broaden the scope to include a wider variety of NGOs and find more diverse discourses and possibly include other actors as well. In addition, future research could compare the current discourses with other discourses to better understand why NGOs established and follow these specific discourses. When governance would be established these types of studies will further help to research the influence of NGOs in governance for geoengineering. This research provides a clear idea of the current developments and contributes to the debate on geoengineering governance.

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Acronyms

BECCS	Bioenergy with carbon capture and storage
C2G2	Carnegie Council geoengineering governance initiative
CBD	Convention on biodiversity
CCS	Carbon capture and storage
CDA	Critical discourse analysis
CDR	Carbon dioxide removal
CFCs	Chlorofluorocarbons
COP 23	23 th Conference of the Parties of to the UNFCCC
COP	Conference of the parties
DACS	Direct Air Capture and storage
EDF	Environmental Defense Fund
GCF	Green Climate Fund
IAM	Integrated Assessment Models
IPCC	intergovernmental panel on climate change
MCB	Marine Cloud Brightening
NGO	Nongovernmental organisation, in this study is used to indicate nongovernmental organisations with an environmental focus
NPS	none party stakeholders
OIF	Ocean Iron fertilisation
REDD+	Reducing emissions from deforestation and forest degradation
SAI	Stratospheric Aerosol Injection
SB 48	48 th Meeting of the subsidiary body to the Paris Agreement
SRM	Solar Radiation Management
SRMGI	Solar radiation management governance initiative
UN	United Nations
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change

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1 Introducing geoengineering governance

Climate change is one of the major threats our society faces. Because of this there is a growing debate regarding solutions which intentionally alter the climate system (Zürn & Schäfer, 2013) in order to combat climate change in addition to strong mitigation measures. These techniques would be altering the climate either by reflecting sunlight away from the earth solar radiation management (SRM) or reducing CO₂ concentrations by means of carbon dioxide removal (CDR) (Zürn & Schäfer, 2013). Many uncertainties still exist concerning both techniques as the lack of outdoor experiments halts the development of further knowledge regarding possible negative side effects, as well as information regarding the certainty of effectiveness. Nevertheless scenarios as modelled by the Intergovernmental Panel on Climate Change (IPCC) on future climate change already rely on CDR techniques such as Bio-energy with carbon capture storage (BECCS) to stay within the 2 degree limit set by the Paris agreement (Horton, Keith, & Honegger, 2016).

Furthermore, it is clear that higher temperature rise leads to more severe climate change impacts. The current global mitigation measures as indicated by the parties to the Paris Agreement would currently not achieve the goal to limit global warming to 1,5 or 2 degrees (Chen et al., 2017; Horton et al., 2016). Some scientist call geoengineering the last resort, where others rather see it as a possibility to ward off the negative effects of increased global warming while at the same time reducing emission to a sustainable level (halting climate change). This possibility of geoengineering requires a debate on geoengineering governance. Geoengineering is often seen to be a global technique affecting all climates and the earth atmosphere, and thus anticipate geoengineering to have global implications. This also requires governance on a global level (Lloyd & Oppenheimer, 2014; Nicholson, Jinnah, & Gillespie, 2017; Virgoe, 2009). The possibility of unilateral action as indicated by the following authors (Barrett, 2014; Bodansky, 2013; Dilling & Hauser, 2013; Huttunen & Hildén, 2014; Edward A. Parson, 2014; Virgoe, 2009; Weitzman, 2015), as well as the major uncertainty of possible negative effects and its global implications, have resulted in numerous calls for governance, e.g.: *“governance before deployment”* (Rayner et al., 2013). The discussion of geoengineering governance is slowly starting to develop in scientific and grey literature (Huttunen, Skytén, & Hildén, 2015; Schäfer, Lawrence, Stelzer, Born, & Low, 2015; Zürn & Schäfer, 2013). Most papers focus on identifying possible governance ideas through international platforms. Therefore, they implicitly focus on governance executed by national governments, especially those which are parties to international governance frameworks and treaties. These explorations of geoengineering governance are increasingly accompanied by an emerging discourse among environmental and civil society non-governmental organizations (NGOs)¹ e.g. ETC GROUP, Heinrich Böll Foundation.

This research contributes to the academic literature on geoengineering governance by analysing discourses among NGOs that have contributed to the discussion on geoengineering. It also contributes to the bigger debate of civil society opinions and arguments on the concepts of geoengineering. NGOs significantly influence public discourses regarding emerging technologies. This research thus provides insight concerning possible future dynamics of acceptance and governance challenges that geoengineering could be facing. As governance is collaboration of multiple actors in multiple fields towards a common goal, civil society actors like NGOs play an important role. Especially in a world in which democracies are generally perceived as the highest form of

¹ In this paper the abbreviation NGO is used to indicate environmental and civil society-based NGOs

governance. This research aims to contribute to the knowledge of discourse development among NGOs in general and aims to explain the development of found discourses. These insights can be used by politicians as well as scientists and provide information on how NGOs present geoengineering governance, and their point of view regarding this subject.

First, this study will further describe the societal and scientific problem and the research gap in literature, that inspired this research. This will be followed by an exploration of the concept discourse and governance which are both essential in this research. This will be followed by an explanation of applied methodology, after which the results of the study are further presented and analysed.

1.2 Conceptual framework

1.2.1 Research problem

The introduction shortly explained that the emerging concepts of geoengineering will require governance and research (Barrett, 2014; Bodansky, 2013; Lin, 2009a; Liu & Chen, 2015; Lloyd & Oppenheimer, 2014; Nicholson et al., 2017; Parker, 2014; Edward A Parson & Ernst, 2013; Weitzman, 2015; Wirth, 2013). Rayner (et al. 2013) emphasizes the importance of governance before deployment. This research focusses on one of the neglected aspects in research on geoengineering governance especially, the lack of knowledge on the development and existence of discourses on geoengineering governance among NGOs. This chapter will further elaborate on the research problem, first it will explain the knowledge gap on geoengineering governance discourses among NGOs. Secondly, it will further explain the need to identify the leading discourses and will follow this up with the research problem to explain these discourses.

Researching the emerging discourses on geoengineering governance will lead to a better understanding of the NGO discourses as well as understanding their development. Considering NGO perspectives further extends the debate on geoengineering governance. Previous research focussed either on possible executors of geoengineering activities or on possible international governance frameworks. Most papers on geoengineering focus on national actors and governments (Huttunen et al., 2015). An increasing number of academic articles address governance or policy issues of geoengineering governance specifically (Barrett, 2014; Bellamy, 2016; Bodansky, 2013; Chen et al., 2017; Horton et al., 2016; Huttunen et al., 2015; Lin, 2009b; Lloyd & Oppenheimer, 2014; Low, 2016; Macnaghten & Owen, 2011; Edward A. Parson, 2014; Reynolds, 2011; Talberg, Christoff, Thomas, & Karoly, 2017; Virgoe, 2009; Weitzman, 2015; Zürn & Schäfer, 2013). However, civil society perspectives such as those from NGOs are not discussed at length within academic articles. The lack of scientific literature on the subject suggests a limited understanding of the civil society discourses on geoengineering and geoengineering governance. Even though NGOs seem to grow in importance in governance, which is emphasized as governance is often called a process encompassing more than governance through governments (Frank Biermann et al., 2009; P. P. J. J. Driessen, Dieperink, van Laerhoven, Runhaar, & Vermeulen, 2012), civil society is also considered to play an increasingly more important role in international governance (Dellmuth & Tallberg, 2015), for example within the UNFCCC process. Examples include open dialogues of the COP president that have become customary at UNFCCC meetings. Institutionalizing the growing recognition of the role of non-state actors and consultation and collaboration of national governments with non-state actors in context of their Nationally Determined Contributions. Such practises strengthen inclusion of local initiatives as well as the inclusion of Civil Society, which is also becoming a greater actor in the realisation of

environmental policies (P. P. J. J. Driessen et al., 2012). Research has found that NGOs influence international governance, local governance and individuals (Betsill & Corell, 2008). This research goes beyond the idea of how NGOs influence governance and elaborates on what discourses NGOs have established regarding geoengineering governance and why and how they developed as such. This emerging topic has brought varying discussions and challenges with it. The analysis of discourses on geoengineering has mainly focussed on the general discourse around geoengineering techniques rather than specifically on discourses of geoengineering governance (Bellamy, Chilvers, Vaughan, & Lenton, 2012, 2013). However, governance is seen as the greatest challenge for geoengineering (Barrett, 2014). Governance challenges such as inequality, equity, legitimacy and questions of democracy are more challenging to solve for the topic of geoengineering governance. Which of these topics are prioritized and how they are presented as being important in geoengineering governance by NGOs is unknown. The relative recent emergence of geoengineering and especially geoengineering governance has opened many new debates and exposed many knowledge gaps (e.g. NGO discourses on geoengineering governance) which is showcased by the recent growth of literature on the topic. Whereas the field was first only of concern to research institutes and some governmental institutions, it has recently developed into the broader debate in which NGOs are starting to become involved with the topic. Until now the emerging NGO discourses on geoengineering governance have not been systematically analysed or explained, something which this research does aim to do. In other words, this research will *identify leading discourses among NGOs concerning geoengineering governance and analyse how these discourses developed*.

To understand and learn from the early development in the field of geoengineering governance. Especially as these early discourses will most likely shape future discourses and influence NGOs that currently might not yet be involved in the topic. Through a thorough analysis of NGO discourses on geoengineering governance this research will contribute to knowledge which is of importance for future development of governance for geoengineering, as well as further research considering geoengineering governance. The identification of leading discourses is mostly important as these will be the discourses that will be most vocal and most heard by society, as well as other NGOs. They are the most likely discourses to be known to a broader public and therefore might influence further discursive development as well as establishing hegemony over other discourses.

Apart from the practical social knowledge for research it is important to know what discourses exist and why, even when the field is still developing. The fact that governance is influenced by NGO discourses (Rietig, 2016), follows the argument by (M. Hajer & Versteeg, 2005, p. 176) that: "*Because reality is seen as socially constructed the analysis of meaning becomes central*". Therefore, it is important to anticipate the development of discourses among NGOs. To further anticipate these discourses understanding them is essential. Understanding discourses could help to anticipate further discursive developments. Nevertheless, currently the governance discussion around geoengineering is lacking the knowledge of NGO discourses towards geoengineering governance.

1.2.2 Research Questions

To respond to the research problem of the lack of knowledge regarding NGOs discourses on geoengineering governance, this research adopts the following research question:

What are the leading discourses of NGOs concerning geoengineering governance and how can their development be understood?

Discourses of geoengineering governance consist of the governance solutions that are proposed by NGOs as well as underlying principles of these solutions in combination with how these solutions are presented by NGOs. Furthermore, the way that NGOs represent, campaign for or against certain governance measures and how they frame these solutions is also part of their discourse. Discourses further extend to also include how NGOs look at, and frame other actors such as scientists and policy makers in this field. The research further aims to explore how these discourses developed and whether scientific development in this field can offer explanations. In addition, this research seeks to identify particularly discourses that dominate the discussion on geoengineering governance. In order to do so the following sub questions have been adopted:

1. Which discourses can be defined in NGO publications?
2. What influences and shapes the discourses of NGOs on geoengineering governance?
3. How can the development of these discourses in NGOs be understood?
4. What are the linkages between the scientific development in geoengineering governance and NGO discourse development?
5. What can be defined as the leading discourse and why?



Figure 1 Conceptual model

First, this research will identify discourses of NGOs on the geoengineering governance. In order to go beyond mere identification world views and belief systems, scientific literature on geoengineering governance, cultural background and the social political context will be used to understand the development of the discourses. Through adding essential background information in this study, the links can be clearly identified.

2 Theory

2.1 Introduction

At the basis of this work are theories of governance and discourse analysis. First, I will go deeper into the theory of discourse analysis, after which I further elaborate on governance and how I will use this in my research. Apart from these two main topics the theory on the development of discourses and how NGO discourses develop, will be discussed as well. As the goal of this research is to go a step further than mere identification of dominant discourses and also understand these NGO discourses, this research draws on theories of social analysis. Critical social analysis, such as discourse analysis, can provide insights about the development and the explanation of social processes. In this context it is important to point out that social realities are not solely based on scientific facts. Social reality is 'conceptually mediated', such that the 'objects' of critical social analysis are simultaneously material and semiotic in character (Gee & Handford, 2012). Social realities are seen as socially constructed (M. Hajer & Versteeg, 2005), rather than scientifically grounded. Ideologies, belief systems, cultural backgrounds, scientific facts and many social aspects influence and shape, discourses and opinions, and construe social realities. Analysing them is a challenging task through the constant change they undergo and establishing what these realities entail is difficult, given that they possibly differ from person to person or between groups of persons.

Discourses are an instrument of social construction of reality (Wodak & Meyer, 2001) and give insight in how different actors use it to construct social reality. The same actors are shaped in return by the discourse itself, as discourse and actors are seen as mutually influential (Gee & Handford, 2012).

"The concept of discourse is epitomized in the following statement: The main importance of discourse analysis lies in the fact that through speaking and writing in the world we make the world meaningful in certain ways and not in others" (Gee & Handford, 2012). In order to identify and explain

discourses, on geoengineering governance among NGOs, a Critical Discourse Analysis (CDA) will be further explored, as this paper tries to explain the discourses among NGOs. This research seeks to contribute to the theory on the development of discourses and to the theory of constructed social realities. It will do so through explaining the development of the identified discourses. Secondly this research seeks to contribute to the understanding of emerging discourses of new and innovative technologies. Within the broader debate on discourse development, this study of NGO discourses on geoengineering governance could function as a case study, although comparisons between case studies on discourse development go beyond the scope of this research. The findings could provide further lessons on how social actors perceive the social realities in context of emerging technologies and what their actions might be. Given that major NGOs are not publicly involved in campaigns on geoengineering governance to date, this research also seeks to explore why actors might keep silent on such a topic.

The role of NGOs in international governance, and governance in general, has been growing and research on the topic of their influence and strategies has provided insightful information (Allan & Hadden, 2017; Betsill & Corell, 2008; Downie, 2014; Rietig, 2016). However, there also needs to be a clear distinction as to what this research considers to be an NGO. As the concept of NGO is very broad, a more specific definition is required as also recognized by Betsill and Corell, whom define NGOs as: *"an organisation that is not formed by intergovernmental agreement, has expertise or interests relevant to the international institution, and expresses views that are independent of any national government."* (Betsill & Corell, 2008). This is also the definition used by the UN.

Nevertheless, this research doesn't look at all these NGOs, since to include all NGOs would not be relevant. To distinguish between different NGOs, we look at their mandates. This research focusses on NGOs with an environmental or civil society mandate. This is still very broad, but it excludes business, market, trade, scientific or industry related NGOs. These limitations were chosen to focus on those NGOs involved in the geoengineering governance debate and exclude those that have a no other specific mandate than to further the discussion on geoengineering governance like SRMGI, or C2G2.

2.2 Discourse:

To identify and explain the differences of the concept of discourse, this research first discusses Hajer's more practical discourse analysis for environmental politics, to be followed by Fairclough's theory of Critical Discourse Analysis (CDA). Runhaar and colleagues identify two distinct approaches to discourse analysis: a more linguistic approach focussing on language and what language is used for on the one hand, and on the other hand, a broader tradition in which the focus of analysis is both on the ways of thinking and ways of presenting specific themes or issues and the related practices, structures and institutions (Runhaar, Dieperink, & Driessen, 2006). The linguistic approach could be relevant given the many linguistic differences in discussing the topic of geoengineering governance such as terminological differences (e.g. the use of climate engineering vs geoengineering), or different assumed uses of geoengineering (emergency solution vs necessary measure). Even the underlying problem is often textually differently defined (insufficient mitigation vs climate emergency) (Bellamy, 2013). However, a detailed linguistic analysis would overlook the broader picture of practices, structures and institutions, and the thinking behind these practices that possibly reveal a discourse. Furthermore, a linguistic approach would not take into account the social context. Therefore, this research follows the broader tradition, focussing on discourses in a more general sense. This means that it is possible not to just look at literature and NGO activities but also take into account the historical cultural and political context in which a particular account of truth arises (M. Hajer & Versteeg, 2005). Media appearances, workshops and educational practices as well as other activities could all express a specific or similar discourse, and when relevant will be considered for analysis. Combining these different inputs can result in a more holistic understanding of the discourse as well as its evolution. The analysis focusses both on the ways of thinking and presenting about the theme of geoengineering governance (e.g. geoengineering might lead away from mitigation measures, therefore we should not consider it), and on the related practices, structures, and institutions (e.g. Campaigns, positioning within governance, Coalitions building, etc). Also position statement on governance or governance principles are informative for the discourse on geoengineering governance. Analysing these NGO activities with a CDA is a form of critical social analysis (Gee & Handford, 2012, p. 9), and therefore has an interdisciplinary character. Material facts and semiotic facts of social realities and the relationship between them is what constitutes this interdisciplinarity.

Fischer (2003) writes that there are many different definitions of discourse and that it is hard to find a fixed or commonly accepted one. Some examples include: *"Discourse is a specific ensemble of ideas, concepts and categorizations that are produced reproduced and transformed to give meaning to physical and social realities"* (M. A. Hajer, 1995). Shapiro (1981: 130) frames it as *"a discourse establishes norms for developing conceptualizations that are used to understand the phenomenon"* (Fischer, 2003, p. 73). Whereas Meinhof (1993) describes it as: *"A discourse in this respect is not just any collection of words or sentences. Rather it is an integration of sentences that produces a meaning"*

(discourse), which is larger than the mere text contained in the sentences" (Fischer 2003, p.74). Driessen & Leroy (2007) take a different approach and use the term discourse to describe the development of thinking about goals and principles behind perceptions of the environment and environmental policy: *"The theory of discourses starts from the idea that all actions objects and practices are socially meaningful and that these meanings are shaped by the social and political struggles in specific historical periods"* (Fischer, 2003). This idea is further supported by Fairclough when he names three different concepts of discourse: *"(a) meaning-making as an element of the social process; (b) the language associated with a particular social field or practice; (c) a way of construing aspects of the world associated with a particular social perspective"* (Gee & Handford, 2012, p. 11). Discourses itself are defined as: *"semiotic ways of construing aspects of the world (physical, social or mental) that can generally be identified with different positions or perspectives of different groups of social actors"* (Gee & Handford, 2012). However, in another book Fairclough defines discourses as: *"diverse representations of social life which are inherently positioned – differently positioned social actors 'see' and represent social life in different ways"* (Wodak & Meyer, 2001, p. 123). Although not that different from the earlier definition, it shows that the term discourse is often defined and used differently, in relation to the topic of research. This is especially clear when comparing Fairclough (Gee & Handford, 2012; Wodak & Meyer, 2001), with Hajer (1995). Whereas Hajer takes a more applicable discourse approach to explain a specific phenomenon (discourses in environmental policy), Fairclough looks more specifically at linguistic, and theoretical aspects of discourse analysis. Another important concept is that discourse is not static and can change over time as indicated by Fischer (2003), but also differs from place to place. Common among all definitions is that 'discourses' are shaped and constructed by society, influenced by social and political contexts, actions or phenomena and that they are different in time and space, and specific to the situation. Differences in definition often accommodate the specific unit of analysis in the research, be it either in case of 'discourses for political analysis' (Fischer, 2003; M. A. Hajer, 1995) e.g. (political actors) or social analysis as applied by Fairclough (Gee & Handford, 2012) e.g. (social phenomenon and constructed realities). In addition, it is common among the different definitions that 'discourse' is not limited to text, speech or a single representation, but also includes actions that are creating meaning and perception which extends beyond mere text or presentation.

Besides society's influence on discourses, discourses also have an influence on society itself. One of the reasons why we analyse discourses is because it helps to understand how society constructs realities. Within the literature this discourse shaping society is sometimes differently named, Hajer and Versteeg (2005) call this a particular account of truth that arises. Fischer (2003) on the other hand states that discourses are not any collection of words, but rather integrated sentences that create meaning larger than the actual text. That discourses around a topic can create realities also seems to be analysed by Gupta and Möller (2018), who see authoritative assessment emerging as de facto governance on geoengineering. This can be seen as a discourse that shapes the reality of international governance. However, the way different discourses influence society is beyond the scope of this research, but the fact that discourses shape society is clear. Simple examples can also be found in propaganda. Knowledge is an important factor that influences society, so how certain knowledge is presented, can be part of a discourse. Another reason why understanding discourses and their development is important.

Another important point is the unit of analysis. As this research tries to identify dominant discourses among NGOs it is important to explore the understanding of how actors influence discourses and construct reality. In this case NGOs act similarly to political actors according to Hajar's theory struggling for discursive hegemony trying to secure support for their definition of reality (M. A. Hajar, 1995). This research will therefore rely on the following definition of a discourse: *A discourse is the way certain phenomena are construed, seen, presented, believed, and perceived by different actors at a specific time, and in a specific context.* Applied to the research at hand discourses are the way that NGOs construe, see and represent, promote, campaign, or are silent about geoengineering governance. The fact that many NGOs have not made public statements on geoengineering governance warrants this particular approach.

Another important aspect in this study is the development of the discourse. Because this research is done in the early stage (not many NGOs are yet involved with the topic) of the discursive development it could provide insights for future development. This research establishes the definition of discourses but as this research also aims to explain their existence, further elaboration on their development is necessary. When following the above-mentioned definition, three major factors shape discourses. The believe and perception of a phenomenon, the framing of geoengineering governance (construed, seen and presented), time and context. The discourse development is further influence by NGOs themselves, and their expertise the topic. Therefore, this research will try to understand the development of the discourse by using information on the cultural background of the NGOs their worldviews and belief systems in combination with, scientific literature, and political context. The exact development of discourses is hard to precisely attribute to specific social processes as it is a complex development with too many different factors influencing this development.

2.3 Governance:

'Governance' is another important concept in this study. Lange and colleagues (Lange, Driessen, Sauer, Bornemann, & Burger, 2013), comment that: *"its exact meaning is far from being well characterized"*. Common among different governance definitions is the shift from hierarchical governance² by state-governments towards a (more) self-regulated mode of governance by societal actors, e.g. such as private-public governance cooperation (Frank Biermann et al., 2009; P. P. J. J. Driessen et al., 2012). Governance is often used to describe a collaborative effort of different actors to achieve the solution towards collective action dilemma's as Driessen and colleagues (2012) call it, or towards collective goals following Lange and colleagues (2013). The shift from government-led governance concepts to those were civil society actors and private sector play an important role is a separate field of research. However, this is exactly what inspired researchers to rather discuss governance than governmental regulations, as governance can encompass all these different actors that are involved in governance. The concept of governance is further practical as it is not tied to a geographical place, but rather traverses this category and is used in the wider overarching idea of governance, covering the international governance as well as national governance and subnational governance.

In order to further research the concept of governance this research needs to further specify the conceptualisation. Each different definition named above has a different conceptual idea of

² Hierarchical governance as defined by (P. P. J. J. Driessen et al., 2012)

governance. In order to establish a conceptual framework of modes of governance Driessen (et al, 2012) uses actor features, institutional features and features concerning content. However, this model is based on the Dutch political system and is less practical when discussing international governance and governance in a broader sense. Therefore in this study the broader conceptualisation of governance architecture as described by Biermann and colleagues, (2009) has been selected for analysis. As this concept is designed to describe meta-levels of governance it is especially suitable for this research. In this definition governance architecture is the overarching system of public and/or private institutions, principles, norms, regulations, decision-making procedures and organizations that are valid or active in the issue area (Frank Biermann et al., 2009, p. 32).

This study adopts the idea of governance architecture to further specify governance in order to identify the discourses on this topic within NGO publications and later interviews as well. This means that within this study special attention is directed towards identifying the different aspects that are named as part of governance architecture. I will first refine the definition of my concept of the different governance aspects in governance architecture after which I will elaborate on the operationalisation of the variables in the methodology.

Table 1 Governance architecture from (Frank Biermann et al., 2009)

Governance Architecture
• Public or private institutions
• Principles
• Norms
• Regulations
• Decision-making procedures
• Organizations valid or active in issue area

The governance architecture consists of the concepts mentioned in the table, and the following paragraph will further describe these concepts in order to clarify them.

Governance often exist within institutions or form institutions, this can for example be the United Nations (UN) which is a clear example of an intergovernmental institution. Another example would be a national government although the concept of governance is not something that is unique to the public sector (P. P. J. J. Driessen et al., 2012). Governance institutions can also be a collaboration of different NGOs organising themselves in an institution. Within this study however the focus is more aimed at the perspectives of NGOs regarding this topic. Rather than further specifying what an institution exactly would entail, we take the broad definition that institutions are the rules of the game in a society, or more formally, are the humanly devised constraints that shape human interaction (North, 1991). To translate this very broad and open definition to a more applicable approach to institution in this study, this study sees institutions as structures of human interactions.

This is still very broad, however all different types of institutions can be included such as conventions, protocols, or outcomes of organisations. The more important conceptualisation for this study is that of private or public institutions. Public institutions are those that are linked to governments e.g. the UN as an intergovernmental organisation. Whereas private institutions are those that are organised by actors who are not linked to governments e.g.: NGOs, or NGO collaborations. This will be a major question within the discourses of NGOs on how governance should be organised through public institutions or rather through private institutions. The idea of institutions will also further highlight how NGOs approach governance for geoengineering especially when it comes to the responsible actors.

A principle is defined by the Oxford dictionary as *“a fundamental truth that serves as the foundations for a system of belief or behaviour or for a chain of reasoning”* (“Principle,” 2018). When applied to identify and understand governance discourses these underlying ideas are helpful, especially as these ideas are not limited to the topic of governance of geoengineering. It can be assumed that some principles of governance in other topics will be coherent with ideas on geoengineering governance, although the empirical analysis must prove this first. This study is especially looking for governing principles that have already been established for a longer period of time and have a clear governance implication such as the precautionary principle, but also principles of inclusion, participation, and equality have implications for governance. Important cornerstones of the discourses are the statements concerning principles that would shape governance. Other principles will be less relevant for the identification of discourses on governance but could further help explain them.

Norms held by NGOs will further shape the discourse of governance for geoengineering, most likely based on the principles that will be identified previously. In this study the focus will be on the norms introduced and held by NGOs considering governance, and especially geoengineering governance. Norms for governance in general as with principles, will most likely also apply to geoengineering governance.

Regulations are often the most visible part of governance and the most easily recognizable for those that do not study this specific topic. Within geoengineering governance discourses this essential concept is most likely the most discussed one. Regulations can be anything from rules for permission of geoengineering to a ban or moratorium, even a discourse in favour of no regulations is considered in this study as empirical factor that is part of the discourse on governance.

Governance can have different mechanisms to reach decisions. The procedure which is applied to reach a decision, whether that might be a consensus, or a majority voting is a big part of governance, and how this is addressed plays a big role in discourses on geoengineering governance. In order to establish this characteristic in governance suggestions such as governance through the CBD will be taken into consideration, bearing in mind the governance discourse of the UN decision-making procedure or that of the relevant body of the UN.

Analysing NGO discourses highlights the aspect of organisations in governance, as mostly multiple organisations are active. To know what role organizations should play in governance according to NGO discourses provides insights into, and is also part of, their discourse. So, all organizations that will be mentioned in NGO activities whether they are organizations facilitating governance, or organizations like NGOs, or other interest groups should be taken into account when establishing the

discourses. Also, the exclusion of organisations in governance can be telling in a discourse. Important in analysing the discourses is that although these different concepts need separate conceptualisation to identify them, they are still part of the overarching concept of governance architecture.

This research aims to identify the discourse of the concept of governance for geoengineering. So apart from shaping the discourse of governance for geoengineering, the presentation of these concepts is also very important. Even though the discourse of governance itself is established by the content of the different aspects, it is also important to further understand how NGOs present these options, regulations, organisations, principles, etc, in order to establish their discourse. The presentation of governance concepts tells much about the discourse in addition to the general ideas on governance from the discourse. An example is the presentation of a governance challenges for geoengineering in general or governance challenges for different geoengineering techniques.

This research focusses not necessarily on the goal of the different governance discourses from NGOs, but rather how and with what governance measures they want to achieve it. The goal of the discourses would always be to govern geoengineering. The reason that this research doesn't look at the goal of governance is because governance is seen as a goal in itself. Whether that is a ban or whether that is actual regulation or a permit system it is still considered governance. Although this research builds on the assumption that NGOs can influence governance, which is well established although of continuing research interest (Betsill & Corell, 2008), this research is not designed to research the possible influence of NGOs in governance. As previously mentioned, the lack of actual geoengineering governance makes this premature and nearly impossible.

3 Research Methods

3.1 Introduction

This chapter will further explain the different methods that were used to identify literature from NGOs on geoengineering governance. It will continue with a description of the analysis of this literature and what methods and theories are used. After having discussed this for the literature, an elaboration will follow regarding the applied methods for the collection of data through interviews.

Figure 2 gives an overview of the research design. This research consists of two main parts. First identifying NGO discourses through analysing of NGO publications and attending NGO-workshops and presentations. This analysis helps in combination with interviews to establish the leading discourses of NGOs on geoengineering governance. The second part concerns the analysis of NGO discourses with the use of cultural background, scientific literature, NGO interviews, Worldview and belief systems and the social political context.

3.2 Technical Design

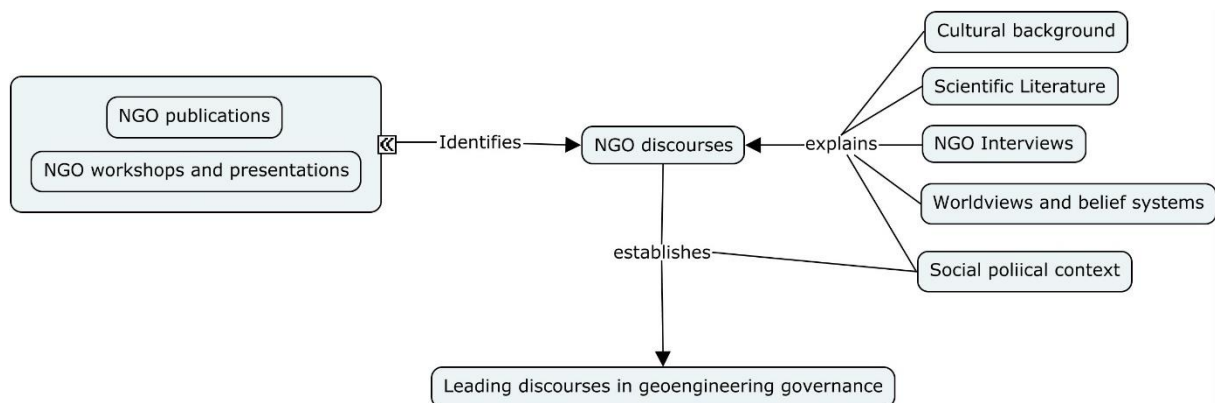


Figure 2 Technical design

Discourse analysis is a methodology for analyzing social phenomena that which is qualitative, interpretive and constructionist (Hardy, Harley, & Phillips, 2004). In order to research discourses among NGOs, this research takes a qualitative approach rather than a quantitative one for two reasons. First of all, the limited number of NGOs which are involved in geoengineering would not render enough results to be able to do quantitative analysis with significant outcomes. Second of all, the qualitative research methods provide the possibility to get a deeper understanding and discover the motives and ideas behind the discourses, which is necessary to be able to understand the discourses and their development. Therefore, this research will use critical discourse analysis theory and related methods.

3.3 Conceptualising NGOs

Previously, this research distinguished between different NGOs based on their mandate. The mandate in short would be the core goal of the NGO, this could be for instance the environment, or representing business. Within these different mandates this research will look at NGOs with an environmental mandate as part of their core goal. Some NGOs take a broader mandate than just the environment, however all NGOs with the environment as part of their core mandate will be considered. NGOs that are through a civil society mandate concerned with the environment and

involved in the topic of geoengineering will be considered as well. Those NGOs with a scientific mandate are excluded such as C2G2, or SRMI. This different category of NGOs that got involved in geoengineering governance didn't do so from an environmental or civil society perspective but rather from a scientific one. These NGOs often try to be a facilitator of discussions or try to open the debate on governance of geoengineering. Although very interesting, they do not represent an environmental or civil society based NGO discourse and therefore their publications are excluded from this analysis. Furthermore, this decision had been made to analyse the discourses of this specific type of NGOs, to get a clear idea of their discourses. Including scientific NGOs would significantly influence this discourse analysis and prevent this research from answering its research question.

Furthermore, only those NGOs that are themselves involved in the topic of geoengineering are considered. This can be through participation in conferences, publications of papers or policy briefs on the topic. Most NGOs which are involved in the geoengineering debate also have a discourse on the governance for geoengineering. This research excludes NGOs that are not involved on the topic because these NGOs do not have an existing discourse. Furthermore, when in a second stage of the research interviews are held only those NGOs already involved are of interest. NGOs that would have not been previously involved in the topic would experience too much influence from the interviewee rendering data unreliable for this research.

3.4 Underlying research concepts/theories.

Apart from the different methods used specifically for the various parts of this research some general overarching research theories are important to mention. The discourse analysis is based on the idea that realities are socially constructed and therefore, analysing discourses can help us to understand those realities. To analyse discourses, inductive reasoning helps to improve the identification without prejudice. This was done through reading the literature and attending NGO workshops and presentations at the COP 23 before starting the actual research. Within this study inductive reasoning is necessary and preferred over deductive reasoning. First of all, it is necessary because this research identifies discourses from NGOs on geoengineering governance, which has not been done before. Therefore, there is no possible deductive framework ready to analyse this discourse. Furthermore, to fully understand the emerging discourse inductive research methods offer more possibilities to understand and identify the unexpected results. A deductive discourse analysis could be limited through the deductive specific framework that has been applied. Inductive analysis leaves the possibility open to further include unexpected findings. Lastly, when conducting deductive research, one might be biased towards finding the elements of this framework you specifically look for, certain questions or other specifics rather than looking at the whole picture.

3.5 Data collection of literature:

3.5.1 Literature based identification of key NGO discourses

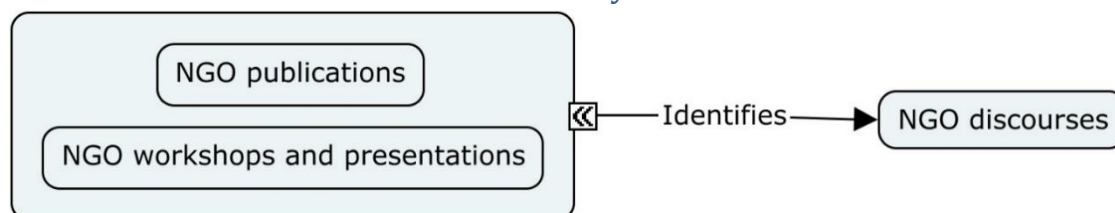


Figure 3 Literature based identification of key NGO discourses

This research starts with an exploration of literature published by NGOs or collaborations of NGOs from all around the world. This is further enhanced by attending NGO workshops and presentation (e.g. UNFCCC COP23 and SB 48 side event presentations).

3.5.1.1. Finding literature

In order to find NGO publications Google search was used, as well as a thorough analysis of NGO webpages searching for the below mentioned keywords (see table 2). First about 68 publications by NGOs were found on the topic of geoengineering. These publications range from books, policy briefs, website statements and other publications that mentioned geoengineering. These were further analysed to select the articles that mention governance for geoengineering. From this selection only, those articles that represent a discourse of the NGO itself on geoengineering governance are selected for coding and further analysis which lead to 20 articles (see annex 2). It's important to not include those articles that just mention governance as being a problem or something that needs to be considered or addressed in international institutions. When geoengineering governance is addressed in such a limited way it does not add substance to the discourse, as it only highlights a problem rather than a discourse. The discourse of NGOs on geoengineering governance only concerns those publications that represent the ideas and realities of NGOs regarding geoengineering governance. Therefore, publications are screened to find those statements that create meaning and perceptions. As governance is something that is more often mentioned within other publications on geoengineering rather than as a specific topic of the publications itself, it was not part of the search terminology.

Table 2 Search term for google search, and webpage search

Google search terms:
Geoengineering
Climate Engineering
SRM
CDR
Engineering the climate
Engineering
Negative emissions

To illustrate the struggle to find relevant literature and illustrate the small body of literature, it is interesting to mention that when searching Greenpeace-international website for the term geoengineering no results show up but when searching Greenpeace UK website there are actually publications which go as far back as 2009 (Greenpeace UK, 2009). It seems that often geoengineering webpages and publications are not made to be easily accessible. The documents concerning geoengineering or SRM and CDR techniques are not always linked and often spread across different sections of the website.

3.5.1.2. Selecting literature

To select relevant publications published by NGOs that discuss geoengineering governance, several criteria should ideally be fulfilled (see table 3). This table, which is based on the idea of governance architecture, helps to identify publications suitable for analysis. Using the idea of governance architecture a publication concerning more aspects of governance is of higher interest for analysis to this research and contains more information to identify discourses. However, as the literature on the subject is still very limited and as this research also aims to get a broader overview of how governance for geoengineering is presented, in order to understand the discourse on geoengineering governance, publications that are not very specific in addressing geoengineering governance are also considered. However, the requirement remains that an article does mention one of the in the table named aspects of geoengineering governance such as forms of regulations, e.g.: Some call for a ban or call for strengthening the CBD moratorium, or principles of governance such as inclusion. All kinds of different publications are considered. This can be anything from statements, policy briefs, blog-posts, or other public contributions of NGOs, to the geoengineering debate. Added to this body of literature are presentations that I attended and at which notes were taken. All these different forms of NGO representation feed into the discourse on geoengineering governance.

Table 3 Criteria for eligibility of literature for analysis

Criteria for eligibility of analysis	
Governance:	Public and Private institutions
	Principles
	Norms
	Regulations
	Decision making procedures
	Organisations valid or active in issue area
No discussion of governance should be happening	

The criteria to select publications are based on the elements that make up governance following the definition by Biermann and Colleagues (2009). Solely mentioning a governance institutions, bodies, or practices is not enough, for example mentioning that there is governance through the CBD for ocean fertilisation is only presenting a fact, not necessarily a discourse, although it could be part of one. However, the publications were also selected to correspond with the idea that rather than merely reporting on governance processes on geoengineering, they also represent ideas of NGOs on governance. In the chapter on coding this will be further elaborated upon. Through statements on any of the governance aspects from table 3, even when not necessarily concerning geoengineering, a more complete idea of the discourse on the geoengineering governance aspects is achieved. Furthermore, publications that mention a specific geoengineering technique, and who are presenting the governance options for this technique in their publications, are also taken into account for analysis e.g.: (ETC GROUP, 2017). This corresponds with the idea that this research focusses on geoengineering especially to be able to incorporate the full extent of different geoengineering technologies. Therefore, it also takes into account those publications focussing on one of the techniques that are either considered to be SRM or CDR. When similar techniques are discussed under different names these will also be included.

Apart from these criteria, the source of the publications is also important in order to decide whether the publication will be taken into account for analysis. Therefore, only publications that express an NGOs position or are written by a major representative of these NGOs are considered as being NGO

publication, even when it was not published by the NGO itself. The discourse is not only represented by the NGOs own publications but is represented by all their expressions on the topic combined. Therefore, it is important to also include these other publications, that could for example consist of commentaries in news articles or other expressions of opinions, such as policy briefs or letters to policy makers.

Lastly when selecting the literature, the selection also excluded those articles that were repetitive in their discourse. For example, similar documents presenting the same discourse published in different outlets. The aim was to focus on those articles that added something new to the different discourses or added a historical perspective, providing insights into the development of the discourse over several years. Some articles also had to be dismissed from the analysis of current discourses because they were less up to date, these were still used to further explain discourse development. As the timeline of the documents concerning geoengineering governance ranges from 2009 to 2018 it is necessary to consider the most recent documents as best representative of the current discourse. This was also put forward in interviews. As discourses constantly develop the constructed discourse in this study is only the discourse from the last few years.

3.5.1.3 Analysing literature

When researching geoengineering governance most researchers choose to distinguish first between the different types of geoengineering techniques and governance requirements e.g.:(Barrett, 2014; Humphreys, 2011). This research differs from that norm as it argues that the broader overarching concept of geoengineering should be used. The problem is that in order to analyse discourses this research follows the discourse of the research subjects, namely NGOs. Many NGOs do not distinguish between the different geoengineering techniques and discuss it as if it were one thing: geoengineering. Some other NGOs do distinguish in some of their publications but then again not in every publication. Because of the changing nature per NGO whether geoengineering is CDR and SRM, or only SRM and specific CDR techniques (e.g. OIF), this research uses the term geoengineering to include all geoengineering techniques.

3.5.1.4 Identifying discourses

Following the idea by Hardy and colleagues that research is: *“an exercise in creative interpretation that seeks to show how reality is constructed through texts that embody discourses; in this regard content analysis provides an important way to demonstrate these performative links that lie at the heart of discourse analysis”* (Hardy et al., 2004, p. 22), this research will use content analysis to further systematically identify discourses. First, in order to constructively analyse the content of publications a strategy put forward by Holsti (1969) is used. Content analysis transforms communication through objective and systematic application of categorization into data which can be summarised (Holsti, 1969, p. 3). This is operationalised in the form of inductive coding which offers the possibility to let the coded frames and storylines emerge from the text itself (Kulatunga, Amaratunga, & Haigh, 2007), which is suitable for this type of exploratory research. For coding in this study, I will categorize the different storylines following the different aspects of governance architecture and code the expression (frames) on these ideas accordingly. The use of inductive coding aims to forgo bias by using an existing framework, and the novelty of this research also means that there are no existing frameworks for coding the discourses of NGOs on geoengineering governance. Secondly inductive coding offers the best possibility to distinguish frames and storylines and for their meanings to be identified from the data itself during the coding process, all the while staying true to the interpretative tradition of discourse analysis (Hardy et al., 2004). Using inductive coding rather than deductive coding leaves the possibility to further enhance and comprehend the

frames and storylines. Especially as there is no existing framework to keep to, and the codes are to emerge from the text.

For the coding of the literature NVIVO is used. Within the coding I will be looking at so called story lines: The primary function of story-lines is that they suggest unity in the bewildering variety of separate discursive components of a problem that otherwise has no clear or meaningful pattern of connections (Fischer, 2003). Storylines are essential parts that make up and help to identify the different discourses. According to Fischer *“storylines are more than a set of facts and normative orientations but rather a melding of these components into a persuasive narrative structure”* (Fischer, 2003, p. 103). Therefore, interviews are used to further understand the ideas behind these storylines. Some scientific literature is also used to further explain the development of NGO discourses. This will be done by a small comparison of discourses with often reoccurring elements in the scientific literature on governance for geoengineering.

3.5.2 Technical design of interview-based analysis of NGO discourses

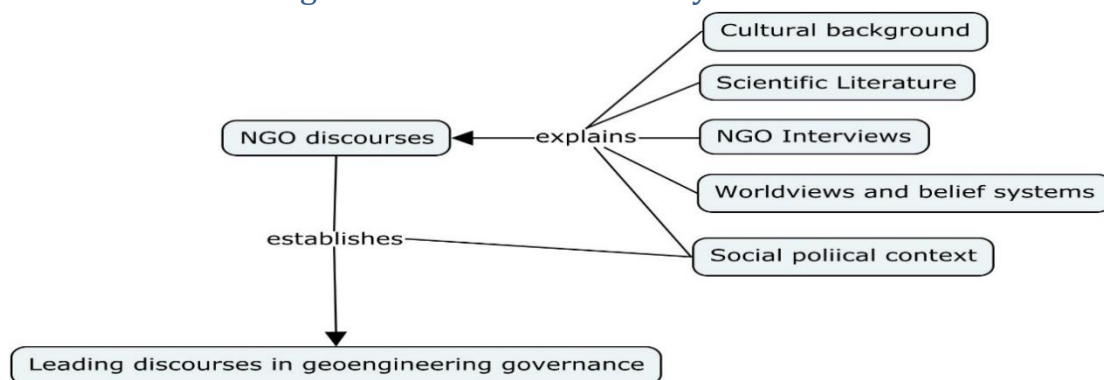


Figure 4 Research framework for interview-based analysis of NGO discourses

3.5.2.1 Introduction to interview analysis

In order to go further than mere identification of the discourse this research tries to further understand them by carrying out interviews with NGO representatives. As presented in the research framework, the interviews will be held with NGO representatives familiar with the geoengineering debate. These interviews are above all a means to explore discourses and gain insights in their evolution to further explain their existence. They will also be used to compare the discourses that were found in the literature. The use of semi-structured interviews allows me to go into detail of possible new information as well as to further explore potential underlying explanations for the development of discourses. As this research assumes that realities are socially constructed backgrounds of specific interviewees can often influence the way in which they position themselves in the debate of geoengineering as well. Therefore, it should be considered that different interviewees with different backgrounds have different storylines and different approaches towards geoengineering governance.

3.5.2.2 Finding interviewee's and executing interviews

Interviews will be held in persons when possible or by video conference calls (skype) when this is not possible. They will be recorded after permission has been sought and transcribed to code them. When quotes will be used in the final thesis these will always be indicated and the interviewees will be referenced. The interviews will be executed anonymously, thus safeguarding the identity of the interviewee and only mentioning the country in which the NGO is based. Through the use of snowball sampling methods most interviewees were people in the organisations that were concerned with climate change, and climate change policy. In that capacity they were also involved in the geoengineering debate. All NGOs familiar with the geoengineering debate are so in the broader

debate of climate change. The odd one might be the ETC group as their organisation is also concerned with technologies like geoengineering and modified organisms, whereas other NGOs were only involved within the broader debate of climate change. Due to the opportunity to attend the UNFCCC SB 48 many of the interviews were held at this event and offered the opportunity to further identify new interviewees through snowball sampling at side events. Although this type of conference brought together different NGOs involved in the topic of geoengineering, it was not part of the official conference agenda. Therefore, geoengineering was only discussed in side-events and mostly under different terminology than geoengineering such as Negative Emissions. In the discussion I will further discuss how the interviews, and snowball sampling at the SB 48 influenced my research.

3.5.2.3 Analysing interviews

The coding process used for the coding of the interviews is similar to that applied in the literature section. However, instead of starting without any previous coding framework this part of the research builds on the previous used codes from the literature, and when needed adds new codes to the codebook in order to code the interviews, thus mixing inductive and deductive coding practices (see figure 5). This enhances the possibility to see similarities and differences, as well as making it possible to identify the development of the discourses. When the interviews would be fully inductively coded, tracing the development of the discourse would be harder and a more strenuous process. Secondly, the main aim of the interviews is to further explain and understand the discourses. Therefore, the interview questions are initially not aimed at identifying discourses. However, some interviews with NGO representatives that didn't publish literature on geoengineering governance, did require questions concerning their discourse.

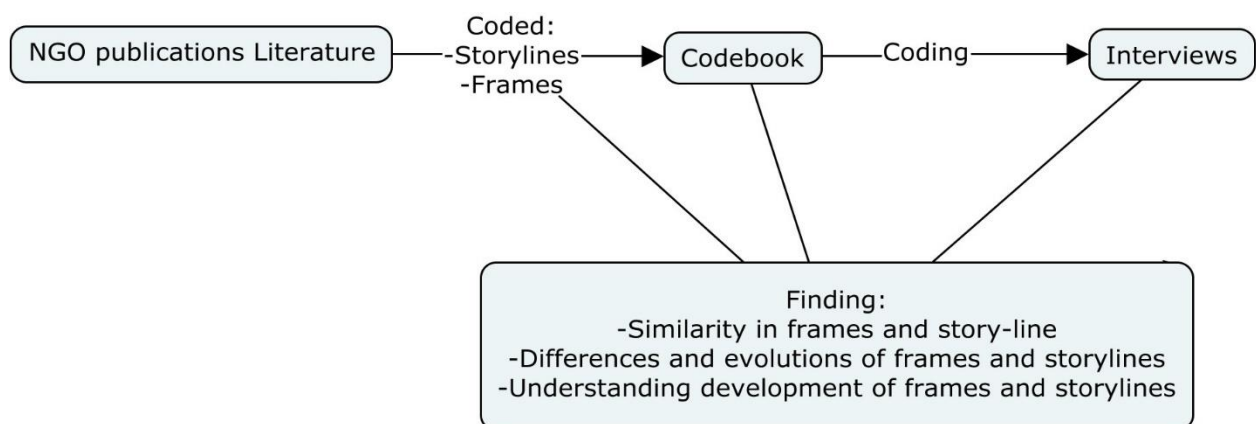


Figure 5 Coding interviews

3.6 Operationalisation of variables

3.6.1 Discourses

Section 3.5 specified the selection criteria for literature. This section will further elaborate on what a discourse constitutes and what methods are used in order to systematically identify these discourses. Starting with articles that discuss geoengineering governance, the analysis further looks into how the ideas mentioned on governance are presented as well as how opposing views are mentioned. Following the earlier concept of discourse as: the way certain phenomena are construed, seen, presented, believed, and perceived by different actors at a specific time and in a specific context. This conceptualisation highlights the fact that a discourse is the creation of a certain reality, it's not just facts or presenting facts, but rather shaping and framing facts and stories in such a way that it represents the desired reality. Hajer (1995) follows this idea as well, adopting the concept from Davies and Harré (1990) that discursive practices are all the ways in which people actively produce social and psychological realities, and therefore arguing that research should examine all discursive practices.

Through coding frames and storylines, discourses are identified. This will be done on a step by step basis.

1. First, statements on geoengineering governance will be identified and coded as nodes
e.g.: Geoengineering should be banned
2. Similar statements will be sorted together under the same node. This will constitute a frame.
e.g.: Ban on geoengineering
3. Than these frames are sorted under fitting storylines when possible
e.g.: There should be an international ban on SRM geoengineering and possibly also CDR
4. Than the several storylines together with frames will make up the discourse
e.g.: Discourse 1 contains storylines 1 till 5 including the different frames (see table 5)

When found frames do not belong to specific storyline, they will remain loose frames outside of storylines and discourses, because a singular frame does not directly constitute a discourse.

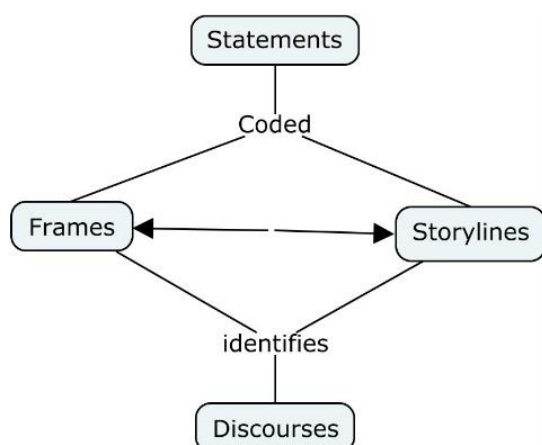


Figure 6 Coding model

When there is a clear connection between the storylines and the frames that all adds up to one comprehensive reality, it becomes a discourse. However, the content and storylines and how they connect are different case by case. One of the research questions also clearly states that it will

identify the leading discourses. The concept of leading is interpreted as being the most present and most often mentioned and well-established discourse. This will show in the amount of occurrence in literature as well as the possibility to see the discourse present among many different NGO publications and interviews.

4 Background

4.1 introduction

To start the result section of this research a general introduction into the realm of geoengineering is necessary, to further explain and explore the different discourses concerning this topic. This chapter will elaborate on the two main types of geoengineering as they commonly are used within NGO literature. This might be different from scientific papers as NGOs often do not exactly follow the scientific literature to the letter, in terms and definitions. After this short introduction paragraph 4.6 will discuss scientific literature on governance for geoengineering. As indicated by (M. A. Hajer, 1995; Hardy et al., 2004) context is essential to further understand the discourses and their development. Furthermore, this section will highlight why governance is often seen as important for these techniques. A complete systematic review on all geoengineering governance literature will not be feasible for this type of research so this should be seen as a small overview of current geoengineering governance literature. The body of scientific literature on the topic of geoengineering governance has substantially grown over the last decade. The technological development, impeding climate change, the 1.5-degree target from the Paris agreement (F. Biermann & Möller, 2016; Chen et al., 2017; Horton et al., 2016), in combination with the use of BECCS and other forms of CDR in the Integrated Assessment Models (IAM) used in the IPCC among others, all contributed to a high scientific interest in the governance of geoengineering. Because of the many unsolved governance challenges that geoengineering will face such as environmental, social, political, transboundary adverse effects, the scientific interest is high. Research into geoengineering governance itself is further complicated by large uncertainties regarding the effectiveness and possible negative side effects of different techniques.

4.2 Geo-engineering techniques

As previously introduced geoengineering is used as an umbrella term to describe different SRM and CDR techniques at large scale to alter the climate in order to combat climate change. Although it has been argued that the term geoengineering is unhelpful, and some call to disaggregate it (Bellamy et al., 2013; Heyward, 2013). Other recent developments have seen the emerging of different definitions for not just geoengineering but also for the different geoengineering techniques. Examples of different terminology instead of CDR and SRM are: negative emissions to replace the term Carbon Dioxide Removal or altering the Earth's radiation balance to replace SRM. However, the above would be seen as over simplification for those that argue for the different terminologies being used. Nevertheless, this research will stick to the most common used terms of SRM and CDR, and the umbrella term geoengineering as these are still most often used in the NGO context. Figure 7 shows an overview of the different techniques, after which a short summary of the different geoengineering techniques will follow for a full overview see (Shepherd et al., 2009).

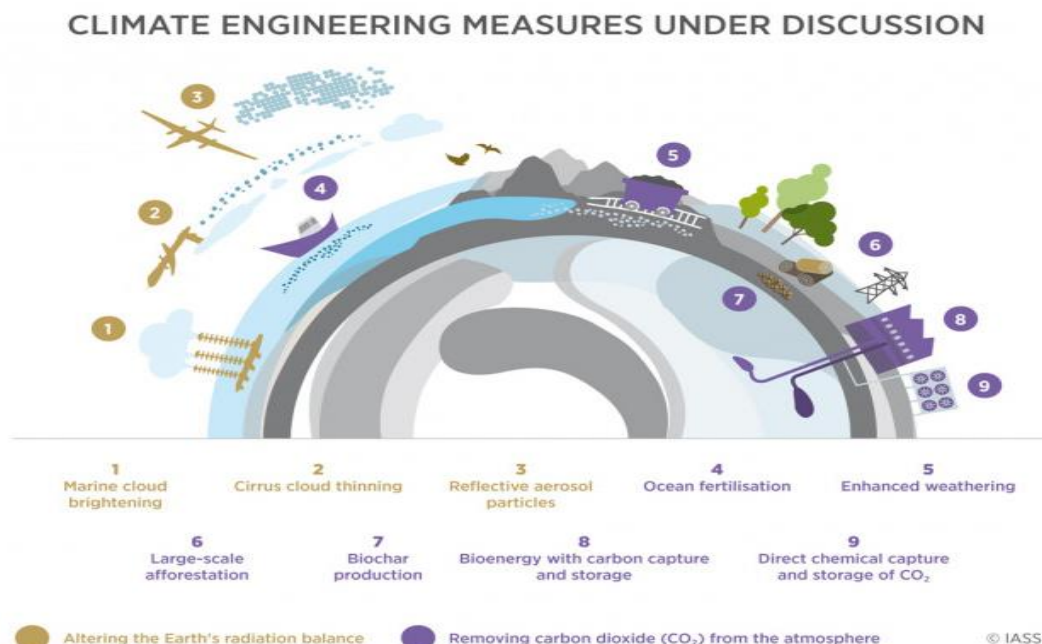


Figure 7 Illustration of various approaches (Boettcher, Schäfer, Honegger, Low, & Lawrence, 2017)

4.2.1 Solar Radiation management.

Solar radiation management or altering the Earth's radiation balance is achieved through influencing the incoming solar radiation. The most commonly prominent techniques are, Marine Cloud Brightening (MCB), and Stratospheric Aerosol injection (SAI) (Boettcher et al., 2017). Marine cloud brightening is achieved through spraying salty particles into the air over ocean to increase cloud cover and therefore increase the reflection of solar radiation over oceans (Shepherd et al., 2009), slowing the increase of the atmospheric temperature. Something which is even more prominent in academic literature is the idea of SAI. Inspired by volcanic eruptions that cooled the planet lead to the creation of the idea to insert Sulphur particles into the stratosphere to copy that affect (Shepherd et al., 2009). The idea is that, through reflecting solar radiation, the temperature rise is either, slowed, halted or stopped. These techniques do not solve the problem that caused climate

change, or even reduce that problem it only addresses the symptom of an increased temperature. However, it could be used to buy more time to get countries in line with the mitigation measures that are necessary to live in a world without too much warming (Nicholson et al., 2017). Especially as it is very unlikely that we remain within the international agreed upon targets of global warming with the current efforts made by countries and individuals (UNEP, 2017). Nevertheless, with all these techniques there is still very little knowledge, and huge uncertainties about effectiveness, side-effects, and unfair distribution of the possible positive outcomes. The technical knowledge of SRM techniques still requires more research.

4.2.2 Carbon Dioxide Removal geoengineering.

Another proposed geoengineering technique would be to tackle one of the main greenhouse gasses, namely carbon dioxide. Through an increased concentration of greenhouse gasses especially carbon dioxide, the earth's greenhouse effect is increased. It is commonly understood that mitigation is the priority when combatting climate change, however there is increasing consensus that mere mitigation measures are not going to manage to keep the concentration of CO₂ sufficiently low to prevent dangerous warming. Even when alternative pathways towards the Paris Agreement goals are adopted CDR is still necessary (Van Vuuren et al., 2018). Nevertheless, it is clear that through the reduction of CO₂ climate change could be tackled. Therefore, there are several technological suggestions to remove carbon dioxide from the atmosphere (Shepherd et al., 2009). These technologies are quite different from SRM however they face similar governance challenges, and share similarities such as the large scale at which they are applied, and the goal to influence the climate globally.

4.2.4. Ocean Iron Fertilisation

One of the techniques to draw CO₂ from the atmosphere is through fertilising the oceans, especially at those places where plankton growth is currently limited by the amount of key nutrients present. Through the fertilisation of the ocean plankton blooms will take up more CO₂ and when they die store it at the ocean floor, thus successfully taking CO₂ from the atmosphere. This was one of the first techniques that have been considered as geoengineering. Some experiments into these techniques have raised significant opposition and were unsuccessful, leading to initial governance for marine geoengineering. Successfully regulating marine geoengineering, to an extent that the many regulations to fulfil deter researchers. However, the topic already seems to some extent abandoned as even at a conference for Negative CO₂ emission, ocean fertilisation was not discussed (International conference on negative CO₂ emissions, 2018).

4.2.5. Enhanced weathering

The process of weathering "CO₂ is naturally removed from the atmosphere through a process called weathering (dissolution) of carbonate and silicate rocks" (Shepherd et al., 2009), this technique also starts with a natural process. This process can be enhanced through the mining of these minerals, by crushing them to increase the surface and uptake rate of CO₂, spreading them out on fields to take up CO₂ or use them in industrial facilities to take up CO₂. In the end we could store the CO₂ that was taken up, by either burying it underground or dumping it in the oceans.

4.2.6 Large scale Afforestation

It has been known that forests take up CO₂ through photosynthesis while producing oxygen. Besides reducing current forests loss and restoring those forests that have been partially cut down the idea of afforestation in the context of geoengineering is to increase forest cover. This might involve afforesting areas that might not have been forest previously, or reforesting areas that historically have been forest before. Only a project with a large enough scale would have any effect on the CO₂ balance, and be seen as geoengineering. However, the amount of land necessary to achieve this effect is unclear and the need for such an amount will most likely cause conflict with respect to other desired purposes for that land.

4.2.7 Biochar.

Similar to afforestation biochar also starts with the concept of plants taking up CO₂ when they grow. Then through pyrolysis, the biomass is turned into charcoals which locks in the carbons and prevent decomposition which would release CO₂. When this bio charcoal is then buried and taken up by the ground carbon is successfully sequestered from the atmosphere and stored in the ground.

4.2.8 BECCS

One of most discussed techniques is bio-energy and carbon capture storage, using biomass plantations to sequester carbon, after which the biomass is used as fuel in an electricity plant where the CO₂ emissions are captured and stored underground. Because the carbon is taken up by the biomass from the atmosphere and because the emissions are captured after using it to produce electricity and stored underground this technique would achieve removing carbon from the atmosphere.

4.2.9 DACS.

Direct air capture and storage is something entirely different. Through a chemical process CO₂ is filtered from the atmosphere and prepared to be stored underground. A technique that currently although technically feasible, requires so much energy that it would emit a similar amount of emissions as it stores purely based on energy consumption.

4.3 NGO perspectives of geoengineering techniques.

The description given above have been based on scientific literature such as the royal society report (Shepherd et al., 2009). However not all NGOs perspective align with these scientific analyses and some of the different techniques are either not mentioned or not considered to be geoengineering. Although the research question is concerned with geoengineering in general rather than the different techniques in order to fully understand the later described discourses some further clarification regarding the way in which some of the techniques are viewed is necessary. This section aims to shed a light on this. As this literature analysis was confined to documents concerning geoengineering-governance the presented results are based on the same literature. An important overall observation is that some NGOs do not associate the origins of geoengineering with the ideas of tackling climate change. The Heinrich Böll Foundation, ETC-group, and Biofuelwatch argue that geoengineering is a technique that was originally introduced as weaponization of weather (Wetter &

Zundel, 2017). Something that some researchers do acknowledge (Bellamy et al., 2013), as the first developments of some of these techniques originated in military purposes. It is a helpful tool in creating critical perceptions of these techniques. However, it does not appear to be the norm for all NGOs and only the three above mentioned NGOs are actively using it as such. Another interesting concept and difference between the NGO approach to the different techniques of geoengineering and that of academics is that the Heinrich Böll Foundation and the ETC-group also consider weather modification as geoengineering, and thus include it in their interactive map (Heinrich Böll Foundation & ETC Group, n.d.).

4.3.1 SRM from an NGO perspective.

From the literature analysis it became clear that from the different SRM techniques one technique is clearly dominant, namely SAI. In this case either the other techniques were ignored or addressed under the bigger banner of SRM with SAI being the main example given by most NGOs. The contributors to the BIG, BAD FIX: (Wetter & Zundel, 2017), do however address all SRM techniques. Most NGOs follow the scientific literature on SRM concerning definition and what it is supposed to do. They do not seem to contest its potential, but they do view this much more critically and less optimistically than some research does. However, although no NGO considers it a solution for climate change, the concept itself is not contested, but rather seen as an affront to tackling climate change and preserving the environment.

4.3.2 CDR from an NGO perspective.

As the different techniques for CDR are spanning a wider field of expertise more NGOs are vocal about these CDR techniques, however these techniques are so diverse that they are mostly not put under the one banner of CDR but rather discussed separately. The origin of this is partially because many techniques are already in use, or tested in other uses. Examples are bio-fuels, which could play a role in several techniques. Therefore, the different techniques will be discussed separately. In general NGOs are more focussed on CDR techniques than SRM, this leads to more NGOs discussing the different CDR techniques.

4.3.3 OIF from NGO perspective:

Although in scientific literature ocean iron fertilisation is technically considered to be a possible geoengineering technique, although more research is necessary, most NGOs frame it differently. They point to some previous experiments that did not succeed, and especially the possible negative side-effects are highlighted. But more focus is even on the already existing regulation that is there for OIF. The already existing governance structure makes this topic often mentioned as an example for other geoengineering governance. However, NGOs see the techniques itself not as a possibility to sequester carbon at all, claiming it a false solution. Currently no large research project on OIF is planned. Therefore, it could be argued that the time that NGOs were contesting the ideas and possibility of the technique itself was around the first experiments. Now their focus has shifted towards techniques without governance or any regulation to keep them in check.

4.3.4 Enhanced weathering from NGO perspective

As Enhanced weathering is only mentioned by in the publication(Wetter & Zundel, 2017), there doesn't seem to be a different interpretation from the scientific one.

4.3.5 Bio-mass based geoengineering from an NGO perspective

The concept of biomass-based geoengineering techniques deserve a further introduction. Due to the background of NGOs either environmentally, or civil society based many NGOs already encountered governance questions around large land-use for bio-fuels. Or forest destruction for other land uses. As biomass requires land at massive scales to be geoengineering, and this most likely will be in conflict with other land uses more NGOs are familiar with either similar or parts of certain bio-mass based geoengineering techniques. Furthermore, because many of the below mentioned techniques are already used on small scale, like biochar and afforestation, scale is a significant factor in the way that these ideas are addressed.

4.3.6 BIOCHAR

Biochar is not one of the most contested geoengineering techniques. However, NGOs do highlight the uncertainty of its outcome, as well as the large amount of lands that would be necessary to produce that much biochar. No clear differences can be found between the NGO perspective and scientific literature. It is sometimes framed though that small-scale biochar is an eco-friendly fertiliser but for large-scale implementation as geoengineering it would be unsuitable. The lack of scientific research also helps to keep this technique relatively low profile. Especially in comparison with Bio energy and carbon capture and storage (BECCS).

4.3.7. BECCS from NGO perspective

BECCS is one of the most discussed techniques, through featuring in the IPCC models as a possible technique to be economically viable it got a lot of traction not just in research but also among NGOs. However, whereas with other techniques NGOs mostly follow the science with BECCS several NGOs e.g.: Biofuelwatch, Heinrichböll Foundation and ETC-group, all argue that this technique is not capable of actually removing any carbon from the atmosphere. Furthermore, critique focusses on the land that is assumingly necessary to grow the biomass to achieve carbon removal, through BECCS. Another point that is introduced here is the idea of Carbon Capture and Storage something that long has been contested by NGOs as it would not be a real climate solution. Although that is currently no longer the view scientifically as most scientist now argue we need both mitigation and carbon capture (Van Vuuren et al., 2018) very quickly. However, for NGOs CCS is still something that they are not in favour of. Together with the fact that BECCS played such a prominent role in the IPCC reports it seems that there is quite some opposition to this technique, previous experiences of NGOs with bio-energy makes them even more cautious about this technique than other techniques.

4.3.8 Afforestation from NGO perspective

To increase forested areas seems to be agreeable with NGOs ideas and possibly even their own efforts to restore and increase forests in general. Although the idea of increasing forests to draw down more CO₂ is not contested, not all NGOs are directly in favour. NGOs seem to emphasize that in the context of geoengineering the scale is so large that it might not be as benign a technique as it

seems. Land-use interests are again an issue, as well as possible land-use change. When digging deeper into the concept of afforestation it seems that some ways of afforestation might not be contested by NGOs but would than mostly be of scales that wouldn't constitute geoengineering. Which brings me to the topic of Natural Climate Solutions.

4.4 Natural climate Solutions

So called Natural Climate Solutions, introduced by (Griscom et al., 2017) as: *“conservation, restoration, and improved land management actions that increase carbon storage and/or avoid greenhouse gas emissions across global forests, wetlands, grasslands, and agricultural lands”*. There are several reasons why NGOs do not consider this geoengineering. It is first of all there is no direct aim to alter the climate system to combat climate change, secondly there is no mentioning of large enough scale, furthermore, it uses existing forests and lands with ways of increasing natural CO₂ uptake rather than inventing new technologies. However, it can also be argued that it does constitute geoengineering. First of all, it increases GHG storage, similar to afforestation or other CDR techniques. Secondly it is specifically named to sequester Greenhouse gasses such as carbon dioxide from the atmosphere. Thirdly it is within the UNFCCC presented as way forward to bridge the gap between 2 and 1.5 degrees. Also, without significant mitigation the realisation among NGOs that some type of sequestering carbon might be necessary seems to develop. Natural climate solutions seem to be the response of NGOs to the necessity of some form of carbon sequestration and counter other geoengineering proposals. The main reason to mention it as part of this research was the use of these ideas in the discourse on geoengineering governance, which I will further elaborate on in the specific discourse. Currently more research into this topic needs to be conducted to further establish its potential, although one could wonder what the real-world potential is. Currently deforestation is still ongoing, and no international governance managed yet to actually stop deforestation or forest degradation. The blurry line between geoengineering and these solutions is a question of execution, how this technique is executed determines how they will be discussed in further research and other literature.

4.5 Uncertainties and risks of geoengineering.

All geoengineering techniques are full of uncertainty and unknown effects, these effects are diverse for each technique, however for some techniques there is a clearer idea of what possible side effects are than others. First of course the difference between SRM and CDR. In which SRM seems to have greater risks, as it involves the stratosphere which ensures a global effect and it is an unprecedented technology. For CDR the risks and uncertainties are a bit more diverse, although a global effect on climate change is the aim of most techniques. OIF strangely seems to have more characteristics in common with SRM than any other CDR technique. Especially the scale and the possible negative effects across borders as OIF is executed in oceans just like the stratosphere there is the possibility of global negative side effects. Not all techniques face this type of substantial inherent problems. Most of the risks come only to the forefront through upscaling e.g.: Afforestation, Biochar. For these techniques common risks and uncertainties are, Land-use conflicts through land-use change or the long-term storage of CO₂. Many of the actual CDR techniques therefore face more local risks and uncertainties. However, organising any type of CDR to influence the climate is always a global activity.

4.6 Short-introduction of the scientific literature for governance of geo-engineering.

Within the geoengineering governance literature there is a tendency to focus more on SRM-governance e.g.: (Jinnah, 2018; Nicholson et al., 2017). The global implications of SRM seem to have especially caught the interests of researches studying governance for this kind of technologies. CDR again seems than a lot more manageable and posing fewer potential international governance challenges. Although CDR techniques seem to be the first type of geoengineering that is going to be used the direct effects are mostly local, and not international. Only through international regulations for CDR techniques, international goals, or international agreements on CDR would these become a more international governance challenge. However, some would argue that CDR is inherently an international governance problem as it aims to alter the earth's climate as all geoengineering and therefore qualifies for international governance. Within the scientific literature there are some further interesting observations. There seems to be three different kind of background from which people approach the debate on geoengineering governance. Some approach it from the idea of the Paris Agreement, in which we follow the 1.5-degree target and article four (Chen et al., 2017; Horton et al., 2016), to not just legitimise the research but also to present the reason why we need these techniques. This has also been observed by the paper of (Michaelowa, Allen, & Sha, 2018), they argue: *“that this aim has triggered an urgent need for research on climate policy instruments consistent with 1.5-degree emission pathways”*. Within the overall geoengineering governance literature you have people more or less cautious about the dangerous scenarios of geoengineering (Virgoe, 2009). Whereas others rather denounce that and see it necessary to explore geoengineering as an uphill struggle (Bellamy & Healey, 2018). Others approach governance more from an international law perspective and look at the challenges for international climate regimes as well as how democratic principles can be held up (Horton et al., 2018). Quite a large other category within governance research literature is that for research governance e.g.: (Dilling & Hauser, 2013; McKinnon, 2018; E. A. Parson & Keith, 2013). In order to continue further research in geoengineering technologies governance for research is required to further guide and legitimise this research. This seems to be a step in before actual governance for deployment of geoengineering. However, it has been argued that some research to be useful needs to be at a scale that there possibly exist global risks or at least transboundary.

Besides the governance debate there is a large body of literature on the different technical methods, 1.5-degree scenario's and other models that aim to further understand geoengineering. Although it's not the exact focus of this research. These models similar to the ones used at the IPCC shape the debate and also in some cases are indicated as a start of using geoengineering techniques to solve climate problems. An example is the use of BECCS in the Integrated Assessment Models to reach the 1.5-degree target. Important to say is that in general the literature doesn't give one solution for a governance framework, many seem to refer to the UN, or international bodies of governance but others are reluctant to do so, as the UN wasn't always effective.

The little knowledge of effects of geoengineering, make the topic of geoengineering governance also interesting for the field of governing uncertainties and futurization (Low, 2016). However, that makes it also one of the greatest challenges to organize governance. The challenges posted by

geoengineering governance offer a wild variety of research interests and the different approaches show the complexity of the governance challenge.

4.6.1 Current governance

Following the earlier broad definition of governance architecture there are some governance aspects clearly in place. However the lack of intentional governance for geoengineering makes it impossible to claim the existence of an geoengineering governance regime (Talberg et al., 2017). Other forms of governance we do see are coined as defacto- or governance by default (Gupta & Möller, 2018; Talberg et al., 2017). The process of the discussion on governance is in the case of de facto governance already discussed as being part of governance as it shapes norms and principles.

Beside this academic literature some international agreements did touch upon governance for specific geoengineering techniques although often more restrictive or within in the broader context of climate change or environmental protection. Although the UNFCCC especially since the 1.5-degree target, and article 4³ seems to have opened the door to some CDR technologies (Horton et al., 2016) and therefore some forms of geoengineering. Nevertheless, the UNFCCC does not further establish any governance framework for actual governance of these technologies as such.

The London Protocol and London Convention did address the matter of one geoengineering technique: ocean fertilisation. As they saw it within their scope they established that ocean fertilisation could only be allowed for legitimate scientific research. The established legally non-binding assessment framework for scientific research involving ocean fertilisation is one of the few concrete regulations aimed at geoengineering (International Maritime Organization, 2013). Another international institution addressed geoengineering was the CBD. In 2010 they agreed that no climate-related geoengineering activities that may affect biodiversity take place, until there is an adequate scientific basis on which to justify such activities, after proclaiming the lack of transparent and effective control and regulatory mechanisms for geoengineering (Convention on Biological Diversity, 2010). The CBD did however leave room for small scale scientific research. Although it might seem that with the CBD agreement geoengineering would have been successfully governed, however that is not exactly the case. The agreement only concerns the parties to the CBD which are missing some essential countries like the USA, which never ratified the CBD. Furthermore, does it focus on marine geoengineering excluding geoengineering techniques that do not influence the ocean. Therefore, although it seems to be the only international institution to address geoengineering as such it's not considered to be legally binding, effective or conclusive.

4.6.2 Governance suggestions

Within the recent growing body of literature on geoengineering governance this research distinguishes different approaches to tackle geoengineering governance. This further informs civil society as well as international organisations to what geoengineering governance could possibly look like. Many articles discuss the possibility to link geoengineering with mitigation (Bellamy, 2016; Chen et al., 2017; Horton et al., 2016; Lin, 2009a; Lloyd & Oppenheimer, 2014; Low, 2016; Edward A. Parson, 2014; Virgoe, 2009; Zürn & Schäfer, 2013). Possibly to combat the moral hazard as well as

³ "To achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of the century" art. 4,1 Paris agreement.

because the discussion of geoengineering governance often takes place within the climate debate. Therefore, goals such as in the Paris agreement influence these articles and governance suggestions. As mitigation is one of the main goals of the UNFCCC, the link with geoengineering within the climate context makes sense. Which is clearly visible in the articles by (Chen et al., 2017; Horton et al., 2016; Zürn & Schäfer, 2013). Another commonality between articles addressing geoengineering is the focus on international governance. Due to the idea of large scale interventions, the global characteristics seem to have academics writing about global governance. This also often results in the mentioning of the UN or a UN institution taking the lead for any governance scheme. As it is currently the only fully international governance institution, with global participation, and secondly the CBD as part of the UN did already take some governance decisions. Some papers also dive further into the different specification of governance architecture for research, or deployment and democratic purposes. The wide variety of suggestions seem to be exemplary of the complexity and uncertainty of governance for geoengineering.

4.6.3 Main governance problems identified.

Common among most of this literature are the different governance problems that are identified for geoengineering governance. I summary these are:

Table 4 Problems for geoengineering governance

International	Large scale interventions will result in transboundary and most likely global effects. This creates international governance challenge therefore governance should have an international character.
Unilateral deployment, or coalition of the willing	Due to the possibility of global effects and only a small group or even a single country who would be necessary to execute geoengineering there seems to be fear for unilateral, or deployment by coalition of the willing.
Uncertainty	Due to a lack of research there are still major uncertainties concerning effects both positive and negative of geoengineering.
Irreversibility	Once some geoengineering techniques have been implemented they are not reversible, such as most SRM techniques. CDR seems less problematic for some techniques e.g.: BECCS, Afforestation. Although other techniques like OIF does experience irreversibility.
There is no clear governance goal	Although academic literature often names the Paris Agreement and 1.5-degree goal as a start goal for geoengineering there is not yet a governance goal for geoengineering governance. It's not clear if it should be regulated, banned, researched or deployed. Or if either of this should be prevented or stimulated.
It is not clear if the climate change effects will legitimize geoengineering	Through uncertainty in models, exact climate-change effects are hard to establish combined with the uncertainty of geoengineering it's not clear if climate change effects will warrant geoengineering.

4.7 Some social and political background

The discussion of geoengineering governance did not start in a vacuum. This short paragraph further highlights some social and political backgrounds in international governance, after which different angles towards the debate of geoengineering are further discussed. Climate change governance is the most prominent. Attention was increasingly drawn to geoengineering after the conclusion of the Paris climate summit (COP 21 of the UNFCCC). The well known Paris Agreement was established with a different approach than previous agreements in this field instead of focussing on the emission reduction there was a target established of 2 degree and the strive to go for 1.5 degrees maximum average global warming (United Nations Framework convention on climate change, 2015). This was a turning point in climate change policy and established the possibility to explore different option than the standard mitigation and adaptation measures that were previously always the largest discussion point. Especially with article 4 the options for geoengineering techniques were left open. This was further supported by the IPCC models which often included BECCS as CDR technique in order to reach the 2 degrees or 1.5 degrees target in their models. This process can be seen as the accelerator of the geoengineering discussion however the discussion has already started a lot earlier, long before the Paris agreement in 2015. The discussion came to light in international governance at the CBD COP on which the idea of a particular CDR technology was discussed that of ocean fertilisation. It was agreed that large-scale operations were currently not justified and that parties should prevent it until these activities are scientifically justified, risks are assessed and global, transparent and effective governance is in place (Convention on Biological Diversity, 2008). This is often being referred to as the CBD moratorium by NGOs (ETC-Group Heinrich Böll Stiftung, 2017b; Wetter & Zundel, 2017). and an international moratorium for that technique was established. Although it's hard to pinpoint when NGO involvement started it's clear that as soon as geoengineering became a topic in the CBD, NGOs were involved. However, publicly there was very limited NGO activity. And still public awareness of what geoengineering is and what it entails is very limited, as said it's a developing discourse and the development on the discourse of governance is a necessary research topic.

Other more general points in the background of geoengineering governance is the lack of action and the growing knowledge of impending climate change. The case of CCS is a good example of the shifting urgency and attitudes towards solving the problem of climate change. Whereas CCS was first seen as a false climate solution, not reducing emission but storing it in the ground. Currently it seems that it is considered to be a necessity in order to achieve sufficient carbon sequestration to stay within the 2-degree target. The need for climate action and the little action taken furthers the case for geoengineering technologies and therefore governance of it. All against a background of an ever-growing world with growing economies, populations and still increasing greenhouse gas emissions.

The full social political context in which geoengineering exists is a study in itself, however to further understand the discourses it is important to keep the above in mind.

4.8 Different angles to come into the debate

What becomes often very clear in the different publication is the cultural background and in general the departing point of such an organisation. Or even just the background of individuals when you speak with them in interviews. From the interviews it became clear that some personal background and expertise often also helped to shape the approach towards governance for geoengineering. Below different angles from which the topic of geoengineering could be approached are described.

4.8.1 The historical angle

Different NGOs have different approaches toward the topic of geoengineering governance whereas some already started to look at the problem from a historical perspective putting the starting date of geoengineering at a time that geoengineering options were considered for military use (e.g. ETC Group, Heinrich Böll Foundation, Biofuelwatch) whereas others only discuss it in the context of solving the current climate problems (e.g. Environmental Defense Fund (EDF)). The question if it would be correct to see geoengineering also as a weaponization process which started during the cold war is a question of definition and scope of the term geoengineering. When you would say that geoengineering is inherently to combat climate change these other uses of geoengineering might seem less relevant, or at least less applicable to the current debate on geoengineering governance. However, this is contested by those who argue that we should not forget the military heritage of geoengineering techniques and therefore be even more sceptical about it, and actually should ban it. As some of the more outspoken NGOs on this topic tend to rather use the later argument. This discourse analysis can't ignore the fact that some NGOs still see geoengineering just as much as a weaponization governance problems as well as a technical climate solution governance problem. Although CDR is not as often mentioned in this context some techniques like OIF are put together with SRM techniques when it comes to these kinds of arguments. Most likely because of their global impact and point source execution.

4.8.2 Climate change angle

When geoengineering was mentioned by Paul Crutzen as possible solution to solve climate change (Crutzen, 2006), the idea of geoengineering became a climate issue. This was at a similar time when the IPCC started to use CDR methods in the IAM in order to achieve a desired minimum temperature rise of 2 or even 1.5 degrees. When in 2015 in Paris the Paris Agreement was adopted on the basis of the achievability of the 2-degree target while aiming for the 1.5 on the basis of IPCC models, article 4 became important for all those that concern themselves with geoengineering. The text explicitly naming anthropogenic sources and sinks, left open the option to create anthropogenic sinks for carbon removal. This argument is often used by scientists to legitimise research and call for further elaboration on the topic (Horton et al., 2016; Michaelowa et al., 2018). However, NGO representatives mostly claimed that this would be a wrong explanation of this text and what was meant with this clause are soil carbons, or other natural carbon sinks influenced by mankind. In the broader picture those who came to know geoengineering in this context often see it as a distraction from climate mitigation and adaptation rather than a solution to add to those climate measures. Geoengineering is then also often mentioned (in the literature as well as interviews) as a measure to continue emission and fool policymakers that emission could continue. Even though every research paper states that geoengineering is not a solution in itself but only an extra measure to existing climate change mitigation measures.

4.8.3 Land-use background

A third context is that of land-use, when the IPCC first started to use BECCS in their IAM, NGOs working on forestry and land-use were alarmed. Deforestation as an effect from policy to promote bio-energy already had been a problem that NGOs such as Biofuelwatch were concerned with. This

extended when especially BECCS started to have a prominent role in the IPCC models especially those models that supported the 1.5-degree target from the Paris agreement. These NGOs see themselves as drawn into a debate they rather not have. Although they are rather focussed on a geoengineering technique they most certainly try to steer away and stay away from this debate. The land-use issues of geoengineering are especially of their concern. Considering that many of the proposed techniques do have potential land-use issues like conflict, and competition with food-production it seems a logical topic. Another interesting point to mention is that for land-use there is already some legislation especially considering deforestation and afforestation under the Reducing Emissions from Deforestation and forest Degradations (REDD+) schemes. Although these regulations do not address geoengineering as such, they address forest emission reductions. Lastly, the NGOs with this angle focus not on the CCS part or SRM part of geoengineering but solely on the land-use part of among others but specially BECCS. They are however a bit more present as BECCS is one of the currently most discussed geoengineering techniques in the context of climate change. Mostly through the use of it in the IAM of the IPCC.

4.9 Worldviews and belief systems

When analysing social processes in the end many human interactions can be explained on the basis of fundamental belief systems. For example, in the Advocacy coalition framework and the model of man by Sabatier and Smith, deep core beliefs, policy core beliefs and secondary aspects are the driver of change (A. Sabatier & Jenkins-Smith, 1993). In more simplistic terminology norms and standards differentiate between individual but form the basis on which we as humans' act. The assumption of how the world works and what roles humans should have in this world is your environmental worldview (Miller & Spoolman, 2012). Which is based on personal ethics and beliefs. This study is not broad enough to further go into the ethics behind the different NGO discourses, or discuss the different types of worldviews that are identifiable. This section rather highlights the main worldview of environmental NGOs and that is that we need to preserve the environment and need to do that in a way that doesn't harm the environment. Although every NGO will have a more specific and detailed description of this very general worldview all environmental NGOs analysed in this research aim to protect the environment, as it's a core aim of their NGOs it is also a large part of their worldview. Some have a slightly different view and argue for environmental preservation from a societal point of view. Nevertheless, they still seem to share the idea that we need to preserve the environment without harming it.

5. Results

5.1 Analysis of literature and interviews

5.1 Literature analysis:

From the literature analysis it became clear that there is one dominant discourse which is highly represented by the most vocal NGOs in the topic of geoengineering and geoengineering governance the ETC group and the Heinrich Böll Foundation. They are so vocal in a few different ways, first of all these NGO published several publications on the topic last year (ETC-Group Heinrich Böll Stiftung, 2017b, 2017a). As well as publishing a book together with the Biofuelwatch (Wetter & Zundel, 2017). Besides that the Heinrich Böll Foundation organised several meetings during the UNFCCC COP23 and at the parallel peoples climate summit (Heinrich Böll Foundation, 2017). Furthermore they often participate in conferences, on the topic of geoengineering, where they also campaign their position (Institute for Advanced Sustainability studies, 2017). It seems that the organisations that lead this discourse are working closely together. In short, the activity of NGOs included but was not limited to: participation at the COP23 to spread information through flyers and campaign especially for real solutions⁴. Share information online to make people more aware of the debate. Write letters to policymakers to help inform them about the topic. Start the discussion at the COP23 in a side event as well as at the people's climate summit parallel conference. Publish a book to extensively explain geoengineering and the role in international governance and its dangers. The main discourse: Ban geoengineering there are different solutions is characterised by a distinct set of frames and storylines which I will further elaborate on in the next chapter.

5.2 NGO interviews:

The NGOs interviews were used to further explain the discourses which will be individually addressed in each discourse under the heading origins and developments of the discourse. The interviews helped for example identify the background of the people presenting the discourses which shaped their view on the topic of geoengineering governance as well as that of their NGO. It also highlighted how the field is further developed through only a small group of individuals that push the topic as it is clear that although the debate and discussion on geoengineering governance is growing also among NGOs it is still something that is not in the mainstream climate campaigns and discussions. Easily explained by the reluctance of NGOs to get involved in the topic, because of the possibility to accidentally legitimize geoengineering with such actions. The lack of capacity and mostly the belief that other options should be executed now and direct, and that there is still a major need for campaigning on that.

⁴ Real solutions are considered by most NGOs as solutions that solve climate change through traditional mitigation measures. Some NGOs also include Natural Climate Solutions (Griscom et al., 2017).

6 Discourse 1: Ban geoengineering there are different solutions.

6.1 Introduction

First of all, the discourse presented here, is the dominant discourse in NGO literature. The number of storylines and frames supporting this discourse is by far the highest in this analysis (see annex). The different NGOs the Heinrich Böll Foundation, ETC Group, and Biofuelwatch are the most involved NGOs in the debate on geoengineering and geoengineering governance. They have published the most articles and conducted the most studies on different techniques as well as governance, all following this discourse. Especially their book: *The Big Bad Fix* accounts for the largest and most comprehensive NGO publication on the matter (Wetter & Zundel, 2017). This first described NGO discourse will also serve as a broader discursive basis on which later I will introduce some smaller differentiations from other NGOs.

Based around 5 storylines this first and dominant discourse is first of all very much against geoengineering governance. The idea of governance could even enable geoengineering, so it would have been better if there was no involvement necessary. Even research on geoengineering whether it are modelling exercises or outdoor experiments these are seen as wrong in this discourse, because they are perceived as a slippery slope towards deployment of geoengineering. However, through recent developments geoengineering has entered into the more mainstream debate and therefore governance is necessary. However, governance can only be considered if it includes the possibility to thoroughly as possible ban geoengineering. Furthermore, as the discussion on governance is only grudgingly held focus should be on governance solutions for radical change. So rather than governance for just geoengineering there should be governance to achieve the radical change in order to reach the climate target of 1.5 degrees. The table shows some of the most commonly used frames for each storyline, see table 5.

6.2 Storylines

There are five Major storylines within this first discourse, that are interconnected and not always clearly distinguishable. **The first storyline** thinks that geoengineering should better not be discussed. **The second storyline** is that we should focus on real solutions instead of geoengineering.

The third storyline is the idea that an international ban is the only appropriate way to deal with all geoengineering. **A fourth storyline** specifically aimed at governance argues for inclusive, fair and rights-based governance. **The Fifth** storyline is about the idea that geoengineering is not just for climate but also used as a weapon.

Table 5 Storyline and frames from discourse 1

Storylines	Frames:
1 Geo-engineering governance should not be discussed	<ul style="list-style-type: none">• Discussing geoengineering governance might permit development of geoengineering• Advocates of geoengineering aim through governance to continue and push forward geoengineering• A discussion should be free from corporate interests

	<ul style="list-style-type: none"> • Governance for geoengineering is impossible
2 The focus should be on real solutions	<ul style="list-style-type: none"> • Geoengineering is a false solution • Climate mitigation is the only real solution • Call for governance of radical change • Real emission cuts • Geoengineering is an illusion to policy makers to keep emitting
3 There should be an international Ban for SRM or all geoengineering	<ul style="list-style-type: none"> • Ban all geoengineering activities • Strengthen the moratorium of the CBD • Time for a test ban treaty • No outdoor experiments should be allowed • Banning is also an approach to governance • Like nuclear technologies geoengineering should be banned • Global scale of SRM and CDR requires global governance
4 Governance should be right based, fair and not dominated by Western-Countries	<ul style="list-style-type: none"> • Geo-engineering Governance should occur through the UN • Should be participatory, rights based • Take into account local communities and the global south • Dominance of technocratic view should be prevented. • Previous UN decisions should be respected on marine geoengineering
5 Geoengineering is more than a climate tool therefore governance is more than climate governance	<ul style="list-style-type: none"> • Geoengineering is inherently of a dual use nature (climate and possibly weaponization) • Weather modification is also geoengineering • Geoengineering originates as weapon and still is

6.3 Elaboration of different storylines:

The table above gives you an overview of the different frames, and storylines, constructing this discourse the next section will further describe the build-up of the discourse around the 5 storylines and how it is presented by the different NGOs. It should be noted that this is an overview of the discourse rather than a representation of any individual NGO.

1 Geoengineering governance should not be discussed

The storyline of not discussing geoengineering governance becomes clear when analysing the literature but is not often mentioned as such. Logically as the publications were selected on the fact that they discuss geoengineering governance. However, a few clear frames fit this storyline as well as an overall distaste for the idea of geoengineering that is tangible in the publications. Nevertheless, the best examples can be found in the publications and side events that are not part of the actual

literature analysis as they did not specifically address governance. One example of such a publications is: “A change of course: How to build a fair future in a 1.5-degree world (Götze et al., 2017). Examples of events are “The case against geoengineering, how to build a fair future in a 1.5 degree world” (Heinrich Böll Foundation, 2017) or “What does the world need to look like to limit warming to 1.5 C”, so that we do not need to rely on dangerous geoengineering technologies and false solutions (United Nations Framework Convention on Climate Change, 2018) . These side events provided good insights into this storyline. Especially when combined with the mentioned frames from the articles that do mention that geoengineering governance should not be discussed. One such event with as title “What does the world need to look like to limit warming to 1.5 C” (United Nations Framework Convention on Climate Change, 2018), went after a very short introduction on the topic of geoengineering into a brainstorm session on how climate action in the form of radical societal change could be accelerated to avoid it. So rather than discussing the topic of geoengineering governance, NGOs focus on other discussions.

Discussing geoengineering governance is also avoided because NGO representatives are afraid that governance does not just mean a ban but also possibly means some kind of regulation of geoengineering activities such as outdoor experiments. This is connected to the frame that governance through voluntary guidelines proposed by research institutions are only there to facilitate rather than limit or regulate geoengineering. This frame discredits, scientist working on governance systems for geoengineering research but also seems to undermine voluntary governance structures.

Another concern for NGOs is corporate interests and interests from actors in favour of geoengineering techniques. Presenting these actors as being from big oil companies and other polluters NGOs argue that without their interventions these corporate interests would make geoengineering more likely and enable pollution through the continuation of burning fossil fuels. As geoengineering is seen by some as a means to keep developing polluting industries.

Lastly the lack of a clear-cut solutions for governance of geoengineering further stops the discussion on geoengineering governance. Whereas other environmental problems can be solved through improving existing governance or developing governance frameworks it seems geoengineering can't. The uncertainties, the possible global effects but also differentiated effects as well as the slippery-slope problem and possible negative impacts, make the problem so complicated that apart from governance for a ban it seems impossible to organise geoengineering governance. Especially when following governance principles, such as democratic, just, fair, and legitimate. This seems to further stop the governance discussion as a message with just a call not to go ahead without alternative solutions or options is harder to sell, and rather limited.

2 The focus should be on real solutions

As mentioned in the first storyline it is often stated that the governance focus should be on real solutions (see codebook). This is than often presented as: geoengineering in itself is no real solutions, a frame that is quite often mentioned in the literature (see codebook). This is further supported by discrediting those that present geoengineering as a necessity from a scientific perspectives such as the Keith Group. It was found that this is done through three approaches. First criticising the valid fact that geoengineering does not solve the underlying cause of climate change. Secondly a more personal form of discretisation through claiming that some researchers are just out for personal gain,

through patents and companies connected to them. It was one of the reasons why the SPICE project was cancelled as well (Cressey, 2012). This also fit the previous frame from NGOs that researcher campaign for voluntary governance structures to advance their research. A third point to discredit the research is about geographical and inclusiveness in research: stating that this kind of ideas are only presented by Scientists from the global north and western countries without taking into account views from the global south. Sometimes also the idea that we could solve the climate problem with a technological solution itself was contested in the interviews it was even seen as perverse, that such a thing could be suggested. Another wide criticism on scientific literature concerning the topic of geoengineering is the use of BECCS in the IPCC report. Something that several NGOS do not even consider as a possible technique to sequester CO₂ is in the IPCC reports presented as CDR technology. Contested by the NGOs are also the IPCC IAM that are too much orientated on cost-optimisation and not representing enough actual possibilities for avoiding BECCS or other CDR techniques.

Certainly, the frame that climate mitigation is the only real solutions is not a surprise after discrediting and contesting the idea that geoengineering is a solution to help solve climate change. This is presented especially within the climate debate, it seems to be used to draw away the conversation from geoengineering.

Presented together with the previous frame is an open call for radical change or even governance for radical change, rather than just enhancing ambitions there is a need for more radical societal change to actually achieve enough mitigation. Implicitly NGOs do acknowledge that without enough mitigation geoengineering might be necessary although they mostly mean to enhance climate action in such a radical way that emission reductions will follow sooner than through the slow process that is currently present in stepping up climate mitigation actions.

The frame of real emission cuts is used to deviate between solutions that do not actually reduce emission but just seem to do so on paper. All schemes in which emission are not reduced but for example bought off or accounted for and given away are put together here.

The last frame was presented in two distinct ways. One way framed it as if policymakers were reluctant for actual climate mitigation solutions and would use every excuse to not make the hard decision necessary to achieve enough mitigation potential. The second way framed it as if policymakers are tricked by geoengineering proposals, offering the idea that climate change can be solved with geoengineering techniques, when that is not the case. The best example of the latter is the fact that very few policymakers seem to have realised the necessary CDR measures present in the IPCC models that kept global temperature rise to 1.5-degree, or the extreme measures to achieve a similar effect with mere mitigation.

3 There should be an international ban on geoengineering governance

This storyline was more straightforward presenting clear governance options. Interesting in this storyline was the fact that most NGOs first pointed out that a ban is a valid governance approach something that although not directly contested by any literature seemed to be necessary to point out throughout publications and interviews.

Secondly the comparison that is made with nuclear treaties is also a clear example of the perceptions of NGOs towards geoengineering. NGOs see geoengineering as an equally large threat as nuclear

technology. This way of putting geoengineering in the same line as nuclear technologies seems to be strategic. However, they also state that the possibility of a weaponization of geoengineering techniques is a real threat. NGOs see the comparison as logical and argue that geoengineering and nuclear technologies share many characteristics. Furthermore, the Non-Proliferation Treaty is one of the few international treaties that aim to ban and stop the spreading of technologies, as well as something that is supported broadly in among Civil Society. Rarely the even more successful Montreal protocol phasing out CFCs gasses is mentioned. As the threatening idea of a similarity with nuclear weapons certainly draws more attention.

Lastly there is a clear signal from all NGOs that such a ban should be organised at a global scale through global governance. The idea of local bans is applauded and supported but in the end the focus is to advocate for a global ban considering the global impacts.

4 Governance should be rights based fair and not dominated by Western-Countries

Within this storyline I the idea of governance that is rights based fair and not dominated by western countries also connects to the frame that the scientific debate of geoengineering is a debate mostly held by scientist from Western Countries e.g. UK, USA, Germany. It's a collection of different often mentioned frames and ideas like rights based, fair, and domination of the governance debate by western countries. When combining the different frames such as rights-based, participatory, including local communities it seems to be in line with the UN governance ideas as present in the UNFCCC and the UN CBD. That not every UN body is suitable became clear as well in the interviews.

The frame to approach geoengineering governance through the UN logically follows. This is further built on by the appreciation of the UN for inclusive approaches, membership of almost all countries and principles such as the precautionary principle that the UNFCCC and the UN CBD have adopted. This combined with the prominent role of NGOs within these UN bodies seems to be the argument for governance through the UN. Other international governance institutions were found lacking in the possibility to come even close to the UN.

The established moratorium was often mentioned and also defended from the accusation that it is not legally binding. It was presented as something that was a starting point for future governance. The fact that not all countries are party to the CBD and therefore do not acknowledge such decisions was not seen as relevant. The almost global agreement made by the CBD after the London Convention and London Protocol decision was presented as existing governance that should not be ignored or neglected.

5 Geoengineering is more than a climate tool therefore governance is more than climate governance

This storyline opens up the debate from geoengineering as a technique to combat climate change to geoengineering as a technique with any possible impact. NGOs seem to want to put geoengineering in this wider debate to give it more attention and to better present its dangers. The idea that geoengineering is possibly also used as a weapon is only present in some publications the publications by the Heinrich Böll Foundation and the ETC Group, and their joint publication with Biofuelwatch (Wetter & Zundel, 2017). Although this dual nature of geoengineering is often mentioned this storyline also presents the broader concerns of geoengineering. Something that is not just inherent for NGOs. Scientific literature also points out the many possibly effects of geoengineering and therefore the need for geoengineering governance. This discourse aims to draw

the debate beyond climate change and often quickly develops to land-use, or interstate conflict as caused by negative side effects of geoengineering. It furthermore opens the debate in the question of how we use the planet and how we should see the role of humans in this world. Acknowledging the complex issues regarding geoengineering governance. This storyline opens the debate sufficiently to include how earth systems are connected and the central role of humans in this. The origins of this discourse also further explain frames like that of weaponization of geoengineering.

Another interesting observation is the broader use of geoengineering as also being weather modification an often-presented view among NGOs and broadening the debate. Apart from publications mentioning this the NGO website map.geoengineeringmonitor.org (Heinrich Böll Foundation & ETC Group, n.d.) is the best example to illustrate that for NGOs geoengineering does not mean the same as defined in most research following the royal society (Shepherd et al., 2009). Although since the term geoengineering was brought up there have been debates on the concept of what would constitute geoengineering. Within the context of this discourse analysis it suffices to say that for NGOs weather modification is seen as geoengineering. However, this seems to be contradicted by some of the responses from NGO representatives on the definition on geoengineering. However, none of these definitions is precise enough, to not be able to include weather modification, as long as the scale is large enough it would constitute geoengineering, relatively similar to the scientific definition.

6.4 Discourse according to governance architecture

Table 6 Discourse 1 according to governance architecture

Public or private institutions	Governance should be organised in public institution that work towards a ban. Ideally it would be the UN, however not the UNFCCC or the CBD, but rather the General Assembly, to make it binding for all countries and globally accepted.
Principles	Precautionary principle
Norms	Climate change should be addressed through mitigation and adaptation, geoengineering is not a solution but a way to continue emission rather than solve the climate problem
Regulations	There should be a Ban on geoengineering that not just bans geoengineering practices but also testing and research on the topic until suitable governance can be applied.
Decision-making procedures	It should be global decision with equal representation, no conflict of interests from the participants in this discussion or businesses that have economic interests in the continuation of emissions.
Organizations valid or active in issue area.	Governments, Actors promoting geoengineering, NGOs, international research institutions e.g. IPCC, advocacy groups, research groups like, Union of concerned Scientists, C2G2, CBD, London Convention & Protocol.

6.5 Origin and development of the discourse:

This discourse starts with the first publications of the ETC-group, who was joined in their campaign by the Heinrich Böll Foundation and later joined by Biofuelwatch. Together these 3 NGOs seemed to have established this core discourse to which others also attached themselves. This discourse

originates with the historical background of weaponization as presented by the ETC Group, and the Heinrich Böll Foundation. Which was a reaction to the experiments and reports that became public after the end of the cold-war. Therefore, this discourse originates before geoengineering entered the broader climate change debate and is being discussed at side-events at the COPs to the UNFCCC or the CBD. In other words, before geoengineering was defined as a measure to combat climate change. As the ETC group was a first mover in the debate on geoengineering they seem to have set the scene and others like the HBF followed. The NGOs following this discourse seem to develop from a position in which they only reluctantly addressed geoengineering but actually campaigned to not discuss it at all. Especially not in the climate related issues as the idea to see geoengineering as a climate solution was wrong. Towards a campaign in which they realised that discussion is necessary in order to halt it and most likely some geoengineering is going to happen and will take place. Therefore, there is a need for governance of a ban as promoted by these NGOs. This developed together with increasing attention for the topic after geoengineering was mentioned in the context of climate change by Crutzen (2006) as well as some geoengineering techniques main BECCS being used by the IPCC IAM. This further drew NGOs to the debate. But before CDR geoengineering techniques were a substantial topic in the IPCC and through the IPCC entered the UNFCCC debates, the CBD was the first governance body to pick up the concept of geoengineering within the context of OIF (Convention on Biological Diversity, 2008). This influenced the development of this discourse as a moratorium was established, and the London-Protocol and London Convention (International Maritime Organization, 2008) functioned to further prevent any ocean related geoengineering techniques. This is part of the reason why NGOs aim for a ban they say it is actually already there, although the CBD is not recognised by all countries in the world and the therefore the ban is not a global or commonly accepted one. Which is probably the reason why the NGOs still have the discourse for governance of a ban on geoengineering. Even in the light of the 2010 decision in which the CBD did widen their definition to include all geoengineering activities that might affect biodiversity (Convention on Biological Diversity, 2010).

Currently the focus seems to have shifted to other geoengineering techniques than ocean fertilisation, as these are to some extent not affected by the moratorium. This also brings us back to the UNFCCC where the ideas of geoengineering seem to gain some ground in side-events after use in IPCC scenarios. The discourse developed from strictly opposing geoengineering governance to the extent that NGOs didn't want to discuss it at all. Towards a more reluctant discussion as NGOs start to realise geoengineering might become a reality. However still many meetings on the topic of geoengineering with NGOs are held behind closed doors. With this shift towards a reluctant discussion the discourse shifted also towards looking for alternatives that would render geoengineering unnecessary e.g. (Götze et al., 2017). So rather than discussing or opposing geoengineering governance directly, methods to prevent geoengineering and campaign for those measures that prevent geoengineering became a main storyline in this discourse. The idea of a ban for geoengineering is still present as well as the reluctance to discuss research on it or to discuss scenarios in which geoengineering is used. However, the focus is now on governance for those developments that will limit the use of geoengineering.

6.6 Critical notes to this discourse

Although this discourse is foremost presenting the necessity for a ban it does also further elaborate what geoengineering governance should look like. It introduces governance principles, rights and

other ideas that governance frameworks should fulfil. This seems in contradiction with the idea that a ban is the only solution and governance should always be a ban.

Another critical point is the reluctance of discussing geoengineering governance while at the same time being part of the more vocal NGOs on the matter. This seems again contradictory. Although they are not in favour of geoengineering many of the NGOs that are considered to have established this discourse do participate in expert meetings and stakeholder dialogues.

Furthermore, there seems to be a conflict of ideas within this discourse. On the one hand NGOs argue that geoengineering governance is necessary in order to regulate it, while at the same time acknowledging that governance might enable geoengineering. Although this is a contradiction, NGOs are concerned for different governance outcomes. Governance for a ban is clearly no facilitator of geoengineering. Governance of research however might be facilitative to geoengineering research. Because the outcomes of a discussion on governance for geoengineering are unclear this contradiction seems to be able to exist.

6.7 Anomalies and other outliers

This was just the main discourse in literature however there are to this discourse many small changes among different NGOs not all of these small differences came to light with the literature analysis, but some were present during the interviews. This are for example NGOs that do support a ban but not on all different techniques or that do look a bit more open to possibly discuss geoengineering. Or those that do not see geoengineering as a weapon and just as another technical solution for climate change. However, these small differences do not necessarily form a discourse, as than it would rather be a description of the different NGOs strategies rather than an overview of discourses.

7 Discourse 2: Governance for geoengineering research

7.1 Introduction

This discourse was not largely present in my literature sample. Only through conversations, interviews and attending workshops did this research find this discourse. The few storylines and few frames further attest for that. Among the researched NGOs this discourse is very small but if you would look at science-based NGOs like SRMGI and C2G2 this is a more prevalent discourse. The idea is that although we are by far not ready for deployment of geoengineering some research into it should be possible. Governance to guide and regulate this research is necessary. The need for research is based on the possibility that mitigation might fail to achieve enough CO₂ reduction in time to prevent severe climate change effects. Furthermore, it is believed that starting research on geoengineering when we actually need it, would be too late. An even worse scenario would be when geoengineering becomes a necessity to prevent certain climate change effects and there is not sufficient research yet to deploy it responsibly, it might be deployed regardless and result in unforeseen negative effects. Therefore, it's better to start research responsibly now for which governance is needed. During some discussion, with NGO representatives from NGOs following the first discourse some personal opinions leaned towards parts of this second discourse, mostly for some CDR techniques.

7.2 Storylines

This discourse has two storylines. The first is concerned with research governance: **Governance is necessary for geoengineering research.** This storyline is further supported by the storyline that: **We might need geoengineering when mitigation fails.** Not to be confused with the idea that we need geoengineering in general, only when mitigation fails according to this discourse.

7.3 Short summary

This discourse can be summarised as: No geoengineering governance for deployment but governance for research of geoengineering. This small discourse supports governance for limited research into geoengineering or is not opposed to it although wouldn't execute any such research itself and does oppose geoengineering in general. This discourse argues that governance should be in place for the research of geoengineering but not for development towards deployment. Initially this study did not look into governance for research of geoengineering, as this would constitute a different research subject on its own and was beyond the scope of this study. However, due to the indicative nature of the analysis this discourse emerged among some NGOs and could not be ignored.

Table 7 Storylines and frames from discourse 2

Storylines:	Frames:
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1 Governance is necessary for geoengineering research	<ul style="list-style-type: none"> • Governance before deployment • Small scale outdoor research is not too harmful for the environment • Without research governance no research will take place • There is already some regulation for geoengineering research • Research on CDR and SRM should be undertaken • Research governance characteristics • It's too early to discuss governance for geoengineering deployment • Governance for research as research proposals will be made • Governance before research • Geoengineering research might be necessary even though we are opposed to the idea of geoengineering research
2 We might need geoengineering when mitigation fails.	<ul style="list-style-type: none"> • Geoengineering is unavoidable • NGO environmentalist might need to consider geoengineering when governments are discussing it • We might need geoengineering when mitigation fails

7.4 Further elaboration of the storylines

1 Governance is necessary for geoengineering research

Governance before any kind of deployment of geoengineering including geoengineering research is necessary as called for by the royal society (Shepherd et al., 2009). This storyline follows this idea with frames as: governance before deployment, governance before research, governance for research as research proposals will be made (see table). It further expresses that research is inevitable and some research is already happening. Previous research projects and growing interests in research activities in this field further develop this discourse. As said before this storyline is not the most obvious in the NGO publications, which are focussed on governance for a ban on geoengineering. To present the idea that governance for geoengineering research is necessary would go against the idea for a ban on geoengineering and might be misunderstood for endorsement of geoengineering in general. Endorsing geoengineering is the very last thing NGOs want to express. This among other things is a reason why this discourse was more often present in the interviews. In these interviews the idea of governance for research was voiced as part of concern of actual geoengineering research activities. Rather have some form of governance for research activities than end up with research activities without any type of governance.

One exception is the EDF that calls for small-scale field research for SRM and research for CDR development (Environmental Defense Fund, n.d.). Interestingly this was the only literature document

that included such frames. This storyline expresses a more open attitude towards geoengineering research in general, and a different approach to geoengineering governance. Geoengineering governance is presented as governance for the research activities, rather than for deployment. Governance for deployment is not part of the discussion. As the overall discourse is still very much against actual deployment of geoengineering. In principal the ideas for governance of research for geoengineering are not against the other discourse. As most NGOs would agree that there should be governance for research when there would be research. Also, NGOs following the first discourse would rather have governance for experiments than experiments without any governance. The support of the CBD moratorium that made an exception for research is in line with this storyline. However, the first discourse and connected storylines differ in that the first discourse rather focusses on banning geoengineering totally including all research on it while some other NGOs are less opposing towards governance for research. The idea that geoengineering research must already be governed and that it is a prerequisite for research as some even call it, fits the second storyline that sees the potential need for geoengineering when mitigation fails.

2: We might need geoengineering when mitigation fails.

Even in the interviews the possibility that mitigation might fail, is not often discussed. When it is mentioned it is voiced as a concern that mitigation might fail and governance for geoengineering has become necessary. Acknowledging that even the possibility that geoengineering might become necessary exists, it is only present in the second and third discourse. Although there are individuals among NGOs who generally would follow the first discourse but individually agree with the possibility but do not express that in their publications and conversations or interviews. Interestingly even those who acknowledge this possibility are still very much against the development and also against geoengineering itself. It is presented as a last resort and a bad case scenario in which geoengineering is realised because of its necessity, when mitigation fails. Furthermore, it seems to be clear that whereas the publications by NGOs seem to focus on the possibilities of not doing geoengineering this storyline has no place in that message. The storyline rather presents itself among those that seem to think it might be too late to prevent geoengineering, either because mitigation is going to fail, or because the developments in geoengineering can't be halted.

A growing number of NGOs seem to accept that some type of geoengineering might be necessary. Which is further supported by the third discourse, that also follows the idea that some form of geoengineering is necessary.

7.5 Discourse according to governance architecture

Within this discourse the specifics aspects of governance are not well established. Sometimes governance characteristics were addressed but only very broadly and often governance for research rather than governance of geoengineering deployment. The different ideas about possible governance were voiced by individuals and the most important ones are summarised in the table below.

Table 8 Discourse 2 According to governance architecture

Public or private institutions	There seems to be an overall understanding for public institutions,
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	potentially on national level. For research experiments with transboundary effects more international governance institutions were mentioned.
Principles	no specifics were mentioned but deducted were -No environmental or other harm from research should occur -Review and identify risks before research
Norms	-Assessment of experiments before deployment
Regulations	No clear proposals are made
Decision-making procedures	National
Organizations valid or active in issue area.	Many different organizations are mentioned some examples are: - CBD seems to have some governance already in place. - A international scientific body.

Within this discourse it's clear that governance is more a general term than a specific idea that is well developed. Therefore, the specific governance characteristics are not clear.

7.6 Origin and development

The origin of this discourse seems to emerge from the recent scientific literature that geoengineering governance for research is necessary as geoengineering might be needed. To understand geoengineering techniques better this research is necessary, and governance is necessary to further guide and control research. This discourse follows this idea but is only presented during interviews and not in publications or during presentations on the subject at the UNFCCC. It doesn't fit within the general campaigns as it seems to acknowledge that geoengineering might be necessary and therefore can be seen as supporting geoengineering something that every NGOs strictly denounces even those in favour of governance for research of geoengineering.

The discourse further developed within the climate change debate as a topic of future research, but also something that became more prominent when the IPCC started to use the 1.5-degree target in IAM with large amounts of negative emissions. This increased the development of scientific papers challenging the 1.5-degree target, which sparked again further development of the idea that we might actually need geoengineering, all contributing to the development of this discourse calling for research.

The fact that it's such a hidden discourse only becoming prominent with two storylines from the interviews could be attributed to 3 reasons. First of all, the message that we might need governance for research seems to legitimate research and therefore in some ways also geoengineering itself, that is how it was often presented in interviews. A second reason connected to this is the idea that research in itself is already some kind of deployment and the border between geoengineering research and deployment is for some NGOs almost non-existence. Especially when research includes outdoor experiments. NGOs argue that even some legitimate outdoor experiments might already

have effects that would mark it as geoengineering. A third reason is the fact that NGOs still find that there is more campaigning necessary for what was described in the first discourse as real solutions. The idea that geoengineering is necessary and therefore governance for research is not attractive campaigning material.

Overall this discourse was also presented by those interviewees that had a more scientific background or were more involved within scientific research. Mostly NGO researchers rather than NGO policy campaigners.

8 Discourse 3: Natural climate solutions

8.1 Introduction

Through the analysis of the interviews and participation at the SB 48 of the UNFCCC a third discourse seemed to have emerged that of natural climate solutions. This discourse was not present in the analysed literature and seems to originate from the idea of a suitable NGO approach to the growing scientific evidence that negative emissions (i.e. CDR) are necessary (Geden, Scott, & Palmer, 2018; Honegger & Reiner, 2018; Peters & Geden, 2017). In short natural climate solutions is the concept to achieve sequestration of carbon through natural means (Griscom et al., 2017). Depending on the NGO this could include restoration of forests, peatlands or even afforestation. Often there seems to be ambiguity among NGOs of what the exact difference is between geoengineering techniques like afforestation and natural climate solutions. Scale still seems to be a large factor in this although there is no clear definition of what scale would result in non-natural solutions and what would still be considered natural and therefore part of natural climate solutions and not geoengineering.

Although this discourse almost seems to ignore the term and concept of geoengineering with some NGO representatives explicitly naming it not geoengineering (annex 4 frame 159), within my scope it is clearly part of the geoengineering governance discourse. First of all, it's often mentioned as a way to actually realise carbon sequestration, and when asked about geoengineering it's often brought up as well. Some NGOs actually focus specifically on this. As it's used in the broader discourse to steer-away from geoengineering it is part of NGO discourses on geoengineering governance.

8.2 Storylines

As this discourse emerged from the interviews rather than the publications, viewer storylines could be identified. The two storylines are Natural solutions for CDR, and the focus should be on real solutions. Although this research only identified two storylines the analysis shows they are laden with meaning and together constitute a discourse.

8.3 Short summary

In short, the discourse on natural climate solutions is concerned with opposing governance within the UNFCCC which includes BECCS it steers away from this idea by arguing that BECCS aren't real negative emissions (annex 4 code5) as well as criticizing the broader IPCC climate models. This discourse is not that concerned with geoengineering as a concept and therefore it also seemed to not have shown up in the literature analysis. The most important frames leading to the storylines are summarised below. Similar to the first discourse this discourse again refers to "real solutions" in the second storyline. Within this discourse real solutions are Natural Climate Solutions as well as

traditional mitigation solutions to combat climate change extending the concept of real solutions from the first discourse.

Table 9 Storylines and frames from discourse 3

Storylines	Frames
1 Natural solutions for CDR	<ul style="list-style-type: none"> • We need to increase CO2 sequestration • We have too much CO2 in the atmosphere • More reforestation and afforestation have possible land-use conflicts • Natural solutions for negative emissions are not geoengineering • Natural solutions are low risk carbon sequestration • Natural solutions are underestimated in models <ul style="list-style-type: none"> ◦ Minimize reliance on BECCS • Minimize the need for CO2 removal through natural solutions
2 Focus should be on real solutions	<ul style="list-style-type: none"> • Research or-and investment must not distract from mitigation • Real solutions are those that lead to emission reductions⁵ • The Paris Agreement should not be read to endorse CDR • Illusion to policy makers that high emissions can continue • Governance for BECCS and NET distract from real solutions • Geoengineering is not real solution • Geoengineering is connected to the amount of emissions • Climate crisis is used to forward CDR and BECCS • Call for governance of radical change • Bigger issues than geoengineering currently to focus on • Actors are against geoengineering

8.4 Elaboration on the presentation of the discourse and storylines

1 Natural solutions for CDR

The above summarized discourse seems to be mainly present at the international UNFCCC meetings in which it exists within the larger climate governance debate. There this storyline is presented by

⁵ In this discourse negative emissions in the form of natural climate solutions are also considered to be emission reductions.

NGOs that published papers on natural climate solutions (United Nations Framework Convention on Climate Change, 2018). This storyline is presented as the solution for solving the residual CO₂ in the atmosphere, it is not presented as geoengineering NGOs see it rather as natural solutions. However, it is most often presented in the same debate and conversations as geoengineering is. Using frames such as CO₂ removal potential of natural forest management and restoration, as well as the title of the specific side event: “Potential of natural forest management and restoration in limiting warming to 1.5-degrees (United Nations Framework Convention on Climate Change, 2018). Using a similar title concept of the 1.5-degrees is in itself no reason to consider it part of the geoengineering governance discussion. However the way natural solutions are presented at the side-event itself, a way of CO₂ removal to prevent the use of other CO₂ removal techniques following Griscom and colleagues (2017) clearly indicate the link between natural climate solutions and geoengineering CDR specifically. It is further mostly presented in the context of the IPCC and the IAM, in which geoengineering in the form of BECCS play a major role. The discourse is further complicated as NGOs claim that natural solutions are not geoengineering however do consider afforestation to be geoengineering. There is a lack of clarity when NGOs would perceive natural solutions as geoengineering and what type of geoengineering e.g.: responsible afforestation might be considered as a natural climate solution.

NGOs seem to use natural solutions for CDR as the solutions to fulfil the scientifically indicated need for more CO₂ uptake. Apart from this presentation of natural solutions, arguments of co-benefits of that these techniques could provide are also used to further promote them over CDR techniques. Co-benefits mentioned by NGOs ranges from biodiversity benefits, to social benefits or economic benefits from sustainable forest management.

2 Focus should be on real solutions

Another storyline that supports this discourse of natural climate solutions is that: the focus should be on real solutions. This is presented firstly by discrediting the solutions that are used in the IPCC models like BECCS and other CDR techniques to solve the problem of too much CO₂. While discrediting these ideas they call for real solution which in this context means natural climate solution and climate mitigation rather than just climate mitigation. In this context they also further argue that the models such as the IAM are too limited and that the natural (real) climate solutions are underestimated, not taken into account in the right way. This also aligns with the general discontent of NGOs with the IPCC. The concept of “real solutions” is broadened and include now also natural climate solutions however, this idea was only present in interviews and side events during the UNFCCC SB 48. This specific discourse doesn’t seem to exist independently from the climate debate or the debate of IPCC models and BECCSs within the climate change talks.

8.5 Governance architecture for natural climate solutions.

As the information was less comprehensive for this discourse a short overview of governance aspects will follow rather than the more detailed analysis that was presented in the previous chapters.

8.5.1 Governance and natural climate solution.

Although it might be due to a lack of further background information but as the discourse presented itself it did not include statements on governance for natural climate solutions. However, it did address governance in general. First of all, the debate on natural solutions is started to counter balance the use of geoengineering techniques in climate modelling something that has been contested by many NGOs as good practices (Annex 4 frame 37). Secondly, in that perspective it is meant as a new technology to be introduced into the IPCC assessment reports and this was expressed by some NGOs. To hopefully also include Natural climate solutions in the models instead of BECCS or other geoengineering techniques⁶. The discourse of NGOs to include these natural climate solutions in climate governance, clearly is a governance approach.

8.5.2 Specifics of governance for natural climate solutions.

However not many NGOs seem yet to have thought out exact governance frameworks for these natural climate solutions. First of all, this can be explained through existing governance such as the REDD+ program and GCF (green climate fund) that offers the possibility to fund projects to restore forests or plant trees in order to enhance mitigation. Furthermore, the practises suggested by NGO seem not to pose major governance challenge and certainly not many that extend beyond the national borders. Mostly because most natural climate solutions are meant for national implementations rather than international. Only when discussing international funding or further organisation of governance through international regimes like the UNFCCC to further initiate these solutions could there be a case for international governance. The argument that the natural climate solutions are aimed to reduce CO₂ emissions globally and therefore require global governance could still be used but through the specification of natural climate solutions to be small scale, and beneficial for the local environment it seems that even this argument doesn't hold much ground.

8.5.3 Natural climate solutions within the UNFCCC

Within the UNFCCC it quickly becomes clear that this discourse is meant to oppose possible governance on currently used CDR techniques from the IPCC reports, within the UNFCCC. Furthermore, this research argues that "natural climate solution" are just a different way of framing existing climate solutions, however it is clear that NGOs try to influence the discourse of geoengineering and then especially that of the BECCS and CDR techniques used in the IPCC models with these solutions to offer a good alternative rather than just opposing BECCS. NGOs stand a better change to convince others to use Natural Climate solutions instead of CDR geoengineering techniques as used in the IPCC IAM.

8.6 Origin and development of the discourse

The origin of the discourse could possibly be traced back even to the starting of the Paris agreement when policymakers and environmental advocates were looking at sequestration of carbon to reduce the amount of carbon in the atmosphere. The solution like land-use change, and conservation of forested land seems to be often named the original introduction of natural climate solutions

⁶ Within the IPCC only CDR techniques are considered rather than SRM. As SRM does not influence the amount of carbon in the atmosphere.

within the international governance debate at the UNFCCC. When the IPCC started using the IAM with a high percentage of CDR techniques (Griscom et al., 2017; Van Vuuren et al., 2018). First the environmental NGOs seems to be at a loss as what to do against it apart from opposing it strongly. However, after the paper published by Griscom and colleagues (2017), natural climate solution became a new focus point within the campaigns for better climate action against the use of geoengineering techniques like BECCS and other CDR techniques suggested in the IPCC. It offers NGOs the possibility to provide a solution that is less environmentally harmful and more useful within their debates.

The further development of this discourse is most likely fully dependent of the uptake of these ideas in the IPCC models and the 1.5-degree special report that will be presented in October 2018. When these solutions are disregarded the discourse might die down, and NGO will use other means to campaign for more forests. Like activities that they already currently undertake such as protecting forests and restoring forests.

8.7 Critical notes

Although the discourse seem relatively straight forward it is often not presented in the most comprehensive and well thought out way. Whereas for example discourse one is thought out till the level of bans and governance mechanisms this discourse is not. Some essential points that seem to be inconclusive are the exact definition of natural solutions mostly the interviewees revered to Griscom and colleagues (2017). However, within the interviews the representatives did not stick to an exact given definition of natural climate solutions and even the definition in crimson is not very precise including 20 conservation restoration and improved land management actions (Griscom et al., 2017). Therefore, the term “natural climate solutions” seem to present all non-technological ways of sequestering carbon from the atmosphere. But more importantly it seems to mean a solution that is not BECCS or geoengineering rather than any specific technology. It could be questioned what the exact meaning will be of natural climate solutions in the future and whether this terminology will ever further be defined or will rather be broad and laden with so many definitions that it faces a similar risk meaninglessness as sustainability did (Hopwood, Mellor, & Brien, 2005).

9 Interviews explaining discourses

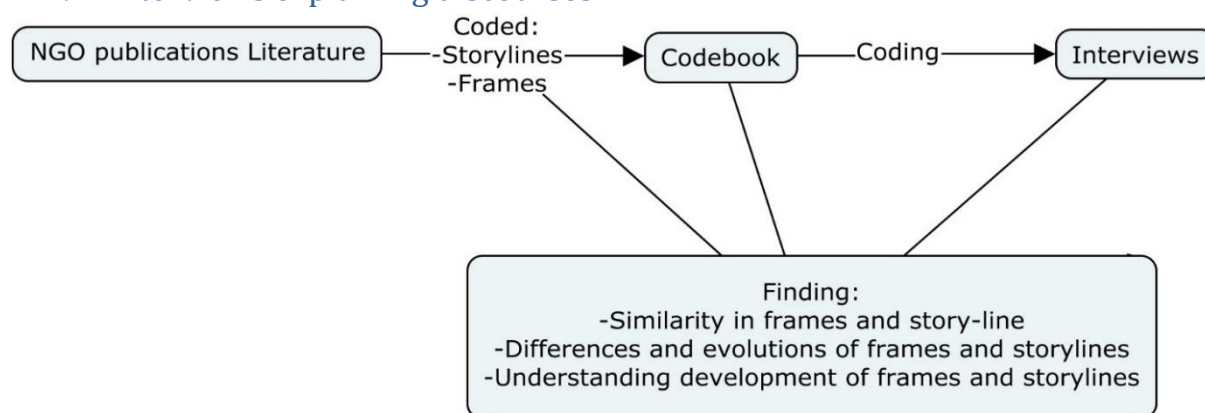


Figure 8 Coding interviews to explain discourses

Aimed to identify the missing pieces of information that further could explain NGO discourses and their development the interviews resulted in the following information.

9.1 Similarity in frames and storyline

In the first discourse similarities of frames and storyline were most present between interviews and publications. This can be explained by the dominant role of this discourse and is further enhanced through the similarity with most NGOs worldviews and the possibility to further align this discourse with their already existing campaigns. Such as more climate mitigation and more action to prevent climate change. Therefore, it was clear that frames and storylines were mostly aligned.

In the second discourse this was not the case, first of all the second discourse is only to be found in the publication by the EDF, but more often are the frames belonging to this discourse mentioned in interviews. It is not possible to establish clear similarities or differences as there were insufficient sources presenting this discourse in the analysed literature.

The third discourse was not present at all in the analysed literature, partly because literature on governance for natural climate solutions was not analysed. Only the literature considering geoengineering governance was analysed. However, within the interviews similar frames and storylines were presented.

9.2 Differences and evolutions of frames and storylines

When comparing differences of storylines, we see mostly that within the interviews a more open message is presented. One open for possible geoengineering governance and geoengineering techniques at least in the second and third discourse, and to some extent during rare occasions with interviewees who generally follow the first discourse. There are no hard borders to draw on the differences, and evolution of frames and storylines.

In general, it seemed that the more negative sides of the discussion on geoengineering governance were left out in the publications but did come into the view during the interviews such as the concern that geoengineering might be a necessary technique. The interviews therefore managed to draw attention to missed or underrepresented discourses like 2 and 3. The first discourse is then also the only one that can be seen as one with development between the publications and the interviews. This difference and evolution are clear and can be best described as a more constructive and open approach during interviews were in the publications there only seems to be room for firm opposition towards geoengineering. This should not be understood in anyway as if NGOs were endorsing geoengineering, however some NGO representatives were more inclined to admit worries and the need for governance exceeding a ban for example regulation for the different geoengineering techniques. Whereas the publications do not offer this breath they clearly and rather call for other solutions and drawing away from the debate.

Interestingly enough there are quite some similarities between the different discourses themselves. Storylines that are used in slightly different ways and other frames that can be named in several discourses seem not to be a strange thing. Although I present the discourses as mostly separate this is only based on the analysis and a way to explain the current discourses. However, in reality the different identified discourses are not that alien towards each other that they can't be integrated, and some NGOs might identify themselves with all three or parts of all three discourses rather than a single one. However, it is clear that in general NGOs tend to focus on either of the discourse following their background, their mission and the different core goals that each of them has.

9.3 Understanding development of frames and storylines

To understand that development of the discourses, interviews were also held with NGOs that didn't have any publications on geoengineering governance. These helped to understand why certain NGOs were not actively campaigning on the topic as well as to further understand that although not publicly most NGOs did concern themselves with the topic in informal discussion and behind closed doors in stakeholder meetings. The rapid increase of attention for this topic seemed also to lead to an increase of NGOs involved in the topic however mostly reluctantly. Instead of a positive attitude to really address geoengineering governance, as most NGOs are not in favour of geoengineering. Many also saw the IPCC as the only reasons why their NGO was forced to discuss this topic. The discourses understanding the possible need for geoengineering came from the personal opinions, rather than the presented public opinions that are presented in the publications. These were more nuanced and less strict which is logical as they do not need to be part of a campaign with a clear storyline. Therefore, the storylines and frames from the interviews were more divers, and more connected as many NGO representatives did not stick to specific storylines or their connected discourses.

Concluding it has been observed that the ideal solutions are mentioned in the publications e.g.: the ideal world and how they would solve it, whereas the interviews also express some concerns when that ideal solutions would not work out in the end, for example when geoengineering is executed anyway or becomes part of the IPCC models in the form of afforestation and BECCS this kind of ideas are not presented in the literature as it would open the door for geoengineering development. Or at least according to NGOs who are very aware of the slippery slope. So in the literature everything is clearly limited to that what should be done (climate mitigation) and what should be banned e.g. (SRM, CDR). In contrast to the interviews in which a more realistic approach seems to be presented taking into account the possible failure of having to do geoengineering.

This means for governance that NGOs will publicly never seem to campaign for anything else than a ban, or clear restrictions. Nevertheless, within less public activities, NGOs seem to have slightly different stances and are more open for discussions of the different topics. Furthermore, it seems the case that NGOs are preparing options like the natural solutions to react for the developing debate on geoengineering governance and geoengineering in general to come up with other counter measures.

10 Discussion

10.1 Scientific relevance and furthering the scientific understanding of NGO discourse analysis

Using discourse theories and governance principles this study contributes to the identification and further understanding of discourse development. This specific type of research on governance among NGOs for geoengineering had not been executed before and no clear comparable research is available. Therefore, this research further helps to understand the theory and the development of NGO discourses in international governance. Some general findings that seems to not be reflected in the theory of discourse analysis is the quickly changing character of discourses among NGOs. Whether this might be because of the research subject NGOs rather than political actors to which Hajer's (1995) discourse theory is shaped. Or rather the rapidly changing topic of geoengineering and with that governance for geoengineering itself. Other concerns could be raised about the timeframes of publications that were analysed, as the oldest publications was only 8 years old. Therefore, it

would be worth considering redoing this research when the debate has further developed to give a better historical overview. Nevertheless, this lack of an historical overview of publications certainly contributed to the fact that this analysis is quite temporal. It is an analysis of how NGOs are looking at governance for geoengineering around early 2018 end of 2017. This was also highlighted by some NGOs that saw the upcoming IPCC report which will be published in October 2018, as a pivot point for their discourse. As well as a pivot point of the general discourse of NGOs concerning governance for geoengineering. Although the relatively novel topic in combination with only contemporary publications does seem to create a lack of historical perspective, this research managed to compensate for that through interviews. Nevertheless, analysing an emerging discourse on governance for geoengineering is inherently incomplete, constantly changing and wrought with inconsistency. First of all, it's incomplete because the changing conditions and limited NGOs involved in the topic do not seem to express a fully coherent discourse. Changing conditions differ from the different fora in which geoengineering is discussed such as side events at the UNFCCC or the CBD, or the London Convention or London Protocol. Each condition seems to differently influence the discourse. The discourse still seems rather incomplete because of the fact that many NGOs have not yet approached the topic of geoengineering governance thoroughly and rather suffice on this specific topic with general statements on governance. This made it harder to identify specific governance characteristics in the context of governance architecture. Lastly the overall presentation of the discourses is inconsistent between the interviews and the publications. This is further enhanced through the quick technological or even political development such as the increasing debates about geoengineering, to which publications do not adapt quickly enough, and interviewees do.

The interviews were an essential part to further understand the discourses, without interviews a discourse analysis in an emerging field would not yield sufficient information to also explain the discourses. Another limitation of discourse analysis is the scope of the research and boundaries set accordingly in the research design. Due to the topic of geoengineering governance, and search terminology on geoengineering as well as criteria to solely select those publications addressing geoengineering governance the topic of natural climate solutions was missed in the literature analysis, another reason why interviews are essential. Due to time limitations this could not be further expanded but would be interesting to include in future research. However, this does bring up the broader questions of the limitations of discourse analysis. The different discourse-theories do not specifically claim any guidelines on width the researched subject, but this seems to shape the discourse analysis significantly. For example, more time would have allowed for a broader analysis, and a more complete understanding of NGO discourses. Within this study the width would ideally be extended to also include the literature of natural climate solutions and possibly other missed literature. Although the interviews can compensate slightly in this matter it would not be similar to extending the actual research. This also raises concerns over discourse analysis in general apart from the temporal factor, also the width of the research is important to take into account when using this research. Especially because a broader field could significantly change a discourse. By increasing the width of the research, the discourse can possibly be seen as a part of another greater discourse.

One of the main factors that might have influenced this research as well is the broad interpretation and different views of what governance entails and what is considered to be governance. The broad definition as adopted in this study seems to be able to cover it. However, although it leaves room for the different interpretation it is hard to distinguish in what some might call governance and others do not regard as governance. This might also have resulted in some more general finding on

governance rather than very specific statements. Due to the relative new field and not fully developed governance ideas, there was hardly the possibility to single out one governance aspect. Governance as it was used in this research seems to become almost too large of a concept to be addressed as an overall concept. Future research might be able to be more precise when the field is further developed, and one could focus on a specific governance concept such as regulation or institution or body. Currently the broad interpretation made it difficult to exactly pinpoint statements to the different governing aspects but did offer the possibility to include all discourse and governance aspects. The clearest example to show how governance was differently understood is that some regarded a ban as an inhibition towards governance, whereas others clearly state that a ban should also be a governance action. The notion that governance is more than government is however something that is very clear in the discourse, so although governance as an overall term is not always consistent the idea that different stakeholders and governments play a role in governance is very clear. However, the broad concept of governance combined with almost no exact indication of what the specific publications mean by this concept makes it sometimes a challenge to interpret the discourse on geoengineering governance.

The governance subject is further problematised by the fact that some types of governance do exist for geoengineering such as de facto governance, or governance by authoritative assessments. However, this is not yet inclusive and currently it seems to not be widely recognised as governance. Or even some limited governance for example for ocean related geoengineering. For example: the moratorium of the CBD is of no effect to the USA who is no member to the CBD.

However, within the scientific field of geoengineering governance, most papers acknowledge the little existing governance but still call for governance. Making clear that there is no actual binding governance for geoengineering, or an overall governance framework for geoengineering deployment. However, some NGOs regard these incomplete governance frameworks although not as sufficient still they regard them as governance and existing framework to work further on. Therefore, there exists some ambiguity into what is governance and what not and what is seen as sufficient governance. This makes the overall discourse even more complicated and quite open for interpretation, however this is also necessary as it would otherwise exclude certain prominent discourses and their storylines such as bans, or endorsement of the existing moratorium of the CBD. Nevertheless, it should be remembered that the discourse presented in this research on governance for geoengineering is not about existing or exactly proposed governance but rather what kind of governance for geoengineering NGOs would like to see and how it is presented. In this context the fact that it doesn't match with actual governance is something to remember and take into account but not something that hinders the discourse. Although it is a challenge to distinguish the different ideas of governance among the different NGOs.

10.2 Social and political relevance

As this research helps to understand the different discourses it can help to facilitate governance in national or international fora. However, the current rapid developments and the possible shift after the 1.5-degree special report will be published, will most likely change the discourse. It nevertheless provides insights in NGOs background and the discourse development which might help to improve governance processes as well as policymaking and NGO engagement, in this process. Furthermore, although the discourse might change the fundamental ideas of NGOs that geoengineering is a bad idea will most likely not. Future research could possibly track the changes between the discourse before and after the 1.5-degree special report. Although as the 1.5-degree special report is not yet

out it would significantly depend on the content of the report what kind of change there will be and if there will be any.

When applying Hajer's theory that discourse try to gain hegemony within a debate, we see that the oldest discourse first presented by the ETC Group and later in collaboration with the HBF, didn't manage to get full hegemony. Although the general message on governance for a ban is still convened and seems to be dominant, there are many other parts of this discourse that are not adopted by other NGOs. Examples are: the start of the geoengineering discussion, presenting the geoengineering discussion also as weaponization issue. Therefore, this discourse by the Heinrich Böll Foundation and the ETC group in itself didn't managed to gain full hegemony although their main points for a ban on geoengineering seems to have been taken over by most other NGOs.

Within current governance institutions it is interesting to see that many NGOs regard the CBD moratorium as a good starting point for geoengineering governance. Especially in the first discourse it seems to be in conflict with frames and test bans. Because although the CBD has established a moratorium it also established regulations for experiments of geoengineering. This later point was mostly not mentioned by NGOs. It is logical that NGOs try to find some handheld for governance of geoengineering, and whether forgetting the framework for testing is intentional or not is unclear. However, it also seems that the conditions set by the CBD are extensive enough to withhold most researcher from going forward with outdoor experiments under those regulations. Therefore, NGOs might feel confident enough to use the moratorium as an example even though it does allow for testing of geoengineering techniques.

10.3 Shifting definitions

Another major challenge in the topic of research on geoengineering governance are the shifting definitions. I looked at geoengineering as an umbrella term that included all different techniques that could be considered to be geoengineering. However, during the research often different terms and definitions were used. Logically when you consider that there have been many deliberate efforts to influence the use of specific terminology. Using the wide definition of geoengineering enabled this research to include all different techniques and governance ideas for these. However, it made the research also slightly less precise. Especially when some NGOs rather addressed a specific technique then the broader concept of geoengineering, which opposes the idea of others that geoengineering should always be addressed as one topic including SRM and CDR techniques. These contesting views and the fact that they are sometimes used interchangeable and sometimes not made this research challenging. When the discourse further develops future research would ideally execute when time permits a discourse analysis of geoengineering governance in general as well as for the two main types of geoengineering SRM and CDR. The differences would provide interesting insights in the different approaches towards these techniques. Nevertheless, when this research was executed there would not have been sufficient publications and discussion on the different topics to have been able to distinguish these three different types of publications and analyse them and find different discourses. The current limited number of publications and NGOs that are openly involved remain best to be analysed under the umbrella term of geoengineering governance. Not the least because many NGOs still rather use this terminology than the specific other techniques. This might however change rapidly when the IPCC's special report on 1.5-degree includes specific techniques under specific names.

10.4 How come the hypothesis was wrong about potentially finding more different types of discourses

Following the initial scan of materials and starting this research it was expected to find a wider variety of different discourses, with possibly Environmental NGOs using environmental preservation arguments in order to support some forms of geoengineering this was never found. Several reasons contribute to this fact. First of all, the concept of geoengineering is too much against the core beliefs of preserving the environment rather than influencing the environment. The idea to technically solve a man-made problem was regarded as impossible, dangerous and only as a way out to keep using fossil fuels. There didn't seem to be progressive NGOs that did want to use environmental arguments for geoengineering also because there still was the overall conviction that it is still possible to not use geoengineering. Therefore, no suggestions were made towards governance frameworks supporting such ideas. The fact that this is changing rather quickly can be seen from the example of natural climate solutions. This discourse presents how NGOs do start to see the necessity of geoengineering and their reaction to it.

The fact that this study focussed on NGOs that already were involved in the topic further shaped the outcomes. Although I argued this was necessary to actually identify a discourse, it does leave the question open how other NGOs that are not involved in this topic might view geoengineering. This does offer a research path in which one could look at the question: When governance for geoengineering was brought positively as well as the techniques itself, would NGOs have a more positive discourse towards geoengineering governance? In addition, further research could elaborate on including NGOs that are not actively involved in the geoengineering discussion. Especially when the topic further develops, and more NGOs come to know geoengineering.

10.5 Research conditions.

Due to using the methods of snowball sampling in finding interviewees the right and knowledgeable people were found and interviewed. However, this also had the bias that I mostly spoke to people with a similar mindset and that often had or were working together. This means that not finding more differentiated discourses could also be a result of this type of sampling. However, this is also influenced by the small field of NGOs involved in the topic, and the interconnections of those involved. When I tried to further broaden my interviewees I used the opportunity of attending the UNFCCC SB 48 climate conference. Although this was an ideal event to conduct interviews with NGO representatives, and offered the possibility to conduct the interviews in person rather than over skype it also influences the perceived discourse. As most of the interviewees were mostly climate specialist or at least largely involved in the climate debate. Geoengineering although gaining attention at these conferences is not seen as something that should be discussed in this context of the UNFCCC according to several NGOs (see annex 4 frame 114.2). However, when discussing geoengineering it would often automatically have a rather to climate change orientated perspective. This would for example be quite different when this research would have been conducting interviews at a COP to the CBD, or possibly at the international conferences on geoengineering organised by the IASS. In those examples geoengineering discourses would possibly be less connected to climate change. The larger question here is whether geoengineering is actually just a climate matter or more. This remains also a governance challenge, but it is clear that at least currently geoengineering is mostly seen in the context of climate change rather than for other purposes. Using the definition of Shepherd (2009), it ties the two concepts of geoengineering and climate change together. However as discussed concepts and definitions can change, and this might also be the case of the link between

geoengineering and climate change. Whether geoengineering ever will be truly free from any climate change context remains to be seen. Furthermore, the small field doesn't allow for a broader scope within this specific field. Future research should ideally take a broader scope and include more perspectives on geoengineering. For this study the time was limited however it was clear that the UNFCCC and proceedings such as side-events further informed and influenced this research.

Nevertheless, because of limited access to NGOs and conferences where NGOs express their views and opinions only the broader public discourse could be distinguished. During interviews it became clear that many NGOs, apart from the official publications and presentations also participate in informal meetings. These informal meetings might have a slightly different tone towards geoengineering governance. However, this couldn't be included in this study because a lack of time as well as the fact that these informal meetings are not open for public. Although interviews might create some form of informal sphere it would not be similar to these types of meetings with multiple NGOs informally discussing the topic.

10.6 Worldviews and belief systems

Although different discourses were found and slight differences within these discourses something that was overall consistent were the worldview and belief system. Interviewees regardless of their background kept true to their worldview and belief systems. This seems also in line with the fact that this research did not find more differentiated discourses. The fundamental beliefs and worldviews were too similar. Although several different participants perceived geoengineering in different ways. Some saw it as a realistic possibility that geoengineering would happen in the near future and that this was problematic as it was a necessary evil. Whereas others held to their belief that such an idea of geoengineering was perverse and not for us to decide on. Another way out of this debate was the natural solutions in which NGOs could still react to the climate change and mitigation reality of possibly not making the 1.5/2 degrees target but not throwing away fundamental belief systems that geoengineering is something bad. The governance that is campaigned for reflects that, but often holds up a harder line than the actual individuals would like to see. They sometimes seem to bid high so that eventually the outcome is not too low.

10.7 The construction of discourses as a way to analyse social processes.

One of the pillars of this research is to construct discourses from analysed literature and interviews. Although this is a valid scientific method to research such a subjective topic as discourses there are certain limitations that should be taken into account. In order to objectively identify and analyse the discourse, this research deducts it from publications. This means that the discourses presented in this study are constructed on the basis of scientific principles: those of discourse analysis. However, they are nonetheless constructed leaving room for interpretation and subjectivity. This means that although the discourses have been established with the greatest care they are not discourses presented by NGOs themselves but rather this research interpretation of how NGOs develop and present their discourse. This might be further improved through wider checks or open discussions with NGO experts on the topics. Which this research sadly didn't have sufficient time for. This could further confirm found discourses however it might also change the perceived discourses into the more socially acceptable one or other influences of NGOs on the initially found discourses.

Reason to name this is the discrepancies between the in publications presented discourse and that of individuals during the interviews, these did not always fully match. Not fundamentally different but rather: the presented discourse is the perfect discourse the ideal solution. Whereas the discourse in the interviews although not fundamentally different are often presented in a less ideal way. It seems that there is some congruency between what is constructed by NGOs, by the researcher and what NGOs might not want to be constructed during interviews and more open conversations. As the publications present the ideal discourse in the best way it seems.

10.8 Future development of research and research gap.

The identified discourses are only established over the short period of time that was the scope of this research, as it was conducted in the very first developments of the discourse, future research could first of all monitor and further research the development in these discourses. Furthermore, it could take a broader approach taking not only into account Environmental NGOs but also possibly research or industry NGOs, to get a better understanding of the whole societal view on the topic. One of the main topics that this research raised was that of the future development of the discourse which is largely going to be influenced by other political and technological developments. How this kind of developments, societal, political, technological, and natural further influence the discourses of NGOs is also of interest for future research. Another research gap that was identified is the actual influence of NGOs in this debate. Due to the fact that there is no existing governance for geoengineering as a whole, the influence of NGOs on governance is not yet measurable. However, this would in future research possibly be identified. Other supporting points of interest would be the role of NGO publications in the IPCC and how NGOs perceive scientific data and how such perception are reflected in the NGO discourses.

11 Conclusion

Coming back to the research question: *What are the leading discourses of NGOs concerning geoengineering governance and how can their development be understood?* This research found only three discourses and from those three discourses one was clearly the dominant one in the field of geoengineering governance.

Within the theory of this research I further explained what a discourse would constitute in this research. The analysed subjects were expression of NGOs on the topic of governance for geoengineering and how they were presented and campaigned for or against in publication, and interviews. Part of the discourse is also how the discourses were put into perspective of other discourses and other actors and views on the topic. The found discourses did not align with the hypothesis to find a variety of discourses on geoengineering governance although the idea that those discourses would be in line with belief systems and values from the NGOs holds true. However, some NGOs with seemingly the same values could interpret these values very differently to support their own discourse. For example, environmental NGOs both value the environment although one does acknowledge in the context of protecting the environment that geoengineering research is necessary. Whereas others argue that there should be a ban on geoengineering or geoengineering field research in order to protect the environment.

11.1 Which discourses can be defined in NGO publications?

This paper started with a selection of NGO publications and to through coding 2 discourses could be identified. Discourse 1 and Discourse 2. Discourse one was more easily defined and most prominent

in the majority of the analysed publications. It is the discourse that steers away from any type of geoengineering and tries to move governance into a ban of all geoengineering activities including experiments or field research. While it further aims to argue for governance for what they see as real climate solutions in other words climate mitigation. They ideally would not be discussing the topic but through the increasing attention for geoengineering they seem to find themselves being drawn into the debate unwillingly. Furthermore, they consider geoengineering as a larger danger as it is more than just a technological solution to solve the climate it is a weapon. This discourse was identified through 5 storylines:

Storylines:
Geoengineering governance should not be discussed
The focus should be on real solutions
There should be an international ban for SRM or all geoengineering
Governance should be right based, fair and not dominated by Western-Countries
Geoengineering is more than a climate tool, therefore governance is more than a tool for climate change

Although there are some storylines and frames present in the literature, but if solely looked at the literature the second and third discourse might not have been identified. Especially because the third discourse fell outside the scope of the literature analysis and the second discourse was only presented by one publication. These frames and storyline leading up to the discourse became clearer in the interviews.

11.2 What influences and shapes the discourse of NGOs on geoengineering governance?

First of all, the discourse of NGOs on the topic of geoengineering governance is shaped by the characteristics of geoengineering. The fact that it are relatively new technologies, that are constantly developing, combined with major uncertainties considering possible negative effects. Furthermore, the global scale, the unprecedented intentional alteration of climate systems, and wide variety of different technologies shapes this discourse. Finally, the use of these technologies in the IPCC models, and the urgency expressed by academics that these technologies will soon become a necessity seem to further shape the discourse. Apart from the very special characteristics of the topic at hand governance for such complex system and discourses on geoengineering governance are shaped by the characteristics that shape NGOs' mission and goals. The most significant differences observed in how the problem is perceived and therefore how the discourse is influenced was the differences in problem definition. Some NGOs perceived geoengineering governance not as means to govern a climate change technology, but they rather saw it as a topic of weaponization and that governance should take this into account.

The background of NGOs further explains the discourse. Most NGOs had a background in either climate change, through which they came across the topic or land-use, only a few came across the topic as a weaponization problem. This heritage or approaching point certainly influenced the discourse. For example, NGOs involved in climate campaign saw the topic of geoengineering as a distraction from actual solutions in the forms of climate mitigation. This shaped their discourse towards a ban as they didn't see geoengineering as a solution for climate change. Whereas forestry NGOs were often afraid for negative side effects of large scale afforestation or bio-fuel plantations. This also led to the discourse opposing geoengineering (discourse 1), as well as discourse 3 to

showcase solutions these NGOs did see as beneficial for their cause as well as solving the problem of geoengineering. There seemed to be almost no discussion about governance as many of the suggestion made in the third discourse would rather constitute national governance. Although some general statements were made but rather vague and imprecise.

Another major influence towards the NGOs' discourses is their worldview and core beliefs. The most prominent one would be the idea that governance for geoengineering is wrong because of the fundamentals behind this idea, in other word the idea that we can solve climate problems with technology. This idea was not in line with their beliefs; that not technological but natural solutions should be sought, the third discourse is an example of this whereas the first discourse is the example of the opposition towards geoengineering. Furthermore, the fundamental ideas of fairness equity, and the precautionary principal were often clearly expressed in governance suggestions. It also became clear that although some small differences existing within NGOs due to the fact that this research analysed a specific group of NGOs the core beliefs were similar and therefore most likely the discourses less likely to differ. However future development of geoengineering techniques might change this.

The social and political context also influenced NGOs through networking, and agenda setting. Especially the UNFCCC Paris agreement with the 1.5-degree target was often mentioned as well as the IPCC reports for using large quantities of BECCS in their models. This motivated some NGOs to discuss geoengineering in the context of the UNFCCC at side events. This also led to more knowledge and more NGOs getting involved and the fact that geoengineering was not anymore just a topic of the CBD where it was discussed first but also seemed to move into the broader climate change debate and its governance sphere. This further influenced the discourse to often be in line with current other climate governance, and most likely as well to think about governance for geoengineering within UN bodies, although the UNFCCC was not a favoured governance institution for geoengineering governance. That the topic is approached through this field of climate change also further influences the discourse to draw people with a climate change background into the discussions rather than policymakers from other fields.

Lastly individuals shape the discourse of NGOs to a large extend. As the topic is fairly new and still developing there are only few NGOs working on geoengineering or geoengineering governance. Combine this with only a limited amount of research into the ideas it already becomes quickly a very small group of knowledgeable people that have these discussions. Therefore, it seems that the individuals that are working on it shape to a large extend the discourse as there are no clear examples to follow combined with the expertise that is only in the hands of few. As there is no clear example to follow and there is no widespread information on the topic and lastly there are no funds to put a large team on the topic. Therefore, individuals involved in the topic mostly shape the discourse through personal inputs without other people to check this knowledge. This personal input also became clear through background questions and the discourses presented afterwards. For governance discourses the personal opinions and knowledge on the different techniques and options certainly mattered. Those interviewees with a more scientific background seemed more inclined to acknowledge the necessity for research governance whereas interviewees with a more climate campaign background were more inclined to follow the first discourse.

11.3 How can the development of these discourses in NGOs be understood?

As introduced before the development of the discourse is dependent on the background and the characteristics such as values or mission of the NGOs. Furthermore, the discourse can be explained through the development of the subject itself and how it develops within international fora such as the UNFCCC, the CBD, or other international conferences such as the International conference for geoengineering. This research found that the development of the discourse can best be explained through 4 different developing factors.

First the research further develops the discourse as the current knowledge on geoengineering is still very limited and therefore developments in research shape the development, which is further reflected in the IPCC reports. The third discourse is the best example of this as they took the scientific consensus of necessity for negative emission and tried to find a solution that would fit within their core values. Secondly, the first and the second discourse are examples of how the discursive development can be explained using the core beliefs and core values of these NGOs in combination with a contempt for some scientific knowledge. Thirdly the discourse developed because and through the increasing demand for climate action and the lack of rapid emission reductions. This is further enhanced through more attribution of weather patterns to climate change, as well as seemingly more extreme weather in the global north. Because the lack of climate mitigation, the necessity of geoengineering seems to become a future reality. Logically than the discourse developed to counter that and include other solutions than climate change in their discourse. Therefore, the current climate action taken explains the discourse. Another clear explanation is the influence of NGOs to other NGOs. The small group NGOs involved in the topic are all influenced by each other, and some literally following other NGOs with similar frames and storylines. Especially the ETC Group who was a first mover in this debate has had a large influence on the discursive development. The small capacity within NGOs in the form of funds and people working on the topic of geoengineering and geoengineering governance, increase the collaboration between different NGOs. This limits the different discourses and the potential of different discourses emerging. When NGOs would have more funds and capacity to work on the topic this might be different. The small group of NGOs involved in the topic enhances the lack of differences observed. Within this context NGOs tend to follow those closest to them based on shared values and beliefs.

11.4 What are the linkages between the scientific development in geoengineering governance and NGO discourse development?

There seems to be difference between the different discourses when it comes to linkages between scientific development in geoengineering governance and NGO discourse development. The first discourse although has some linkages in such that they call for governance, but that seems also to be the extent of it. Especially because the first discourse rather tries to discredit research and rather tries to move research into the idea of governance for rapid emission reductions. This means that they see research on governance for geoengineering rather as the wrong type of research, as they would rather see it developing into research to organise governance for more rapid climate mitigation or CO₂ reduction (not through technical means). This discourse seems than to develop pretty much without much direct links to academic geoengineering governance papers. The second discourse however has closer links to the scientific discourse with the focus on governance for research rather than deployment to which quite some scientific articles have been dedicated. It links

with the idea that geoengineering is necessary and governance for it in the future. Although there is a difference whereas research is also more inclined to consider deployment the NGOs discourse is still only about research and sees deployment as not currently the right option. The third perhaps more linked to the scientific developments from the IPCC than geoengineering governance literature. Especially as the natural climate solution discussed in the third discourse are not always considered to be geoengineering. The discourse has linkages between the IPCC scientific discourse as it is a response to the 1.5-degree necessity of negative emissions. Furthermore, it developed as a response to the technological concepts such as BECCS or Large-scale afforestation.

As the literature on governance for geoengineering governance rather focusses on current governance systems such as de facto governance, or authoritative assessment or voluntary guidelines. There is relatively little literature that actually suggest governance frameworks, bans or other regulations. NGOs do not seem to follow any of these suggestions directly, mostly because almost no scientific paper discusses the possibility to organise governance to ban geoengineering. This would also not be in line with research proving the idea that geoengineering will be necessary. Nevertheless, in academic literature as well as the NGO publications the transboundary nature of geoengineering lead to governance suggestions for international governance

11.5 What can be defined as the leading discourse and why?

From this research one discourse clearly emerged as the leading discourse among NGOs involved in geoengineering governance, discourse 1. Its prominence in the NGO publications as well as the expressions of the storylines and frames in the interviews make it clear that this discourse is the dominant discourse. This discourse was found to be the dominant discourse on the basis of the theory as described by Hajer on political discourse analysis, because we still discuss geoengineering in a political environment.

Hajer (1995) described that: *“different discourses fight for hegemony in the political field to represent their truth.”* This is clearly visible in international conferences such as the UNFCCC when considering geoengineering. When looking at the different discourses this research found that the first discourse has won most ground, doing that by not just presenting their discourse in publications and side-events but also clearly discrediting other ideas of governance that are not a ban. Presenting them in favour of geoengineering and influenced by companies linked to fossil fuel production. It therefore is a clear example of presenting their “truth” which can be summarized as: Geoengineering is no real solution and we rather discuss governance for real solutions, there should be governance for an international ban on geoengineering. The struggle for hegemony seems to also follow the theory presented by Sabatier & Smith on advocacy coalitions (A. Sabatier & Jenkins-Smith, 1993). Within this theory there is a so called ‘devil shift’: *“A tendency to view opponents as less trustworthy more evil, and more powerful than they probably are”* (Sabatier, Hunter, & McLaughlin, 1987). This was clearly part of how the first discourse was presented. Other factors that play a role in achieving hegemony are the few other discourses that are present to compete with for hegemony. Furthermore, the relatively limited knowledge about geoengineering in general, as well as the uncertainties of negative side effects of geoengineering techniques as well as the effectiveness of the techniques itself helps NGOs to further this discourse. As most NGOs still rather focus on other issues than geoengineering the dataset is limited. The lack of an opposing discourse further enhances the hegemony as although the other discourses are different they are not directly opposing the first discourse or each other. Only some specifics are directly opposed such as discourse one’s full ban on geoengineering

research, by the second discourse. However, a ban on geoengineering deployment on the other hand is not opposed. Due to only these small opposing factors there lacks a clear counter discourse compared to the leading one to actually compete for hegemony.

To conclude and return to the main questions there are three distinguishable NGO discourses on geoengineering governance. From these three discourse one is clearly the leading and most dominant discourse. The different characteristics previously mentioned further explain why and how the discourse developed and the background of these discourses. Future research could further broaden the scope to include a wider variety of NGOs or possibly countries and policy makers as well as use these results to analyse the development of discourses or their influence in possible future governance decisions.

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Annex 1: Interviews.

List of geographical origins of the interviewed NGO representatives

To ensure anonymity of interviewees their names can't be published and are only known to the author. This list will only contain the country in which the NGO is based, and the representative worked.

Interviewee	Country where NGO is based.
1	USA based NGO
2	UK based NGO
3	UK based NGO
4	UK based NGO
5	Belgium based NGO
6	UK based NGO
7	USA based NGO
8	German based NGO
9	German based NGO
10	USA based NGO
11	Mexico based NGO
12	German based NGO

Interview guide for Semi-structured interviews with NGO representatives:

Explain research:

- Got intrigued by the many governance challenges of this novel discussion
- Discourse analysis on NGO discourse on geoengineering governance
 - Focus on governance, less on geoengineering
 - Literature analysis and interviews
- Interviews to better understand NGO discourses on geoengineering governance, how did they come to be why these current discourses.
- Do you mind me recording this interview for personal use and transcribing?
- Initially I will not disclose any names directly, but is it alright to refer to you as a NGO representative of a German NGO?
- Short setup: First some more introductory questions, than more content related, discussion?

Introduction:

Before we really start the interview can I ask you two questions:

- What is geoengineering in your own words.
- What is governance in your own words.

1. How long have you been working for this NGO? How did you come to work here?
2. What is your position within the NGO?
3. Why did you get into the geoengineering campaign? Was this initiated by yourself or the NGO?
4. Since when do you follow the geoengineering discussion?
 - a. Where do you get the most information from on the topic?

- b. What would be reliable sources according to you on this topic, and how is this decided?
- 5. How did you personally get involved in the topic of geoengineering?
- 6. What do you find the most interesting about the topic of geoengineering?

Main:

Involvement and positions:

- 7. Would you consider your NGO involved in the topic of geoengineering?
 - a. And what do you consider the main activities on this subject from your NGO.
- 8. What is the most important goal for NGO's in the geoengineering debate?
- 9. Does the NGO think that the discussion on governance for geoengineering should be held?
- 10. Could you explain why governance for geoengineering is important, from your NGO perspective?

Governance for geoengineering?

- 11. What would be the main message of your NGO on governance for geoengineering?
 - a. What would be the main requirements of geoengineering governance?
 - b. What governance principles are the most important?
 - i. *Participatory governance(inclusion)*
 - ii. *Equal involvement (gender, etc)?*
 - iii. *Precautionary principle?*
- 12. How would your NGO design a governance framework for geoengineering?
 - a. What would you consider to be the main barriers of this governance idea?
 - b. Would you consider this suggested idea realistic?
- 13. Does your NGO have a specific Campaign plan on geoengineering governance?

International governance institutions

- 14. Should geoengineering governance be organised internationally?
- 15. Do you think that there is currently a suitable international governance institution/body for geoengineering governance?

Only use when necessary:

(During the last COP 23 in Bonn NGO sent a letter to delegates to remember the moratorium established by the CBD on geoengineering by the means of Ocean fertilization, and that this should be remembered in future governance.)

- 16. Do you see the UN as a suitable framework for governance of geoengineering, and why?
 - a. What body do you see as most suitable to take up governance for geoengineering?
 - i. Why?
 - b. How should these bodies of the UN work together?
 - i. Why should they?
 - c. Some scientific paper argued that Geoengineering could/should be governed through the security council is this a suitable solution?
 - i. Why?

Often in scientific literature the claim is made that geoengineering and climate change mitigation should be linked together in order to prevent the moral hazard of steering away from climate mitigation when discussing geoengineering, if we apply this to geo-engineering governance.

17. Do you think that governance for geoengineering should be linked to climate mitigation governance?
 - a. Should this than be done through some international governance body?
18. What do you think about the current involvement of NGOs in this field?
 - a. Should more NGOs get involved?
 - b. What kind of NGO's?
 - c. Should governance be open to all NGO's/CS organisation also those in favour?

Conclusion:

19. Do you maybe have any question for me concerning this research?

21. When you think that even the discussion on governance for geoengineering is a slippery slope and a moral hazard are you not afraid that this might happen without governance?

Annex 2: Analysed publications

Name	Nodes	References
Smolker, Rachel. 2014. "What Is Climate Geoengineering? Word Games in the Ongoing Debates over a Definition." Truthout. https://truthout.org/articles/what-is-climate-geoengineering-word-games-in-the-ongoing-debates-over-a-definition/ .	13	15
Biofuelwatch. 2017. "The Big Bad Fix: The Case Against Climate Geoengineering." http://www.biofuelwatch.org.uk/2017/big-bad-fix/ .	16	20
Paul, Helena, and Almuth Ernsting. 2011. "Letter to the Members of the Liaison Group on Climate-Related Geo-Engineering as It Relates to the Convention on Biological Diversity." http://econexus.info/sites/econexus/files/Letter to CBD Liaison group.actual sent.pdf .	3	11
CBD Alliance. 2012. "Climate-Related Geoengineering: Engineered to Fail?"	9	21
Thomas, Jim. 2010. "Join Our Campaign to Halt Geoengineering." https://theecologist.org/2010/may/04/join-our-campaign-halt-geoengineering .	5	6
The Ecologist. 2010. "Regulate Geoengineering before It's Too Late , Say MPs." https://theecologist.org/2010/mar/18/regulate-geoengineering-its-too-late-say-mps .	2	2
Environmental Defense Fund. 2018. "Our Position on Geoengineering." Accessed May 11. https://www.edf.org/climate/our-position-geoengineering .	9	14
ETC Group. 2009. "The Emperor's New Climate: Geoengineering as 21st Century Fairytale," no. August 2009.	4	5
GROUP, ETC. 2009. "Memorandum Submitted by ETC Group." http://www.etcgroup.org/sites/www.etcgroup.org/files/Memorandum submitted by ETC Group.pdf .	18	19
ETC GROUP. 2017. "What Is Wrong with Solar Radiation Managment?" http://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc_briefing_why_srm_experiments_are_bad_idea_0.pdf .	9	10
ETC-Group Heinrich Böll Stiftung. 2017. "Climate Change , Smoke and Mirrors." Bonn. http://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc_geoeng_briefing_usletter_sept2017_v2.pdf .	21	30
ETC-Group Heinrich Böll Stiftung. 2017. "Riding the Geostorm." doi:10.1039/c2lc90065c .	42	81
ETC GROUP. 2018. "ETC 's View." Climate and Geoengineering. Accessed September 10. http://www.etcgroup.org/issues/climate-geoengineering .	3	3
ETC Group. 2013. "Opposition to Geoengineering: There's No Place Like H.O.M.E." Opinion Article, Geoengineering Our Climate Working Paper and Opinion Article Series, 1–4. https://geoengineeringourclimate.files.wordpress.com/2013/05/etc-group-2013-opposition-to-geoengineering-click-for-download.pdf .	5	6

Greenpeace. 2013. "Outline Position on Geo-Engineering." (document with author)	6	7
Currie, Duncan. 2018. "Governing the Big Bad Fix ? What to Do about Geoengineering," no. January.	13	22
de la Plaza, Coraina, Oliver Munnion, Simon Fischer, and Simone Lovera. 2017. "The Risks of Large-Scale Biosequestration."	19	71
IPCC signatories. 2011. "Open Letter to IPCC on Joint Working Group Expert Meeting on Geoengineering." ETC. http://www.etcgroup.org/upload/publication/pdf_file/IPCC_Letter_with_Signatories_-_7-29-2011.pdf .	7	7
Wetter, Katy Jo, and Trudi Zundel. 2017. <i>The Big Bad Fix, the Case against Climate Geoengineering</i> . Biofuelwatch, Heinrichböll Foundation, ETCGroup. doi: http://dx.doi.org/10.1108/17506200710779521 .	41	107
WWF. 2012. "Position Paper Overview of WWF Positions." In . Hyderabad, India.	5	7

Annex 3 Codebook from coding publications

Frame number	Node Name	Description	Sources	References
1.	Concern about geoengineering governance	Whether any concern on governance for geoengineering was expressed	4	4
2.	Current international governance failed why would it succeed with Geo-engineering	Doubt about the effectiveness and the capability of international governance	2	3
3.	Danger to food and water and irreversibility	Some geoengineering techniques might be dangerous to water and food resources, with irreversible effects	4	4
4.	Global governance geared towards monoculture plantations	Global governance facilitates monoculture plantations	1	9
4.2	Current governance prioritizes private-sector and industrial plantations	Current governance prioritizes private-sector and industrial plantations	1	8

Frame number	Node Name	Description	Sources	References
5.	risk of conflict caused by negatives side effects of geoengineering.	Conflicts as a result from possible negative geoengineering outcomes, or side effects	2	2
6.	Soft governance better fits international governance	Soft governance such as guidelines rather than binding regulations seem more in line with current international governance practices	1	1
7.	No other governance instruments	The argument that there is currently no governance instrument to govern geoengineering	3	7
8.	Not governance	Text describing other things than governance issues	1	1
9.	Scientific propaganda	Text that describes science as being used to promote geoengineering, and text that says that geoengineering is just propaganda by scientist with vested interests	3	5
10.	Storyline 1 Geo-engineering governance should not be discussed		0	0
11.	Call for governance	Call for governance of geoengineering	7	17
11.2	Call not to separate CDR and SRM governance	Similar to the node name.	2	5
12.	Can geoengineering be governed	The doubt if it is possible to govern geoengineering with all its complexities	2	3
12.2	Is it possible to apply modern governance methods	Is geoengineering governance possible with modern	3	3

Frame number	Node Name	Description	Sources	References
		governance ideals such as inclusive, fair, and equitable governance		
13.	Contested views of ETC Group	Document contest views by ETC group	1	1
14.	Definition what is governance for geoengineering	A definition of what governance would be in the context of geoengineering	1	1
15.	Governance through voluntary guidelines only to promote geoengineering	Governance by the means of voluntary guidelines promotes geoengineering	3	5
16.	might permit development of geoengineerg	Governance might lead to further development of geoengineering with permission	3	4
17.	No governance leads to geoengineering	The lack of governance is used by proponents of geoengineering, to further develop geoengineering. Therefore as long as there is no governance for geoengineering to regulate it, it will further develop	2	4
18.	No independent expertise from researches with commercial interests	Researchers with commercial interests (such as patents) should not be seen as independent experts	3	4
19.	Storyline 2 The focus should be on real solutions		4	5
20.	Actors against geoengineering	Those actors that are against geoengineering in a general sense	2	2
21.	Call for governance of radical change	Those arguments that call for governance/policy/etc	3	4

Frame number	Node Name	Description	Sources	References
		to promote radical change rather than geoengineering.		
22.	Climate crisis is used to forward CDR and BECCS	The argument that climate change will lead to a climate crisis which warrants CDR and BECCS use	4	6
23.	Governance for BECCS and NET distracts from real solutions	Same as node	4	5
24.	Illusion to policymakers that high emissions can continue	The idea that policymakers are fooled by scenarios that include geoengineering and with such scenarios can continue business as usual without taking climate action	5	7
25.	Paris Agreement is an incentive for CDR	That the 1,5 degree from the Paris Agreement is an incentive for CDR	4	5
26.	Research or-and investment must not distract from mitigation	Same as name of the node	5	7
27.	Storyline 3 There should be an international Ban for SRM or all geoengineering		1	1
28.	Regulations	The form of governance than can be characterised as regulations, either by law agreements or other formal, but possibly voluntary rules that are applied	4	9
28.2	Ban	The idea that all of geoengineering should be banned, Also possibly includes statement concerning bans on specific	9	16

Frame number	Node Name	Description	Sources	References
		geoengineering techniques		
28.3	Call for Test Ban	The argument that all outdoor tests should be banned	7	11
28.4	other legal ruling	Legal frameworks/regulations or other forms that are not a Ban	8	11
28.5	Reaffirm moratorium	The call to reaffirm the moratorium set by the CBD this expresses the acknowledgement of already existing governance as well as indicates that the CBD should apparently be part of governance for geoengineering.	8	9
29.	Storyline 4 Governance should be rights based, fair and not dominated by Western Countries		2	3
30.	Actors	Description of the role or involvement of different actors and their opinion	2	2
30.2	Actors in favour of geoengineering	Those actors that are portrayed as being in favour of geoengineering	7	13
30.3	Geoengineering discussion-governance denied	Actors ignoring earlier governance discussion on geoengineering such as the CBD and London Convention and protocol	5	8
30.4	No independent expertise from researches with commercial interests	Same as the node says.	3	4

Frame number	Node Name	Description	Sources	References
31.	Governance characteristics, (principles, etc)	What characteristics are described as being necessary for governance of geoengineering, this could be principles, actors involvement etc	6	27
31.2	Democratic governance	Same as the node	4	6
31.3	Equality in governance	Same as the node	3	9
31.4	importance of NPS	The importance of None Party Stakeholders in governance. This means all those stakeholders that are not countries.	4	14
31.5	Only international governance is the right way forward	Geoengineering governance should be international.	3	6
31.6	Participatory governance	Same as node	4	17
31.7	Precautionary principle	The principle that: a lack of scientific certainty should not be a reason to hold back measures to prevent avoid or minimize such a threat.	4	8
31.8	self-regulation and ethical guidelines of conduct	Regulations and ethical guidelines organised by those who execute geoengineering	1	3
31.9	Transparent governance	Governance process should be open to public scrutiny	2	2
31.10	Woman rights	The argument that women rights in governance for geoengineering are essential	2	9

Frame number	Node Name	Description	Sources	References
32.	Governance through UN	Same as node	2	3
32.2	Governance NOT through UNFCCC	Arguments that say not to govern geoengineering using the UNFCCC	1	1
32.3	Governance through CBD	The argument to let the CBD govern geoengineering as being the best body to do so.	7	10
32.4	Why	Describing why the CBD is the best to use to govern geoengineering	0	0
32.5	Governance through London Protocol and London Convention	Call for governance through the London Protocol and the London Convention and why	5	5
32.6	Governance through UN Security Council	The governance of geoengineering is a security issues therefore the UN security council should decide on it	1	1
32.7	Governance through UN-GA	A governance solution should be established be the General Assembly rather than other subsidiary bodies of the UN	3	4
33.	Grave and unfairly distributed negative effects	Possible negative effects as a result of geoengineering techniques	4	8
34.	local and indigenous communities	Arguments and statements that promote inclusion of these in governance, as well as arguments why these should be in	7	16

Frame number	Node Name	Description	Sources	References
		governance such as local knowledge etc		
35.	Polycentric governance leads to influences not preferable in climate governance	Including to many stakeholders in governance might lead to influences of geoengineering proponents	3	15
35.2	Actors with interests against environment	Actors such as oil-companies, and other big polluters	3	13
36.	Storyline 5 Geoengineering is more than a climate tool, therefore governance is more than a tool		2	3
37.	Framing	Describing frames that are used: CDR and SRM the bad from the Ugly (both are as bad), or geoengineering is a weaponization problem etc what frames are used	1	2
37.2	framing against geoengineering	describing framing of SRM and CDR as well as geoengineering in general,	3	3
37.3	Framing in favour of geoengineering	Describing the framing of other actors and also scientists, that frame geoengineering as a positive thing (or at least in such a way to that they are in favour of geoengineering	2	2
37.4	Nuclear comparison	Comparing geoengineering with governance or ideas and the problems of geoengineering means that you frame geoengineering as if it were like nuclear	3	4

Frame number	Node Name	Description	Sources	References
		weapons/(energy), the so called in this research nuclear frame		
38.	Governance broader than climate-related issues	Geoengineering is not just a climate tool so governance is also more.	1	1
39.	Governance on geoengineering would deal with heat and CDR-GHG	Other points geoengineering governance would have to address in addition to geoengineering	2	2
40.	Unilateral deployment	Expressions on deployment of geoengineering by one actor or one state	4	6
41.	weaponization	The problem of weaponization of geoengineering techniques	5	7
42.	Storyline 6 Governance is necessary for geoengineering research		1	3
43.	Governance before research	Governance is necessary for research and should be there before research starts	1	1
44.	Research on CDR and SRM should be undertaken	Same as the node	1	2
44.2	Small scale research only	Research and connect experiments should only be small scale	2	2
45.	Storyline 7 We might need governance for geoengineering when mitigation fails		1	1
46.	Geoengineering unavoidable	We might not be able to avoid the need for geoengineering	1	1

Frame number	Node Name	Description	Sources	References
47.	NGO-environmentalist might need to consider when governments are discussing it seriously	When governments are seriously discussing it NGOs should be involved as well even when wished not to be.	1	1

Annex 4 Codebook from coding interviews

Frame Number	Node Name	Description	Sources	References
1.	Active in Conventions and treaties (not publicly)	Activities of NGO	1	2
2.	Afraid polarisation of the debate prevents discussion of acceptable parameters	Same as the name	1	1
3.	Background interviewee	The background of an interviewee	1	1
4.	Legal, international relations	Same as name Node	1	1
5.	BECCS is not carbon Neutral	The claim that BECCS is not carbon Neutral and not even close to a negative emission	3	7
6.	Concern about geoengineering governance	Whether any concern on governance for geoengineering was expressed	1	1
7.	Current international governance failed why would it succeed with Geo-engineering	Doubt about the effectiveness and the capability of international governance	3	5
8.	Danger to food and water and irreversibility	Some geoengineering techniques might be dangerous to water and food resources, with irreversible effects	1	1

Frame Number	Node Name	Description	Sources	References
9.	Global governance geared towards monoculture plantations	Global governance facilitates monoculture plantations	0	0
9.2	Current governance prioritises private-sector and industrial plantations	Current governance prioritizes private-sector and industrial plantations	0	0
10.	risk of conflict caused by negatives side effects of geoengineering.	Conflicts as a result from possible negative geoengineering outcomes, or side effects	2	2
11.	Soft governance better fits international governance	Soft governance such as guidelines rather than binding regulations seem more in line with current international governance practices	0	0
12.	Conflict of interests		1	1
13.	Definition geoengineering are negative emissions	Definitions whether geoengineering is a negative emission	9	15
14.	Definition Governance	How governance is defined	1	1
15.	Also includes Banns	A definition of governance that includes banns as governance option	4	6
16.	Broad view on governance, more than just regulation	Governance is seen in a broad sense	7	12
17.	Doesn't include ban	Governance doesn't include a ban	1	1
18.	Discussion will change after new IPCC report on 1.5	The acknowledgement that there will be a shift in the debate after the new IPCC report on 1.5 degrees	2	3

Frame Number	Node Name	Description	Sources	References
19.	Do not link mitigation and negative emissions	The idea that climate mitigation and negative emissions should not be linked through any type of governance	5	5
20.	Every NGO against it	The claim that no NGO could support geoengineering	3	8
21.	Geoengineering should be dealt with as comprehensive case	The call to not address geoengineering as separate techniques	2	2
22.	Governance to legitimise geoengineering	Governance practices could legitimise geoengineering	2	2
23.	Historical	Describing historical aspects of the development of geoengineering governance	1	1
24.	2005-2006 Involved broader debate on potential impact of geo-engineering	Same as node	3	3
25.	2007 Turning point to deal with governance	Turning point after P. Crutzen mentions geoengineering to combat climate change.	2	2
26.	2009 Royal Society report raises awareness and uncertainties	Significant document and point in the development of geoengineering	2	3
27.	After models of the IPCC used BECCS	The involvement of NGOs in the debate on geoengineering as a result of the use of BECCS in the IPCC models	2	2
28.	Article by Paul Crutzen opened the debate	Same as node	1	1

Frame Number	Node Name	Description	Sources	References
29.	CBD took it up	Acknowledgement that CBD took up the topic of geoengineering.	1	1
30.	No one will to proceed with governance in 1990's	When it was mentioned in the 1990 geoengineering was not further picked up in governance, and stayed a technical niche at that time	1	1
31.	Paris Agreement as turning point	The use of the 1.5-degree target agreed in the Paris Agreement was a turning point for the geoengineering discussion	4	5
32.	Started as military interests in 1960-1970	The claim that geoengineering started as military projects	1	2
33.	How did interviewees get into the topic	Same as node	1	1
34.	Asked	Interviewees where asked by their NGO to further research the topic	3	3
35.	Self-interests	Interviewee was involved based on a personal interest in the topic	3	3
36.	How should the discussion be shaped is it removals, enhanced sequestration, geoengineering	What type of terminology is preferred to shape the discussion of geoengineering	1	1
37.	IPCC IAM are not correct	The claim that the IAM of the IPCC are incorrect	3	4
38.	Link geoengineering governance with mitigation	The linking of climate mitigation targets with geoengineering in governance	1	3

Frame Number	Node Name	Description	Sources	References
39.	To prevent deviation from mitigation	Possible reason to link mitigation and geoengineering in governance	1	1
40.	Yes because it makes sense	Possible reason to link mitigation and geoengineering in governance	1	1
41.	Yes because proposed in context of mitigation (climate sinks)	Possible reason to link mitigation and geoengineering in governance	1	1
42.	Moral Hazard, Mission creep	The problem that supporting or even working on geoengineering might prevent further development of climate mitigation and already existing policies	3	4
43.	NGOs don't get into the topic	Reasons why NGOs might not like to get involved in the topic of geoengineering	2	4
44.	Acknowledging geoengineering would acknowledge that mitigation failed	Same as node	1	1
45.	Don't want to turn away from real solutions	The moral hazard	2	2
46.	might legitimises geoengineering	Working on it can be seen as legitimizing it which is not the NGOs intention	1	1
46.2	NGOs should not be involved in making experiments acceptable	The idea that if NGOs would work on giving input concerning experiments they might make experiments more acceptable	1	1

Frame Number	Node Name	Description	Sources	References
47.	No capacity (funding)	Lack of financial capacity to work on geoengineering	2	2
48.	People want to work on mitigation not on geo-engineering	Same as node	2	2
49.	NGOs getting into the topic	Why NGOs do get into the topic	1	1
50.	After Paris it was clear that it is part of the discussion	Growing debate with the Paris Agreement as the main reason for the increase of NGOs in the debate	2	2
51.	Because National research entities get into it more NGO involvement	As NGOs need to keep up with national research groups and their developments.	5	6
52.	Focus should not be on this but more NGO do get into it	The acknowledgement that the focus should be on mitigation but still more NGOs do get into the topic of geoengineering	4	5
52.2	As long as biggest focus is on emission reductions	The requirement of NGOs that the bulk of attention is still given to emission reductions	2	2
53.	Forests, land-use and climate issues are connected (forestry background)	Same as node	5	8
54.	Important that NGOs start thinking about this	Large well know NGOs WWF, Greenpeace do start to think on the topic	1	2
55.	Individuals push the topic	It are individuals who push the topic of geoengineering within NGOs, not so much a broadly carried topic.	3	6

Frame Number	Node Name	Description	Sources	References
56.	More should get into it and more do get into it	The wish that the debate on geoengineering governance is joined by a wider variety of NGOs and the acknowledgement that the number of NGOs that are involved is growing	7	9
56.2	Also more civil society NGOs	Same as node	3	5
57.	Share view with HBF, ETC broadly	A similar view as the Heinrich Böll foundation and ETC group present	2	4
58.	Via Ocean Iron Fertilisation	One of the ways in which an interviewee could have gotten into the topic of geoengineering	2	2
59.	Within Climate into negative emissions, BECCs IPCC,	A way how interviewees and NGOs in general could get into the topic of geoengineering	8	11
60.	No answer to design governance framework	Lack of answers when asked how interviewee would design a governance framework	2	2
61.	No geoengineering before deep decarbonisation pathways and agreement to Paris Agreement	The governance idea that would only allow for geoengineering when deep decarbonisation pathways would be adopted first as well as the Paris Agreement	1	3
62.	No other governance instruments	The argument that there is currently no other governance structure to govern geoengineering	5	6

Frame Number	Node Name	Description	Sources	References
63.	no public campaign on geoengineering	The NGO does not have a public campaign on geoengineering	3	5
64.	Because focus should be on what we can do not on what we can't do.	Reason why there is no public campaign on geoengineering	2	2
65.	Because it's a mostly technological discussion currently	Reason why there is no public campaign on geoengineering	2	5
66.	Campaigning against still raises profile, (moral hazard)	Reason why there is no public campaign on geoengineering	1	1
67.	It is a risky campaign area	Reason why there is no public campaign on geoengineering	1	1
68.	It's a complicated topic that doesn't lend itself well to campaign on	Reason why there is no public campaign on geoengineering	2	5
68.2	It's a nuanced message which is never easy	Reason why there is no public campaign on geoengineering	1	1
69.	Not a core agenda item	Reason why there is no public campaign on geoengineering	1	3
70.	There is not really a solution	Reason why there is no public campaign on geoengineering	1	1
71.	Not governance	Text describing other things than governance issues	0	0
72.	Scientific propaganda	Text that describes science as being used to promote geoengineering, Text that says that geoengineering is just propaganda by scientist with vested interests	1	1

Frame Number	Node Name	Description	Sources	References
73.	Silent opposition on it should be more outspoken	Expression on NGO involvement in the debate	1	1
74.	Some articles get published with a specific view	Articles should be seen in context and some have a certain agenda	1	1
75.	Some Large US based NGOs are in favour or ambiguous about geoengineering	Point on NGO involvement in geoengineering	1	1
76.	Storyline 1 Geo-engineering governance should not be discussed		2	2
77.	Call for governance	Call for governance of geoengineering	4	4
77.2	Call not to separate CDR and SRM governance	Similar to the node name	2	4
77.3	Because CBD also uses it in this way	Because the CBD also uses the term geoengineering governance of SRM and CDR should not be separated	1	1
77.4	It is not easier to govern CDR than SRM	As there is no difference in difficulty to govern CDR and SRM it should not be separated	1	1
78.	Can geoengineering be governed	The doubt if it is possible to govern geoengineering with all its complexities	6	10
79.	Contested views of ETC	Text contest views by ETC group	4	6
80.	Definition what is governance for geoengineering	A definition of what governance would be in the context of geoengineering	3	3
81.	Governance of negative emission might open up	The idea that the discussion on a set of	1	1

Frame Number	Node Name	Description	Sources	References
	for riskier technologies of geoengineering	geoengineering techniques might lead to more riskier techniques being discussed as well		
82.	Governance through voluntary guidelines only to promote geoengineering	Governance by the means of voluntary guidelines promotes geoengineering	2	2
83.	is it possible to apply modern governance methods	Is geoengineering governance possible with modern governance ideals such as inclusive, fair, and equitable governance	2	2
84.	might permit development of geoengineering	Governance might lead to further development of geoengineering with permission	1	1
85.	No governance leads to geoengineering	The lack of governance is used by proponents of geoengineering, to further develop geoengineering. Therefore as long as there is no governance for geoengineering to regulate it, it will further develop	1	4
86.	Prefer not to but ideas are already out there so the discussion needs to be held	The wish to rather not discuss geoengineering, but the reality that it is already discussed so the discussion needs to be held.	2	4
87.	Storyline 2 The focus should be on real solutions		11	43
88.	Actors against geoengineering	Those actors that are against geoengineering in general sense	4	4

Frame Number	Node Name	Description	Sources	References
89.	Bigger issues than geoengineering currently to focus on	Those arguments that call for governance/policy/etc to promote radical change rather than geoengineering.	2	2
90.	Call for governance of radical change	Those arguments that call for governance/policy/etc to promote radical change rather than geoengineering.	3	3
91.	Climate crisis is used to forward CDR and BECCS	The argument that climate change will lead to a climate crisis which warrants CDR and BECCS use	2	2
92.	Geoengineering is connected to the amount of emissions	Linking CO ₂ concentrations and geoengineering	4	8
93.	geoengineering is no real solution	Claiming that geoengineering does not fit solutions such as climate mitigation and emission reductions, or natural climate solutions	3	4
94.	Geoengineering takes money away from real solutions	Same as node	1	1
95.	Governance for BECCS and NET distracts from real solutions	Same as node	2	2
96.	Illusion to policymakers that high emissions can continue	The idea that policymakers are fooled by scenarios that include geoengineering and with such scenarios can continue business as usual without taking climate action	7	9

Frame Number	Node Name	Description	Sources	References
97.	Inhibits transformation to a just 1,5 world	Geoengineering activities and the discussion of these would pose this inhibition	1	2
98.	Paris Agreement incentive for CDR	The idea that the Paris Agreement constitute an incentive for CDR because of article 4 and the term anthropogenic sinks	1	3
99.	Paris Agreement should not be read to endorse CDR	Statement that Paris Agreement should not be seen to mean CDR when talking about anthropogenic sinks	4	6
100.	Real solutions are met with more scepticism than geoengineering	Same as Node	1	1
101.	Real solutions are those that lead to emission reductions	Emission reductions not being negative emissions	2	2
102.	Research or-and investment in geoengineering must not distract from mitigation	Same as node	3	3
103.	Talks about geoengineering poison the climate debate and on climate change mitigation	Same as node	1	2
104.	Storyline 3 There should be an international Ban for SRM or all geoengineering		4	4
105.	Governance to prevent all geoengineering	Governance should have as goal to prevent any geoengineering	1	2
106.	Not able to ban BECCS or some other CDR techniques	The conviction that it will be impossible to have a ban for BECCS or	1	1

Frame Number	Node Name	Description	Sources	References
		some other local CDR techniques		
107.	Regulations	The form of governance than can be characterised as regulations, either by law agreements or other formal, but possibly voluntary rules that are applied	1	1
107.2	Ban	The idea that all of geoengineering should be banned, Also possibly includes statement concerning bans on specific geoengineering techniques	6	24
107.3	Call for Test Ban	The argument that all outdoor tests should be banned	1	3
107.4	other legal ruling	Legal frameworks/regulations or other forms that are not a Ban	6	9
107.5	Reaffirm moratorium	The call to reaffirm the moratorium set by the CDB this expresses the acknowledgement of already existing governance as well as indicates that the CBD should apparently be part of governance for geoengineering.	3	5
108.	Storyline 4 Governance should be rights based, fair and not dominated by Western Countries		6	10
109.	Actors	Description of the role or involvement of	1	1

Frame Number	Node Name	Description	Sources	References
		different actors and their opinion		
109.2	Actors in favour of geoengineering	Those actors that are portrayed as being in favour of geoengineering	7	17
109.3	Geoengineering discussion-governance denied	Actors ignoring earlier governance discussion on geoengineering such as the CBD and London Convention and protocol	2	2
109.4	IPCC report used to forward BECCS	The IPCC report is used to further the development of BECCS	1	1
109.5	No independent expertise from researches with commercial interests	Same as the node says.	3	4
110.	Governance characteristics, (principles, etc)	What characteristics are described as being necessary for governance of geoengineering, this could be principles, actors involvement etc	4	6
110.2	Adaptive governance	Same as node	1	1
110.3	Bottom-up discussions	Same as node	1	3
110.4	Democratic governance	Same as node	2	3
110.5	Pre-Prior and informed consent	Same as node	1	1
110.6	Equality in governance	Same as node	2	2

Frame Number	Node Name	Description	Sources	References
110.7	Fundamental rights	Adhering to fundamental rights such as that in the Universal declaration of human rights, and the rights of the child	1	2
110.8	Governance should be international	The wish that geoengineering governance should be internationally organised	7	14
110.9	Global not just international	Including not just multiple international countries but all countries in the world	2	5
110.10	Only international governance is the right way forward	Geoengineering governance should be international.	4	4
110.11	Unless bans or prohibitions of experiments	Bans and prohibitions of experiments can also be local this is only a positive addition to any other form of ban	2	2
110.12	Governance start not from the idea we need geoengineering	The idea that the goal of geoengineering governance is not to facilitate geoengineering	1	1
110.13	importance of NPS	Same as node	1	1
110.14	Include Global South	Include the global south governance for geoengineering	3	3
110.15	Participatory governance	Same as node	6	16
110.16	Precautionary principle	The principle that: a lack of scientific certainty should not be a reason to hold back measures to prevent	2	4

Frame Number	Node Name	Description	Sources	References
		avoid or minimize such a threat.		
110.17	self-regulation and ethical guidelines of conduct	Regulations and ethical guidelines organised by those who execute geoengineering	0	0
110.18	Transparent governance	Governance process should be open to public scrutiny	4	6
110.19	Woman rights	The argument that women rights in governance for geoengineering are essential	1	1
111.	Governance issues when developed countries do BECCS, afforestation in developing countries	Same as node	1	1
112.	Governance only in form of a ban	Governance for geoengineering can only be considered as a ban for geoengineering	2	2
113.	Governance should be technology specific	Per different geoengineering techniques there should be specific governance	3	4
113.2	Governance should be scale specific	Governance should be further organised on the basis of the scale of geoengineering techniques	2	2
114.	Governance through UN	Same as node	6	7
114.2	Governance NOT through UNFCCC	Arguments that say not to govern geoengineering using the UNFCCC	7	12
114.3	Governance through CBD	The argument to let the CBD govern	10	20

Frame Number	Node Name	Description	Sources	References
		geoengineering as being the best body to do so.		
114.4	A moratorium prevents governance of something	The idea that a moratorium is not governance, and that such a moratorium would not be governance but prevents governance of geoengineering	1	1
114.5	Why	describing why the CBD is the best to use to govern geoengineering	4	5
114.6	Governance through London Protocol and London Convention	Call for governance through the London Protocol and London Convention	4	7
114.7	Governance through UN SC	the governance of geoengineering is a security issues therefore the UN security council should decide on it	0	0
114.8	Governance through UN Security Council would be terrible	Geoengineering governance should not be a topic within the UN security council.	1	1
114.9	Governance through UNFCCC	Same as node	3	3
114.10	Governance through UN General Assembly	A governance solution should be established be the General Assembly rather than other subsidiary bodies of the UN	3	4
115.	Grave and unfairly distributed negative effects	Possible negative effects as a result of geoengineering techniques	3	4

Frame Number	Node Name	Description	Sources	References
116.	local and indigenous communities	Arguments and statements that promote inclusion of these in governance, as well as arguments why these should be in governance such as local knowledge etc	7	11
117.	More governance is better		1	1
118.	Not through UN		1	1
119.	Polycentric governance leads to influences not preferable in climate governance		0	0
119.2	Actors with interests against environment		1	1
120.	Several international bodies have picked up the topic.		1	1
121.	Who owns geoengineering, who regulates it		4	6
122.	Storyline 5 Geoengineering is more than a climate tool, therefore governance is more than a tool		4	12
123.	Broader than just a technical issue		3	3
124.	Framing	Describing frames that are used: CDR and SRM the bad from the Ugly (both are as bad), or geoengineering is a weaponization problem etc what frames are used	1	1
124.2	framing against geoengineering	describing framing of SRM and CDR as well as	6	12

Frame Number	Node Name	Description	Sources	References
		geoengineering in general,		
124.3	Framing in favour of geoengineering	Describing the framing of other actors and also scientists, that frame geoengineering as a positive thing(or at least in such a way to that they are in favour of geoengineering	2	3
124.4	Nuclear comparison	Comparing geoengineering with governance or ideas and the problems of geoengineering means that you frame geoengineering as if it were like nuclear weapons/(energy), the so called in this research nuclear frame	2	6
125.	Geoengineering is a strategy to further entrenched inequalities and a certain wrap on power and control	Same as node	1	1
126.	Governance broader than climate-related issues	Geoengineering is not just a climate tool so governance is also more.	3	4
126.2	It's an exacerbation of power imbalances	The idea that the power that comes with having certain geoengineering technologies enlarges power imbalances	1	1
127.	Governance on geoengineering would deal with heat and CDR-GHG	Other points geoengineering governance would have to address in addition to geoengineering	0	0
128.	No weaponization problem	There is no weaponization problem	2	2

Frame Number	Node Name	Description	Sources	References
		of geoengineering technologies		
129.	Unilateral deployment	Expressions on deployment of geoengineering by one actor or one state	1	1
130.	weaponization	The problem of weaponization of geoengineering techniques	3	11
131.	Storyline 6 Governance is necessary for geoengineering research		3	3
132.	Difficult to draw the line between acceptable and unacceptable so we need governance	Governance should further clarify what type of research would or would not be acceptable	1	2
133.	Even though we are opposed to the idea of geoengineering research	Even when opposed to geoengineering research governance is still necessary	3	3
134.	Governance and research march together	Governance furthers research and the other way around they both pro	1	2
135.	Governance before research	Governance is necessary for research and should be there before research starts	4	6
136.	Governance challenges researchers	Researchers do face currently governance challenges	1	1
137.	Governance for research as research proposals will be made	As there are already proposals for research we would better also have governance on it	3	6

Frame Number	Node Name	Description	Sources	References
138.	It's too early to discuss governance for geoengineering deployment	The reluctance to discuss anything else than research	1	2
139.	Only governance for research not yet for deployment	The reluctance to discuss anything else than research	1	6
140.	Research governance characteristics	Characteristics for geoengineering research	5	11
141.	Research on CDR and SRM should be undertaken	Same as node	3	3
141.2	in such a way that prevents conflict, and helps to understand geoengineering	Requirements of research governance for geoengineering	1	1
141.3	Small scale research only	Requirements of research governance for geoengineering	1	1
142.	There is already some regulation for geoengineering research	Existing regulation for research of geoengineering	4	8
143.	There should be a global agreement before deployment	No unilateral action	1	1
144.	Storyline 7 We might need governance for geoengineering when mitigation fails		1	1
145.	For the residual CO2 we are open to the idea	NGO that was open to the idea of geoengineering for residual CO2 emission from industry that are hard to decarbonize	1	1
146.	Geoengineering unavoidable	Same as node	4	6
147.	NGO-environmentalist might need to consider	When governments are seriously discussing it	4	6

Frame Number	Node Name	Description	Sources	References
	when governments are discussing it seriously	NGOs should be involved as well even when wished not to be		
148.	We might need geoengineering when mitigation fails	The idea that geoengineering would be necessary when not enough CO2 is mitigated	5	7
149.	When DACS could work and is affordable we should look at it	A positive attitude toward DACS	1	1
150.	When we find geoengineering technology that is acceptable we need to reconsider	Not one found yet but not in principle against the idea	1	1
151.	Storyline 8 Natural solutions for CDR		4	5
152.	afforestation is geoengineering	Same as node	1	1
153.	Forest restoration benefits local people	Same as node	1	2
154.	In the context of negative emission preference for natural solutions	Natural solutions are preferred as a concept over negative emission technologies	3	4
155.	Minimize the need for CO2 removal through natural solutions	Same as node	2	3
156.	Natural solutions are underestimated in models	The argument that models such as the IAM and IPCC scenarios are not taking into account natural solutions sufficiently	4	9
156.2	Minimize reliance on BECCS	Same as node	3	5

Frame Number	Node Name	Description	Sources	References
157.	Natural solutions as low risk carbon sequestration	Same as node	3	4
158.	Natural solutions to protect biodiversity and climate	The co-benefits of natural solutions	3	4
159.	Negative emissions (natural solutions) as such are not geoengineering	The difference between natural negative emissions and technological negative emissions	3	5
160.	Reforestation and afforestation more has possible conflicts with food products and land-use	The problem of scale that constitute geoengineering	2	4
161.	We have too much CO2 in the atmosphere	Same as node	4	5
162.	We might need BECCS don't fully exclude it	As we might need some geoengineering we can't follow	1	1
163.	We need to increase CO2 sequestration	Same as node	8	13
164.	Survival and integrity of land more important than possible negative effects of negative emissions	Same as node	1	1
165.	The current discourse is highly politicized and dangerous	The current discourse on geoengineering	1	1
166.	There should be research into geoengineering governance	Call for research on governance of geoengineering	1	2
167.	There should be some kind of enforcement mechanism	Same as node	1	1
168.	Treating information in a specific way (wary)	Recognising the source of information and acting accordingly	1	2
169.	Wary of chemtrails debate		0	0

Frame Number	Node Name	Description	Sources	References
170.	A lot of public discussion quickly falls into issues of chemtrails evidence	Same as node	1	1
171.	What governance is there for the carbon storage place (long term liability)	Governance for other aspects than executing geoengineering technique, namely long term storage	1	1