

Appendix

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Appendix A: MTM spectra

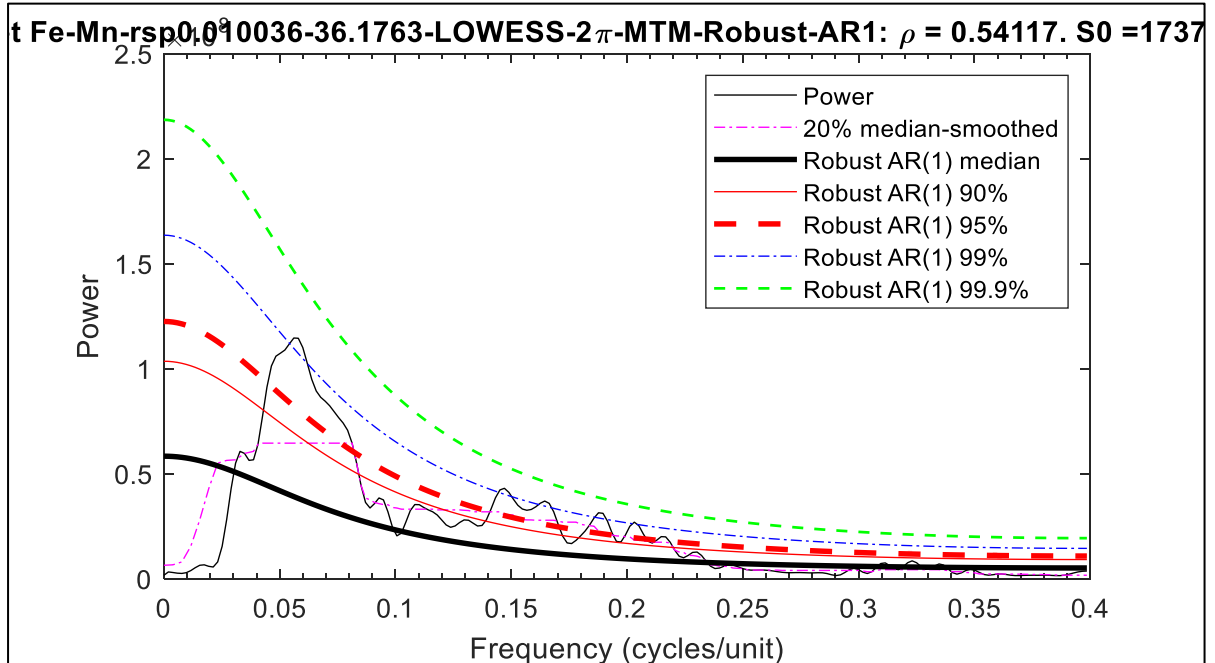
Appendix B: Cross-spectral analysis

Appendix C: Bandpass filters

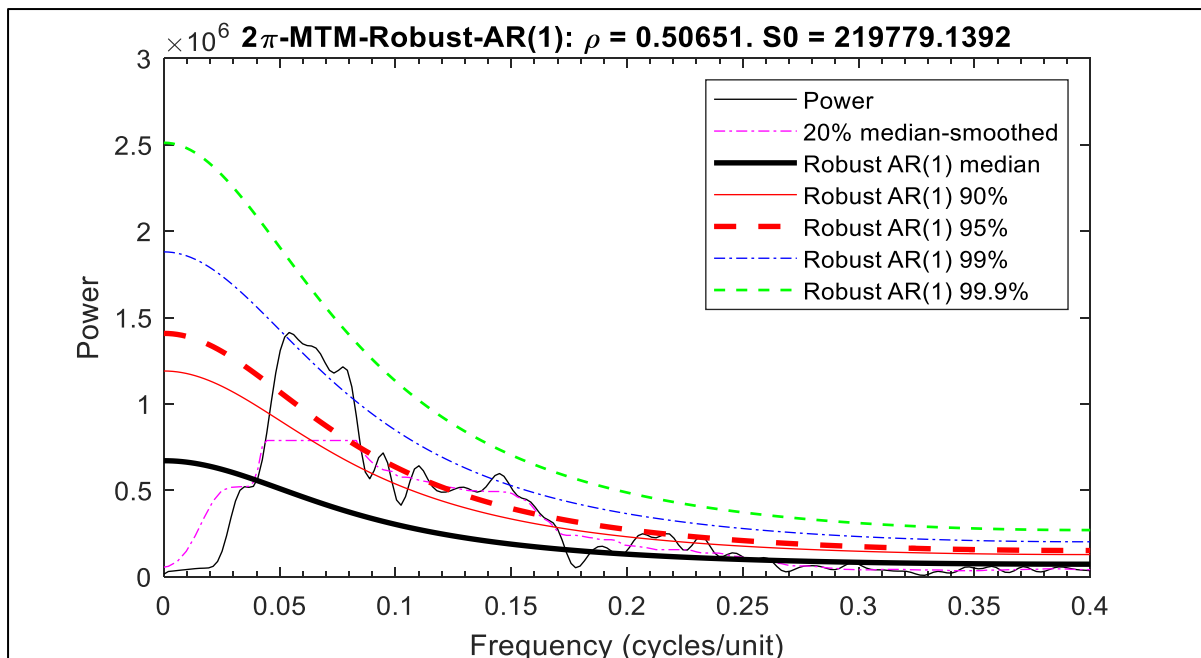
Appendix A: MTM Spectra

Frequencies between 0 and 0.4 are displayed along with confidence levels. The most significant bands in A1 and A2 are in the $\sim 19.5\text{m}$ intervals, at $\sim 8.0\text{m}$ for A3 and A4, at $\sim 11.3\text{m}$ for A5, and at $\sim 3.8\text{m}$ for A6-A8.

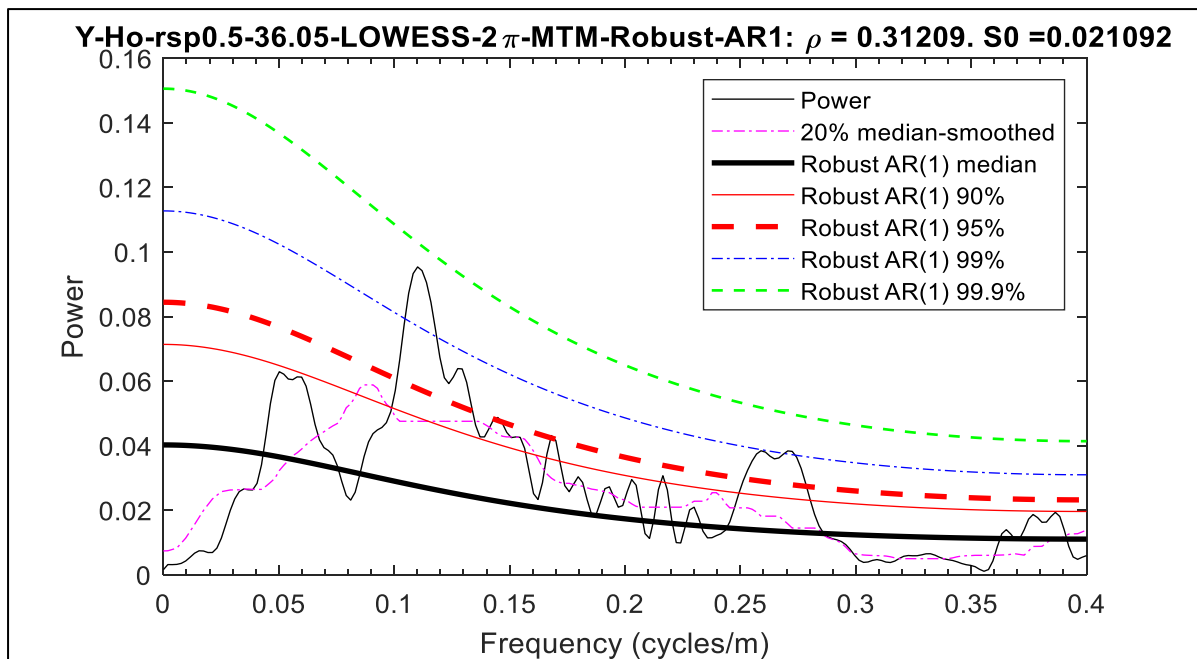
A1: Fe/Mn – [Lantink et al. \(2019\)](#)



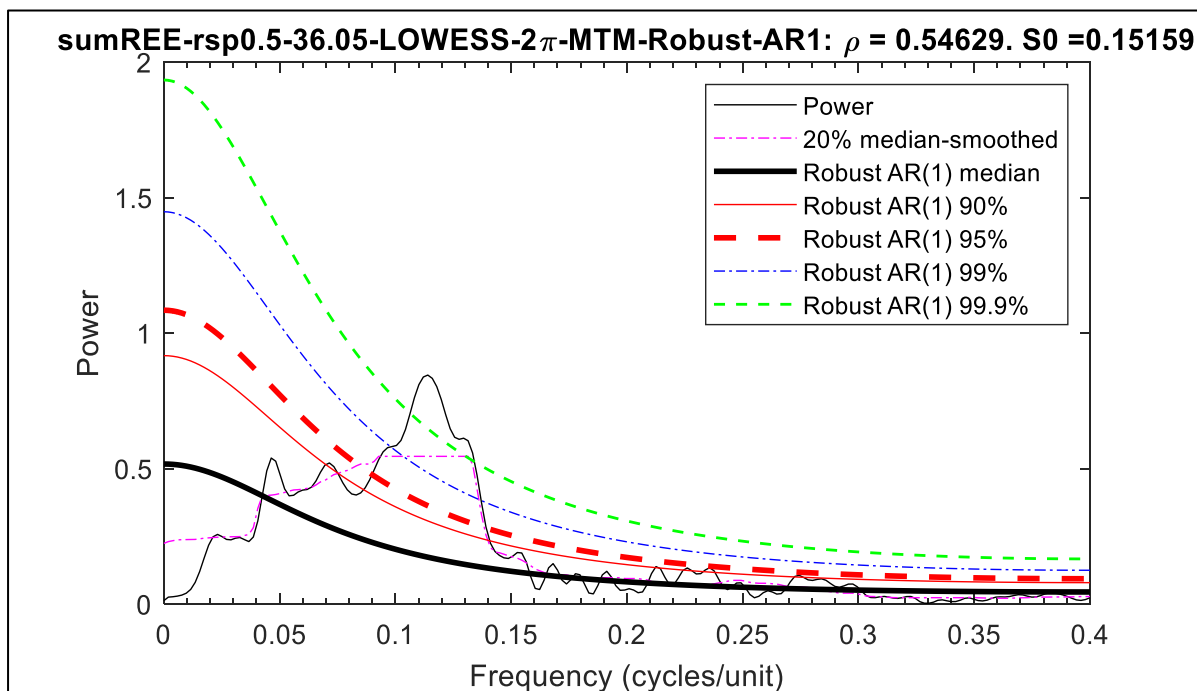
A2: Fe/Mn



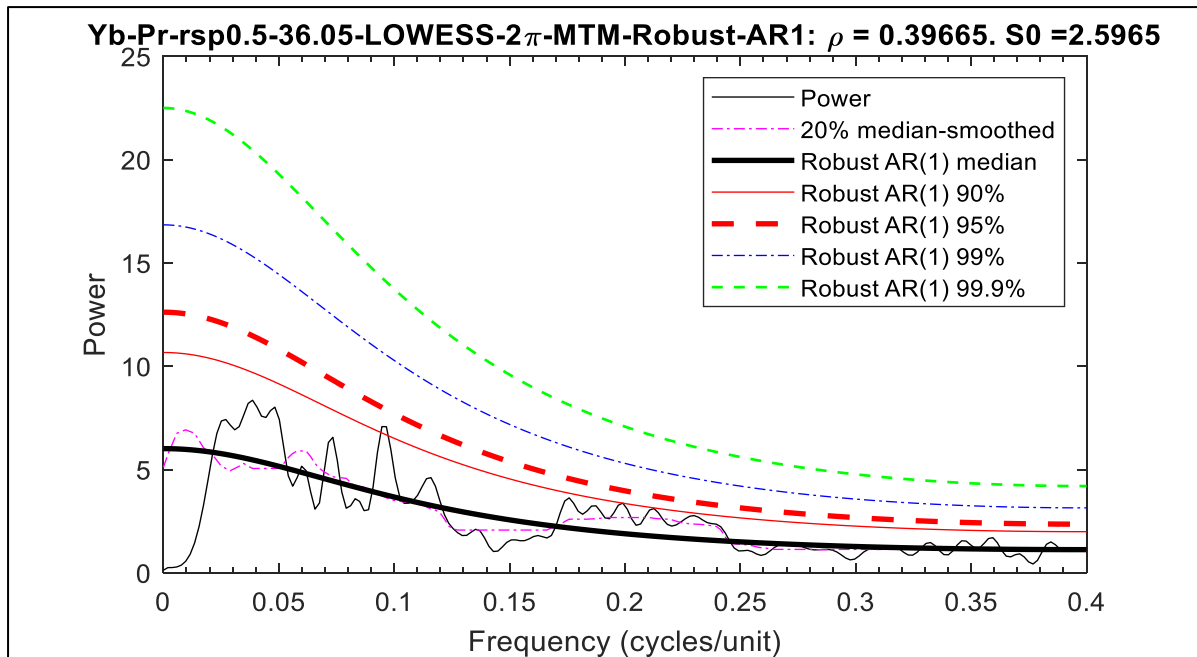
A3: Y/Ho



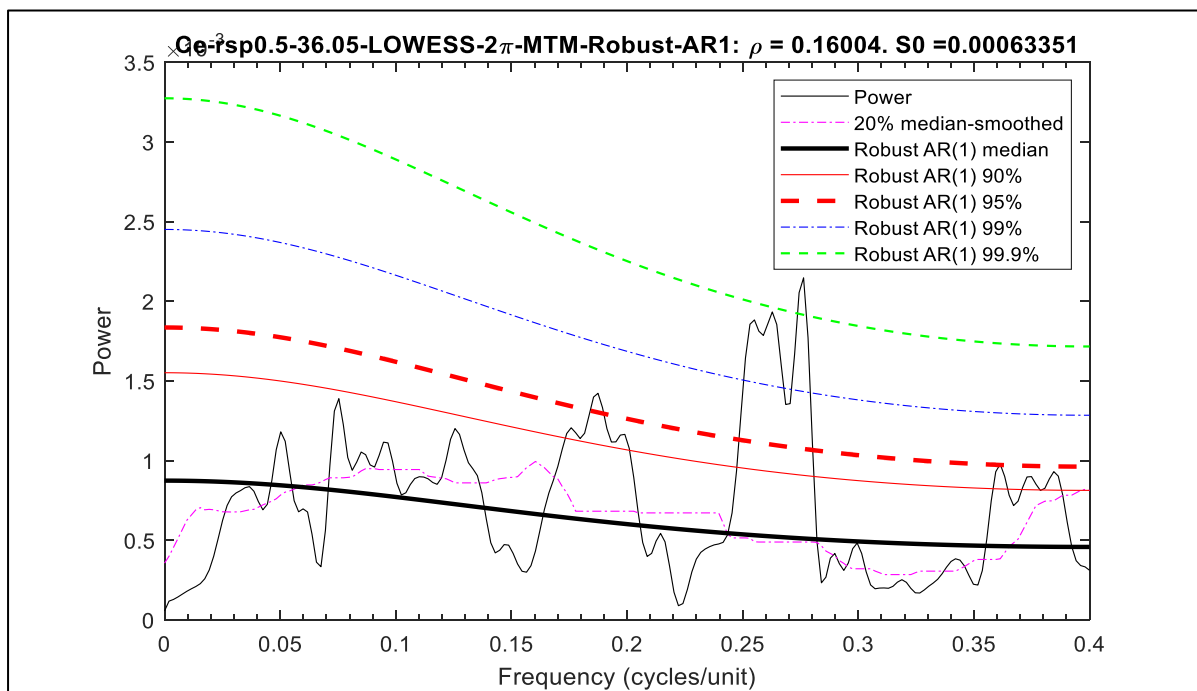
A4: sumREE



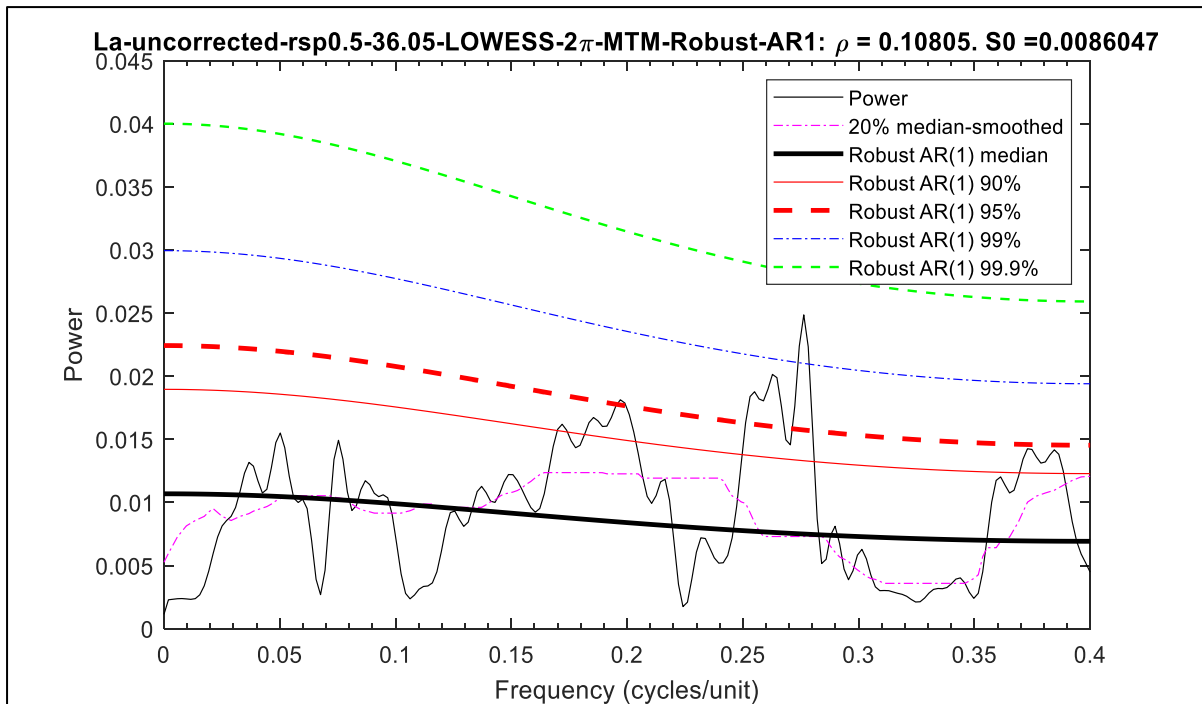
A5: Yb/Pr



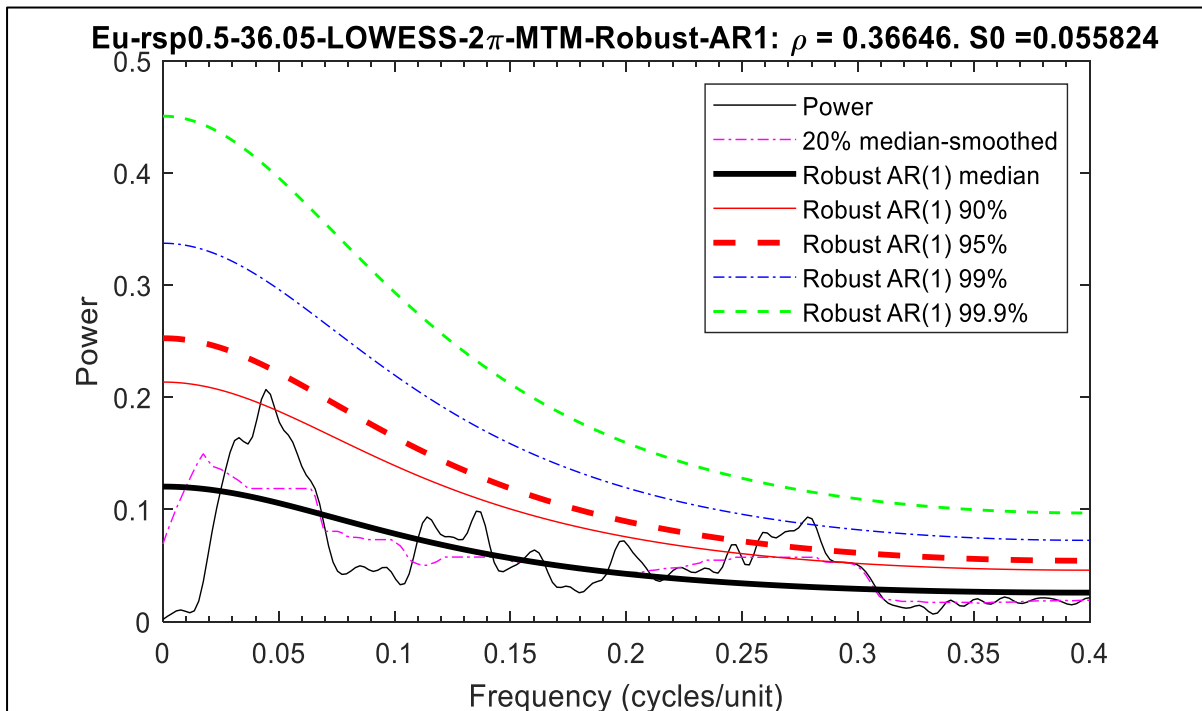
A6: Ce



A7: La



A8: Eu

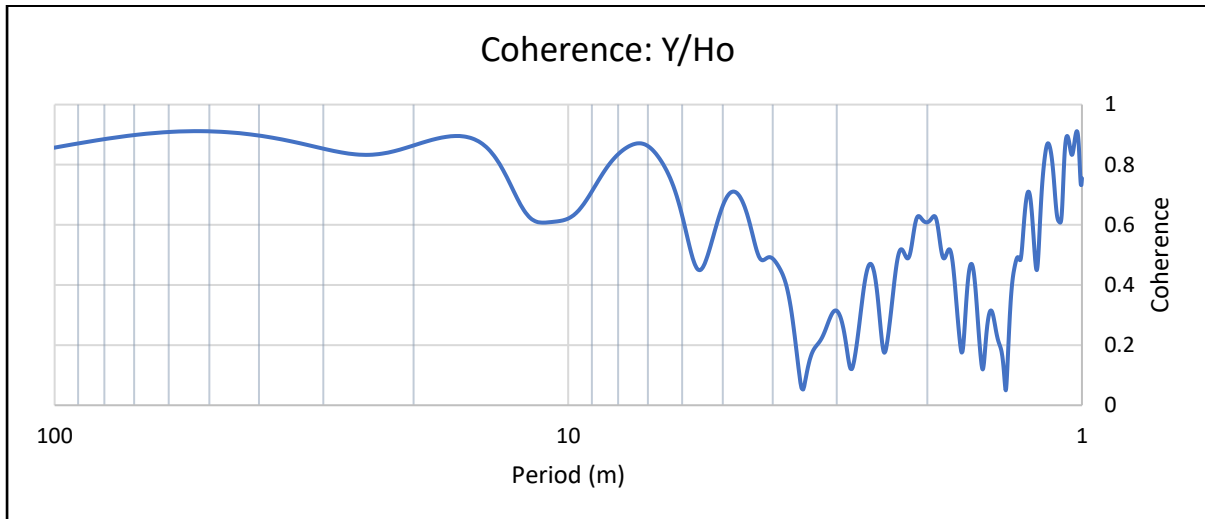


Appendix B: Cross-spectral analysis

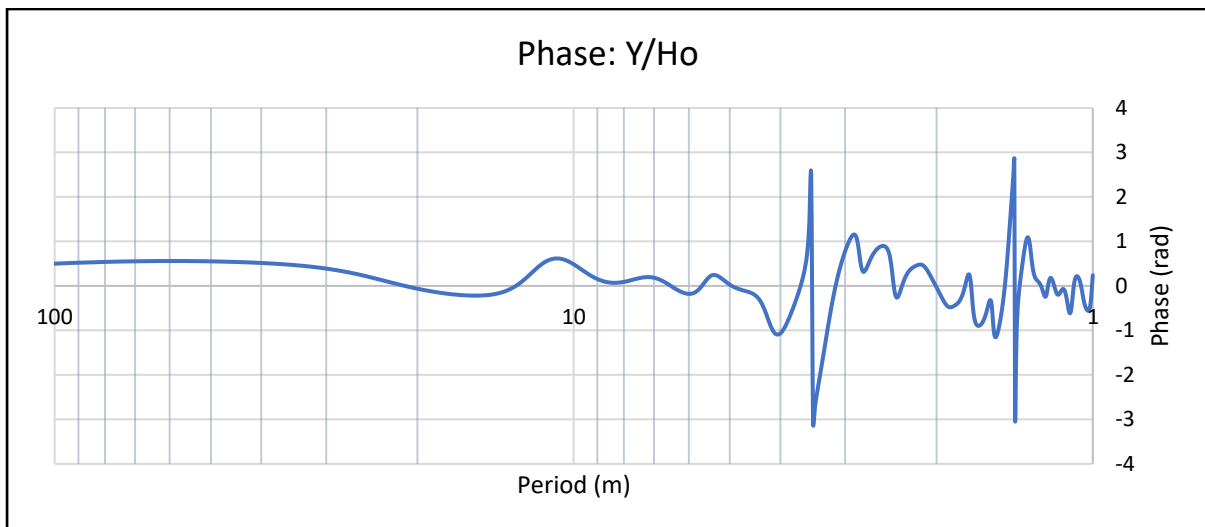
Cross-spectral analysis was performed against Fe/Mn. An in-depth description of the cross-spectral analysis of Y/Ho can be found in the report.

Appendix B1: Y/Ho

B1a



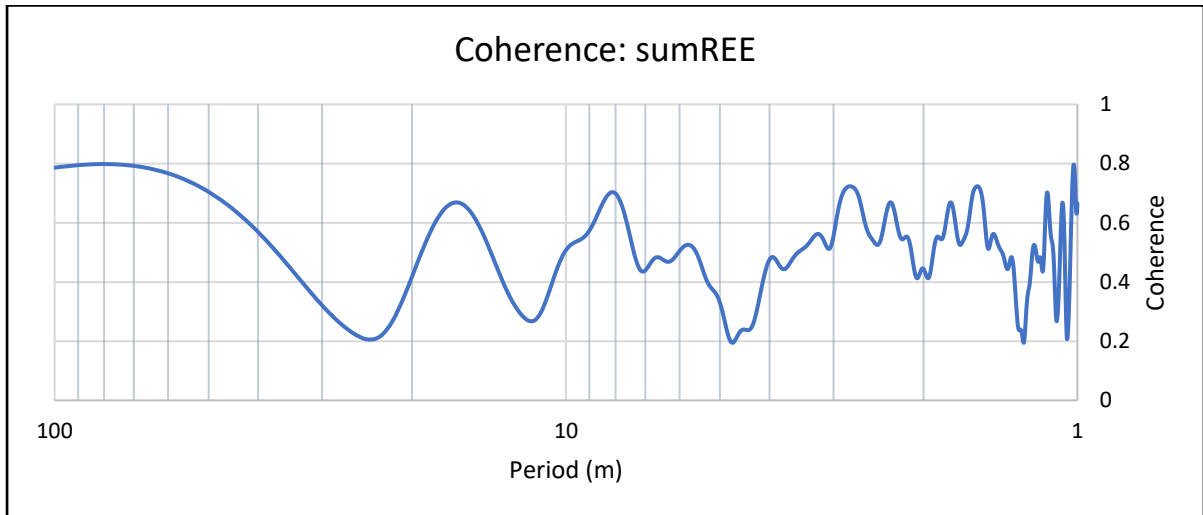
B1b



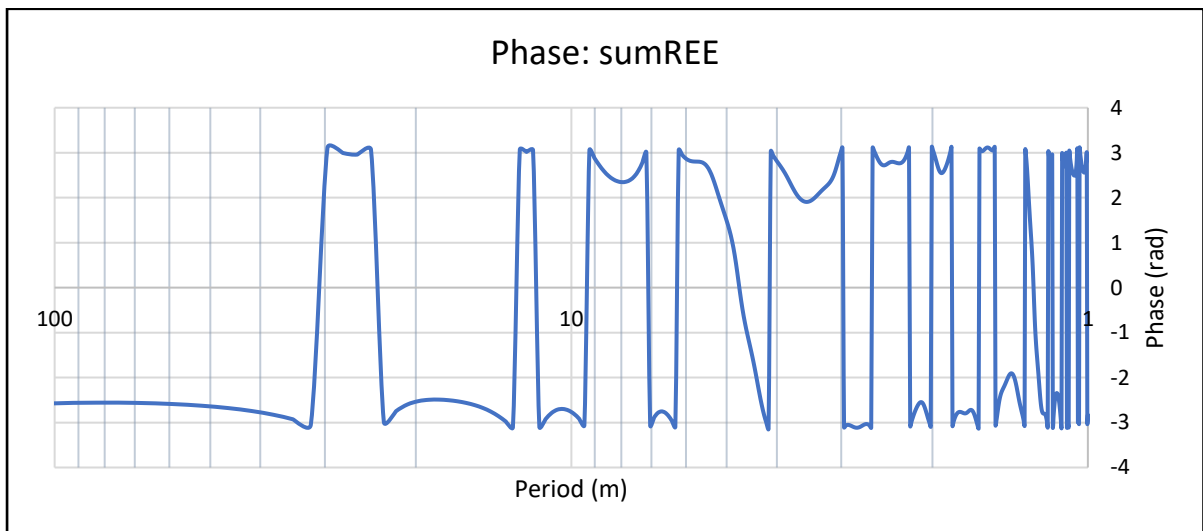
Appendix B2: sumREE

The highest coherence (~ 0.7) is found at $\sim 2.7\text{m}$, 8.0m , and 16.0m . The entire profile is in a clear anti-phase relationship.

B2a



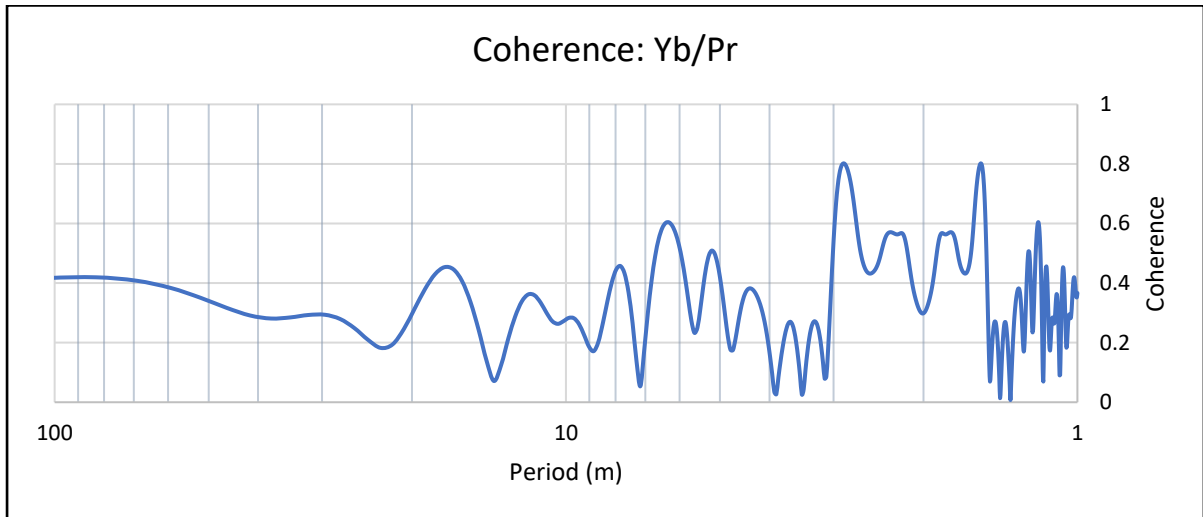
B2b



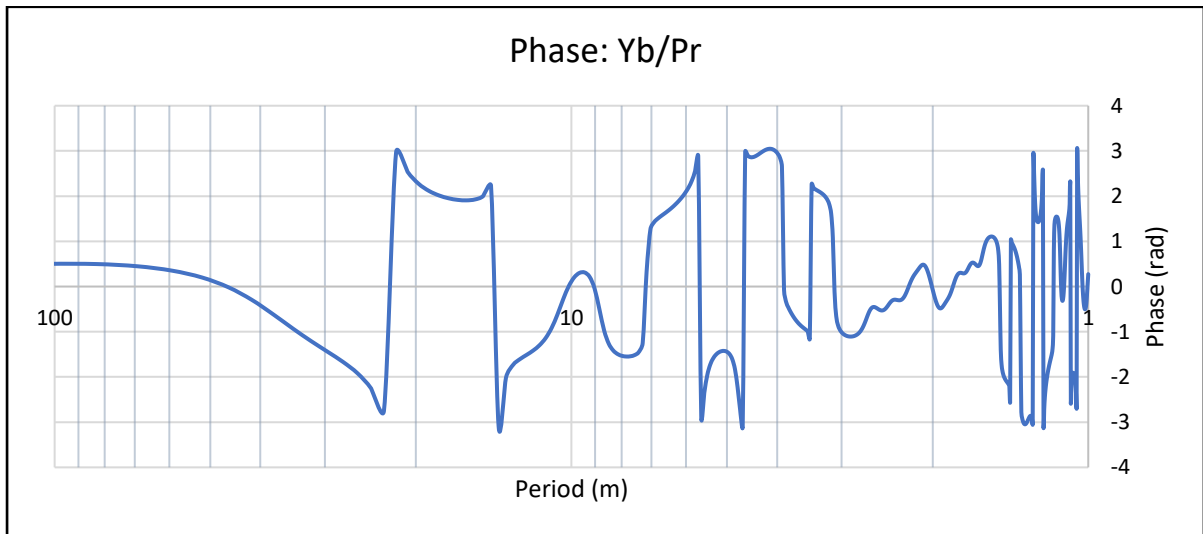
Appendix B3: Yb/Pr

Coherence is relatively low (<0.6) apart from $\sim 2.7\text{m}$ and $\sim 6.3\text{m}$. Phase relationships are predominately anti-phase.

B3a



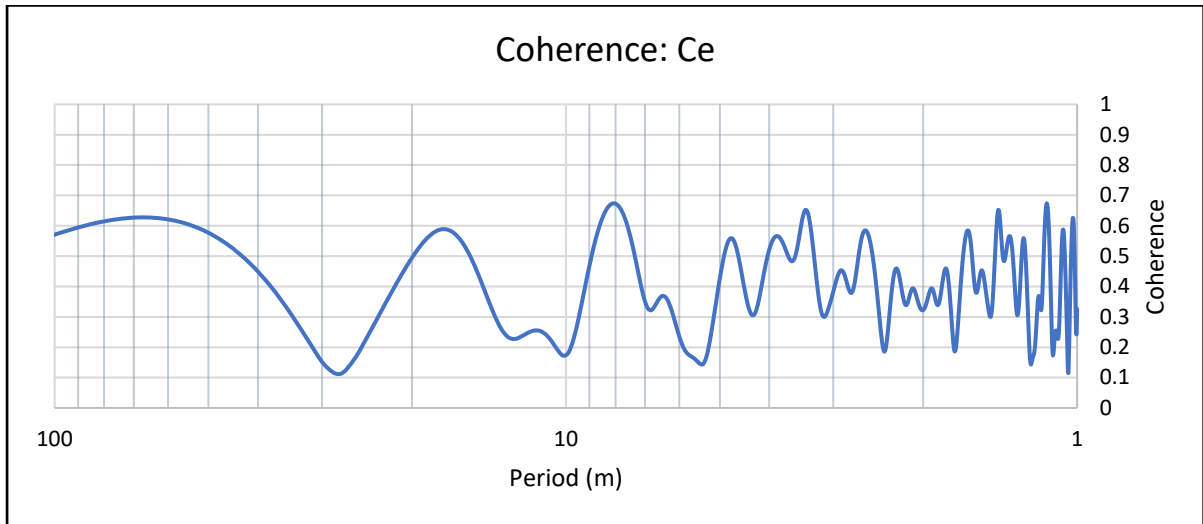
B3b



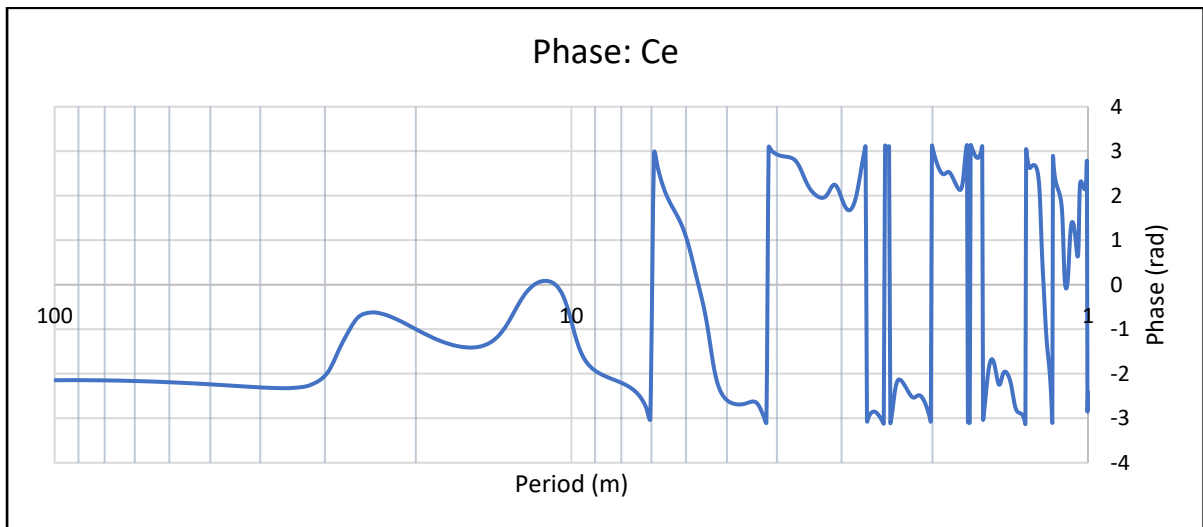
Appendix B4: Ce

Coherence is relatively consistent throughout but does not exceed 0.7. The phase relationship is strongly anti-phase, with periods at 10-20m being intermediary.

B4a



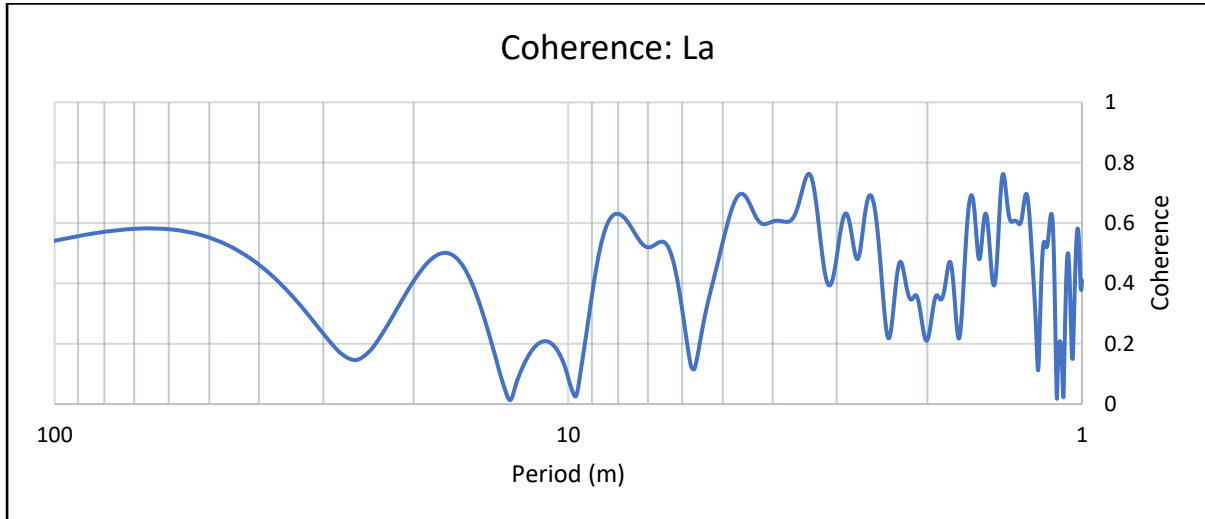
B4b



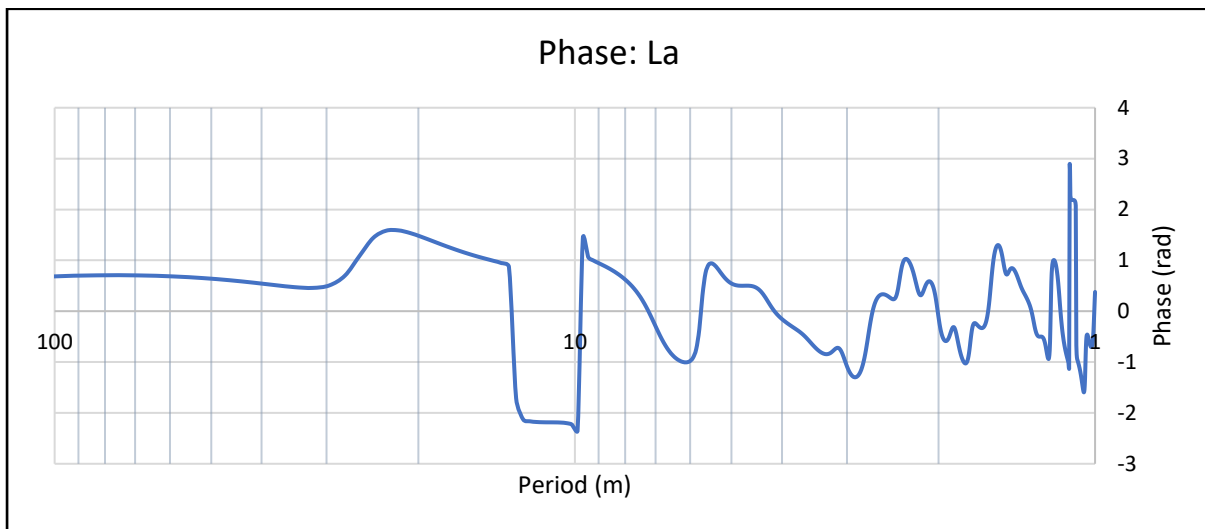
Appendix B5: La

Coherence is relatively consistent throughout but rarely exceeds 0.7. Lanthanum is almost in-phase throughout, except for 10-13m.

B5a



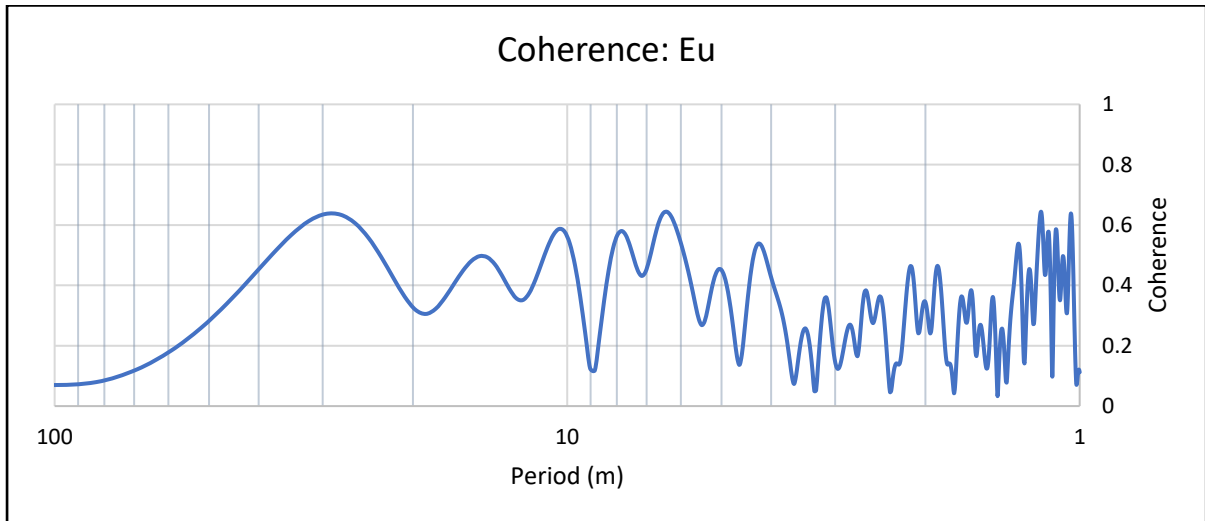
B5b



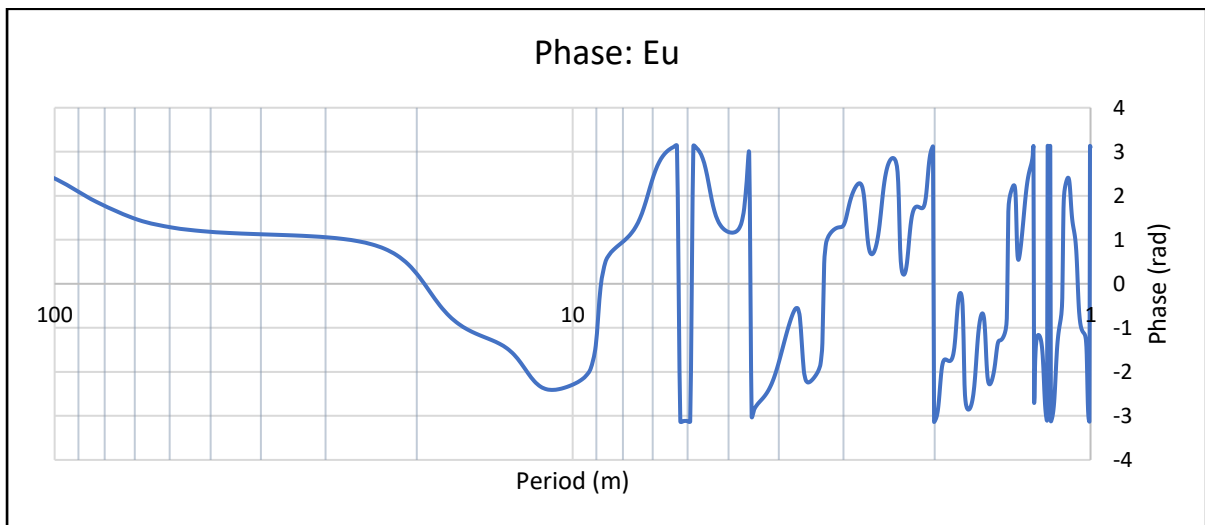
Appendix B6: Eu

Europium has a relatively low coherence throughout (<0.6). The phase relationship is predominately anti-phase.

B6a



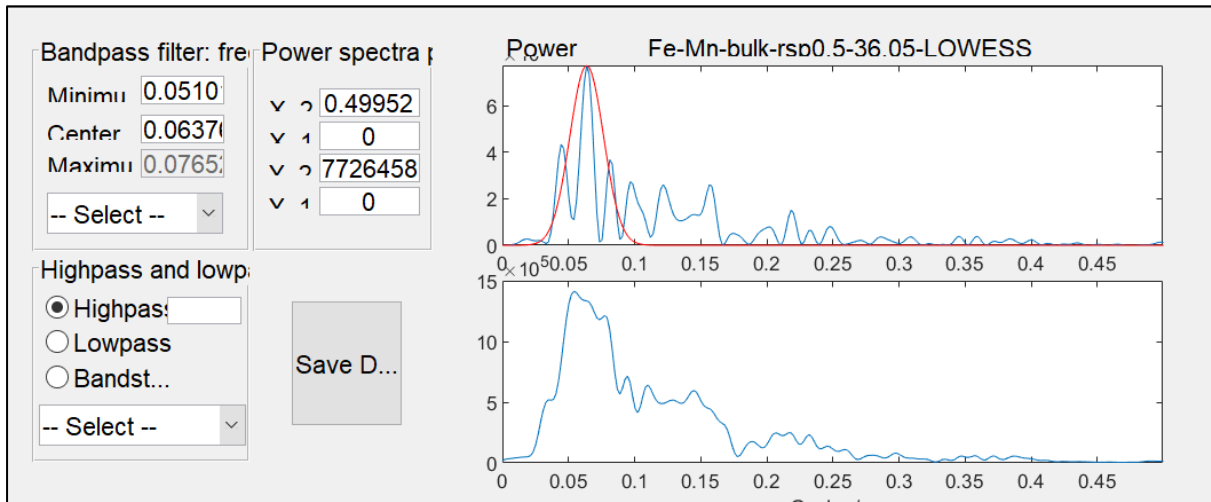
B6b



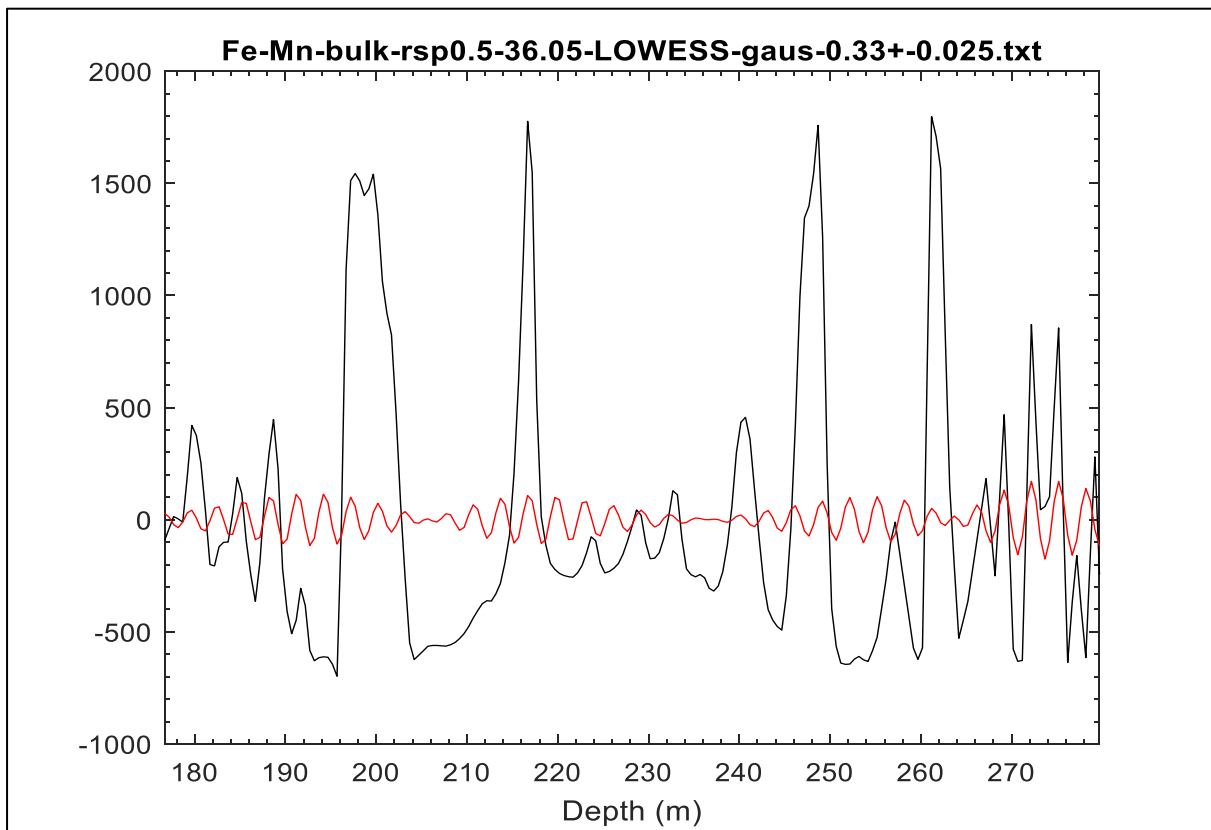
Appendix C: Bandpass filters

Appendix C1: Fe/Mn

C1a

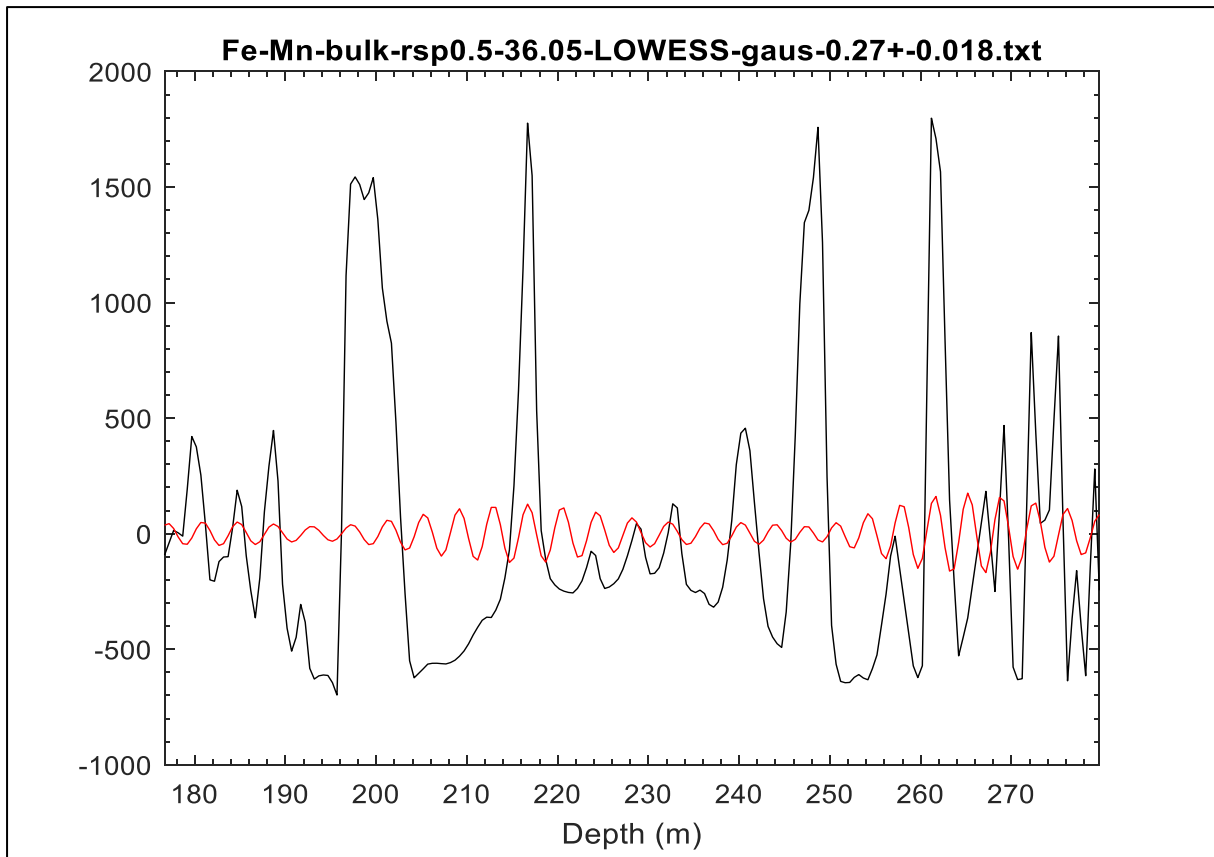


C1b: Fe/Mn ~3.0m filter

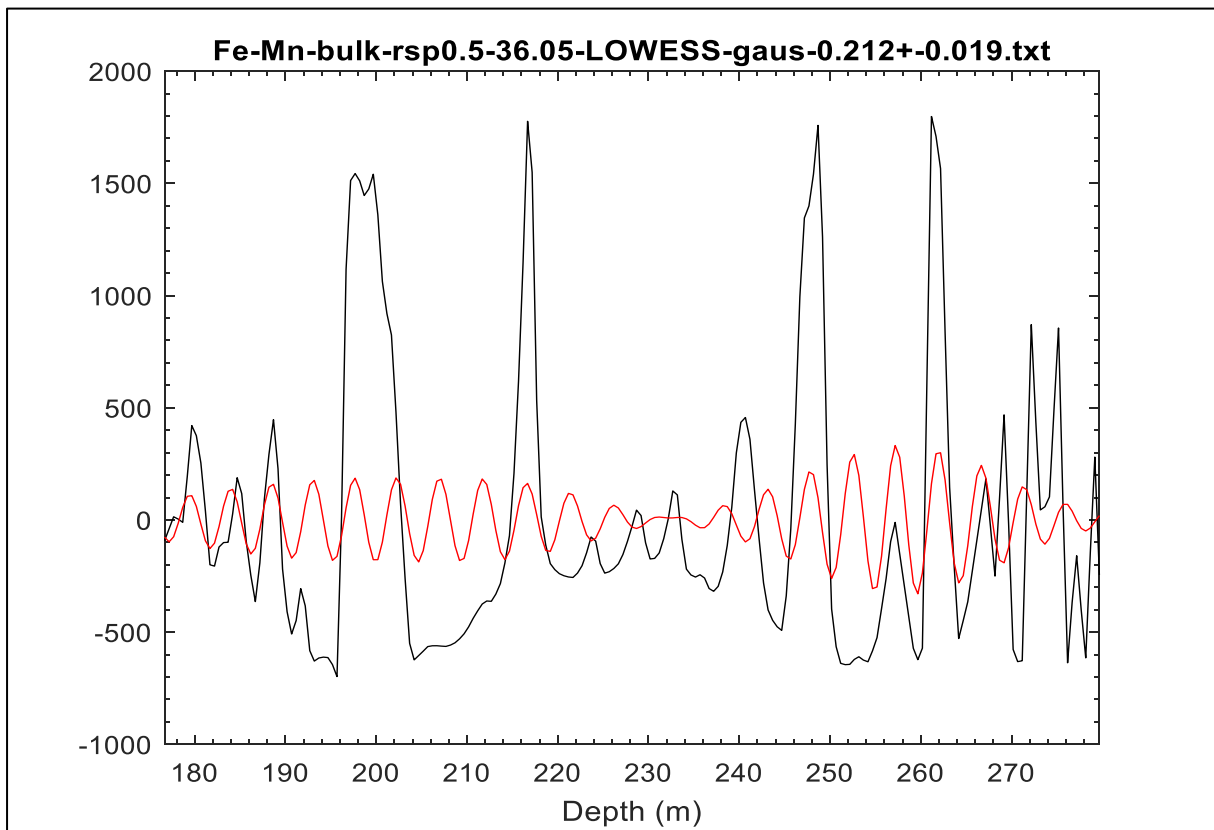


Appendix

C1c: Fe/Mn ~3.7m filter

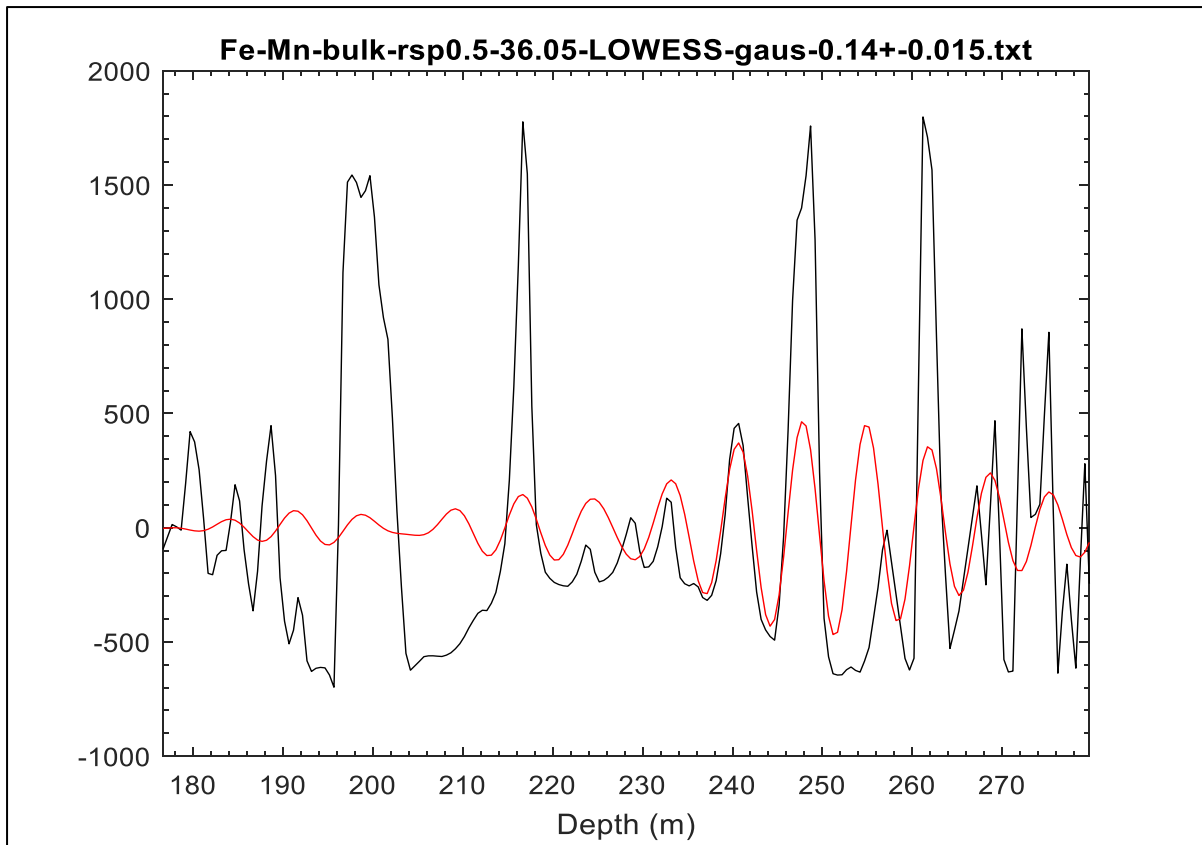


C1d : Fe/Mn ~4.7m filter

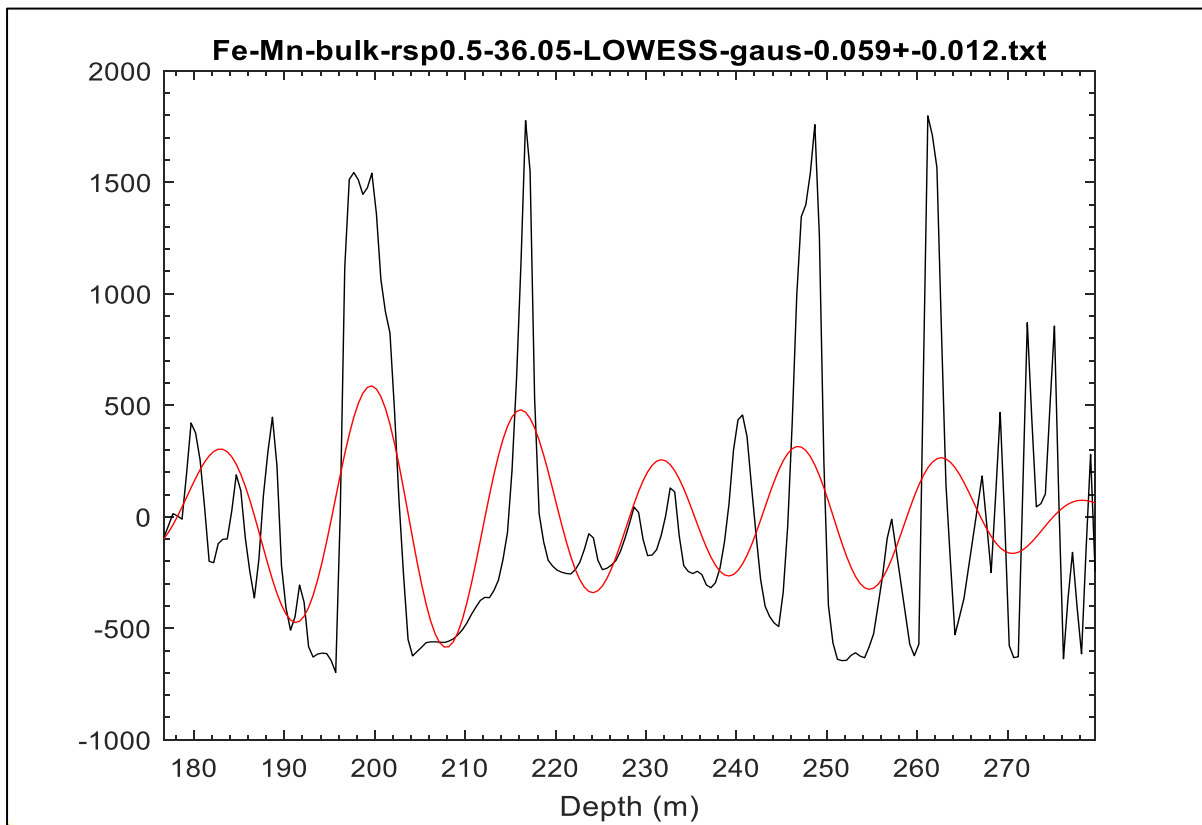


Appendix

C1e: Fe/Mn ~7.1m filter

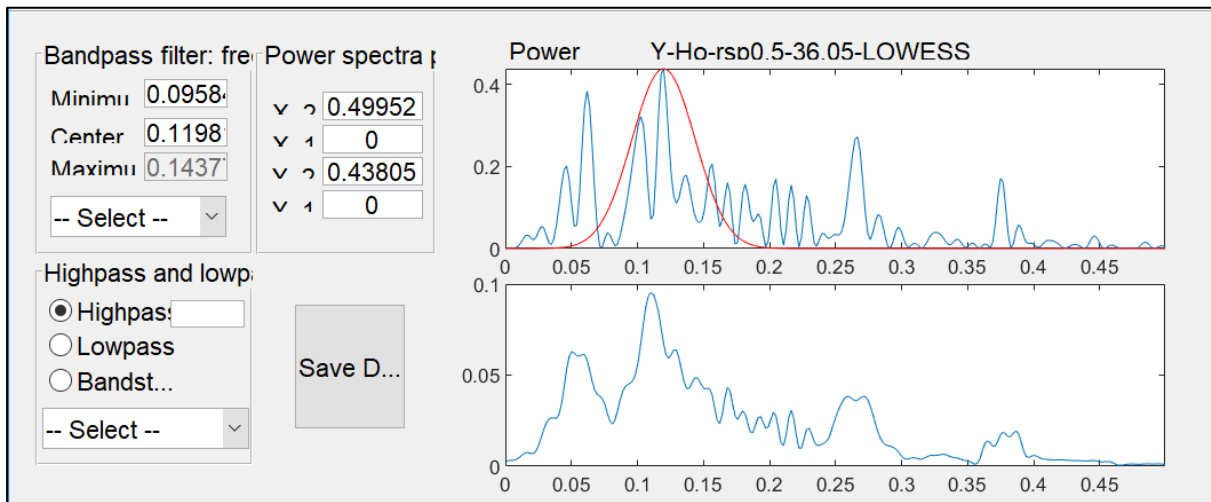


C1f: Fe/Mn ~16.9m filter

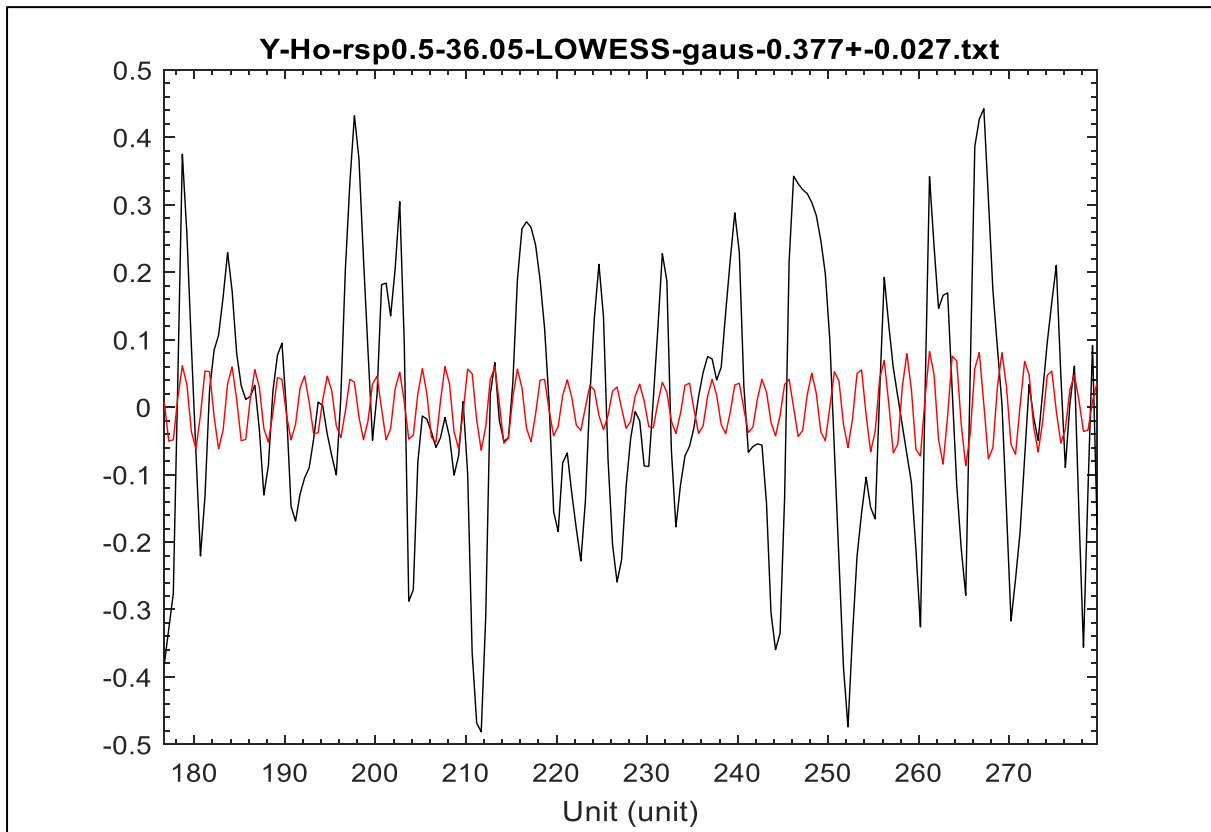


Appendix C2: Y/Ho

C2a:

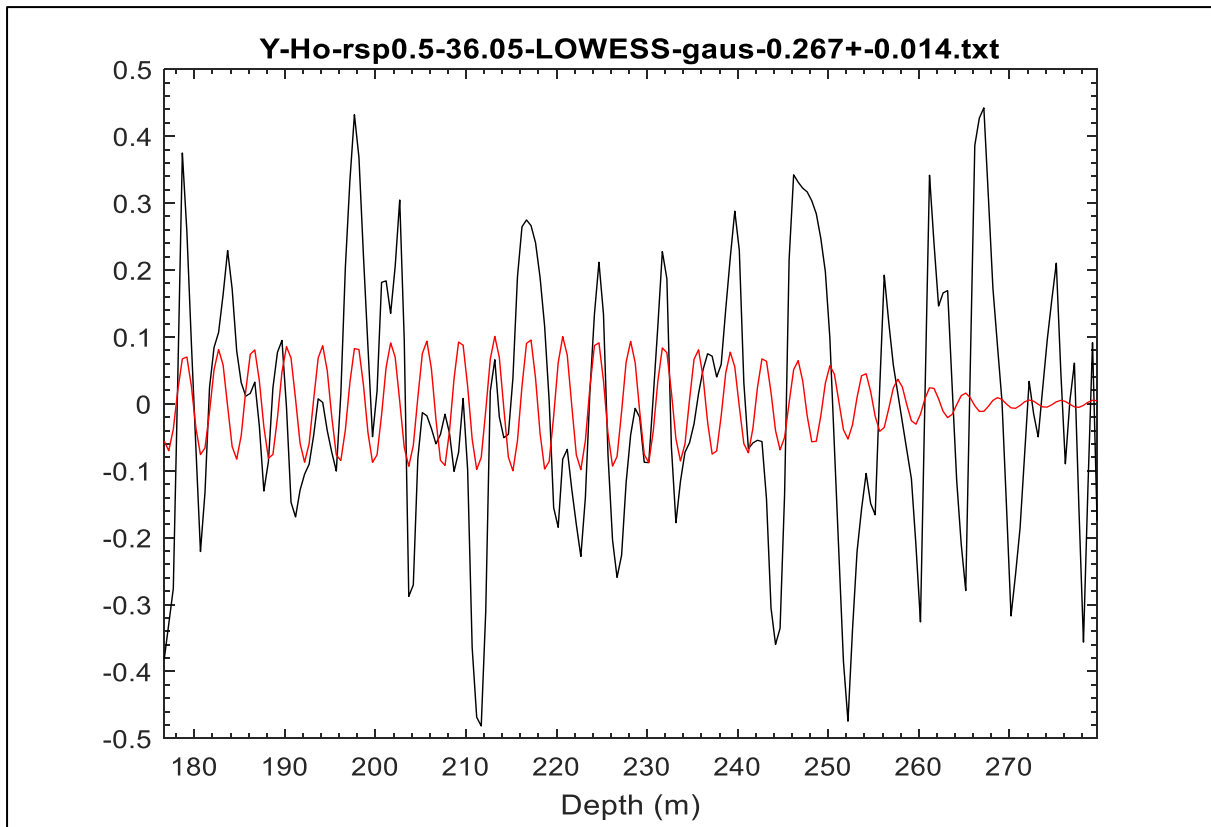


C2b: Y/Ho ~2.7m filter

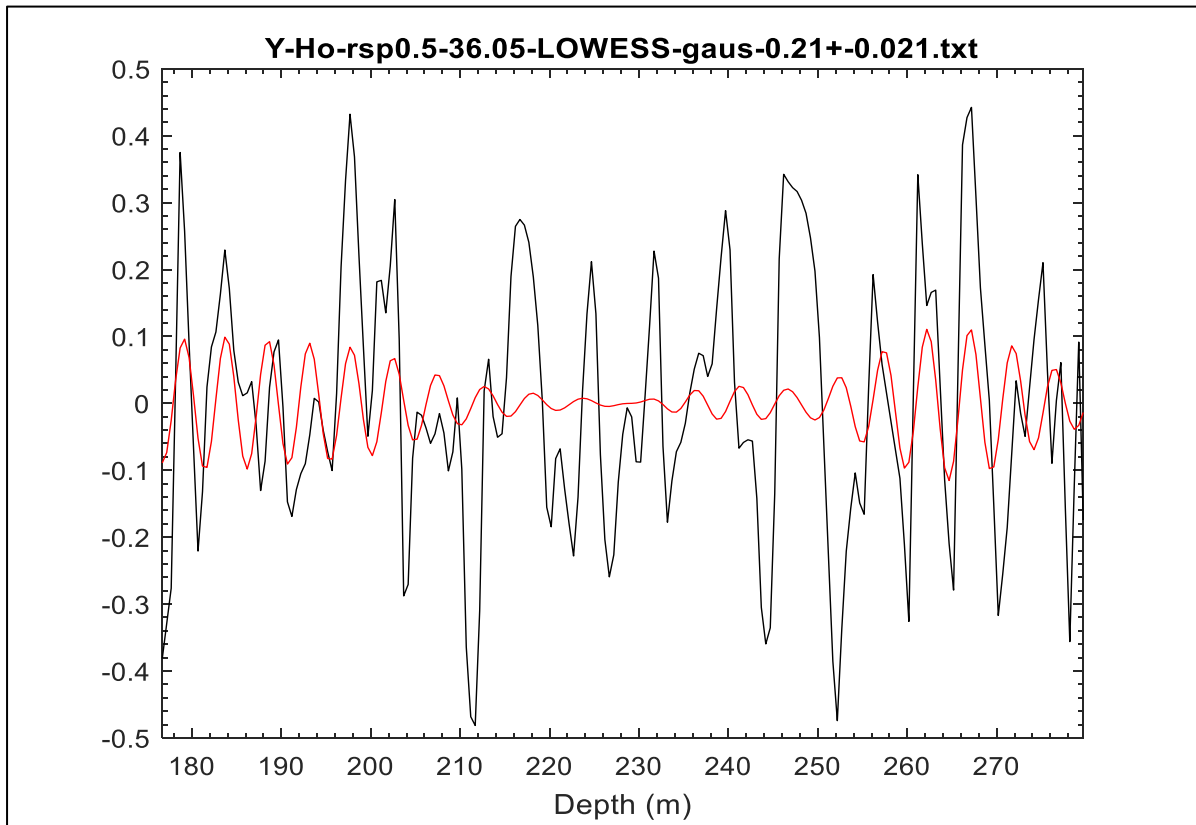


Appendix

C2c: Y/Ho ~3.7m filter

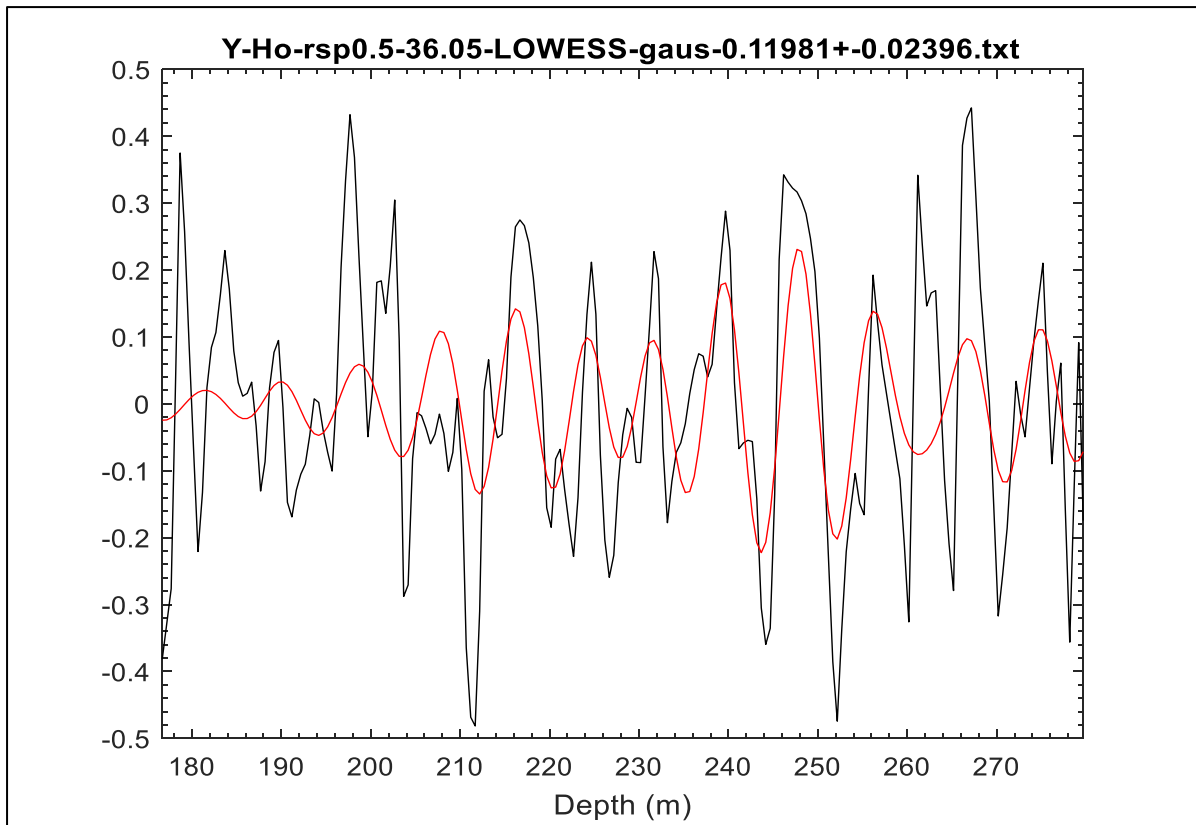


C2d: Y/Ho ~4.8m filter

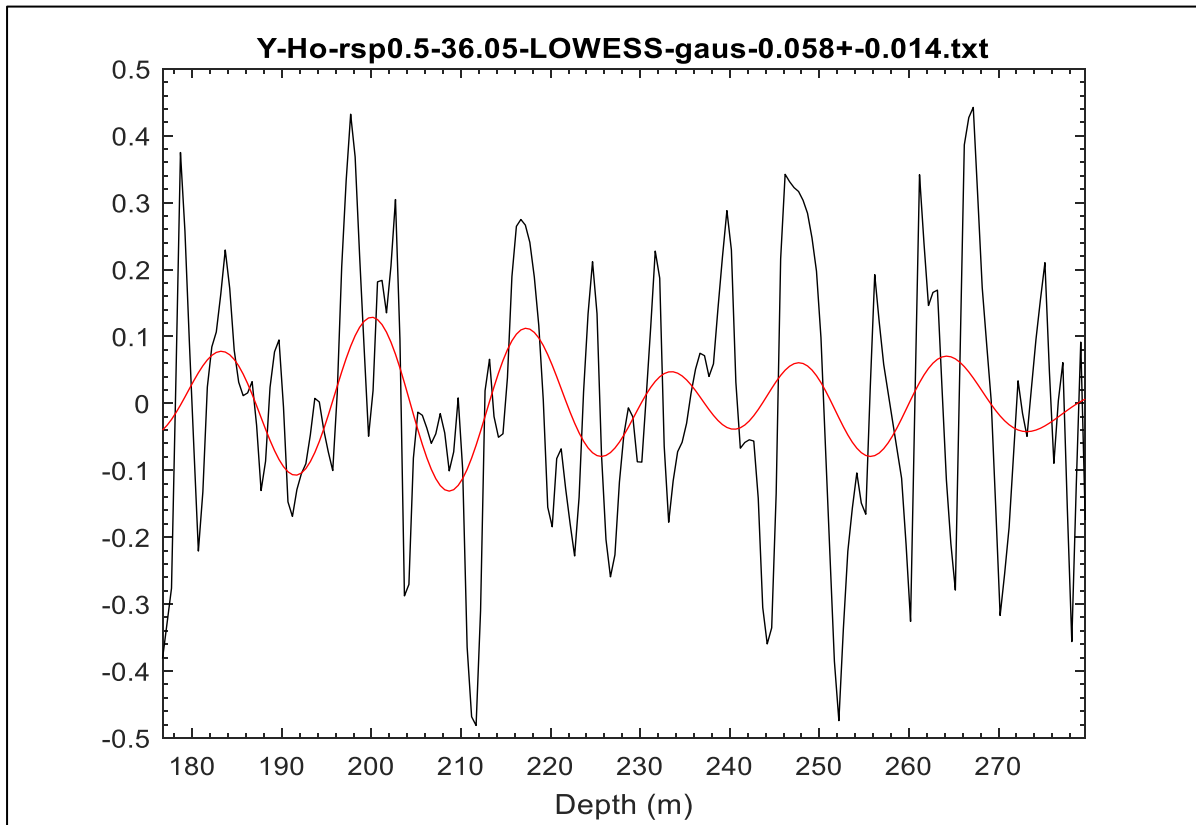


Appendix

C2e: Y/Ho ~8.3m filter



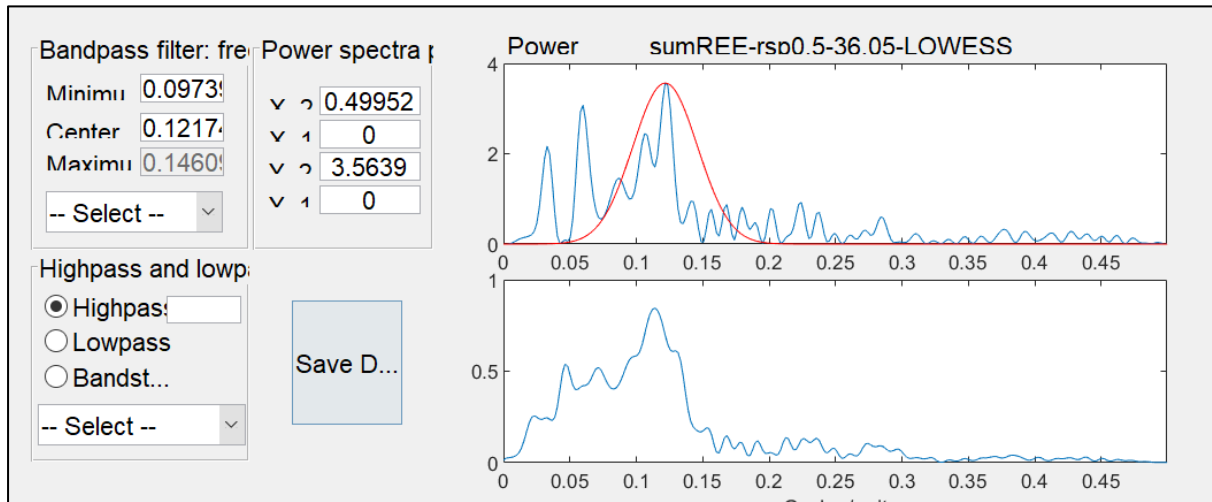
C2f: Y/Ho ~17.2 filter



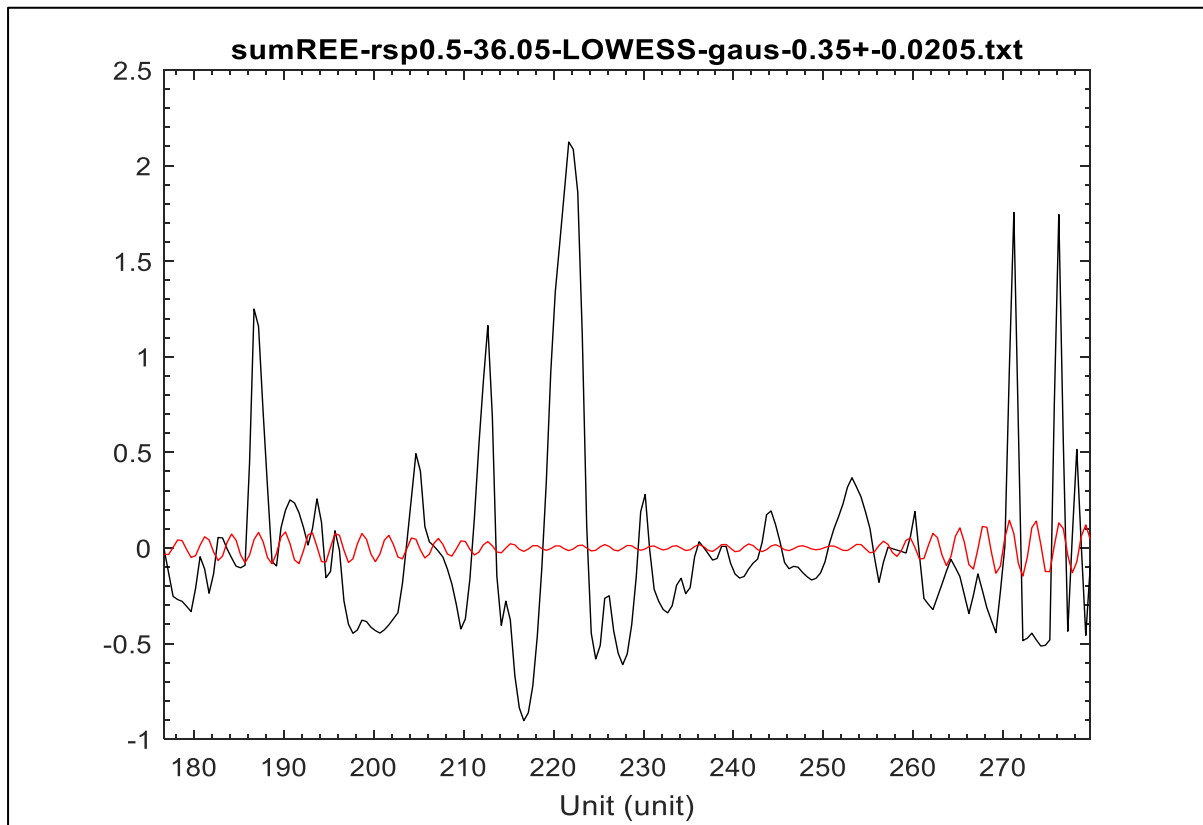
Appendix C3: sumREE

The filters are generally weak throughout the entire profile, with the ~5.1m and ~8.2m being the exceptions. The ~8.2m in particular captures the variability throughout the full stratigraphy the best, with ~5.1m being better in the upper and lower stratigraphic parts. The smaller ~2.9 and ~3.6m while less significant reflect this pattern, with the ~3.6m being better throughout and the ~2.9m capturing the small-scale variability the best in the upper and lower stratigraphic parts.

C3a

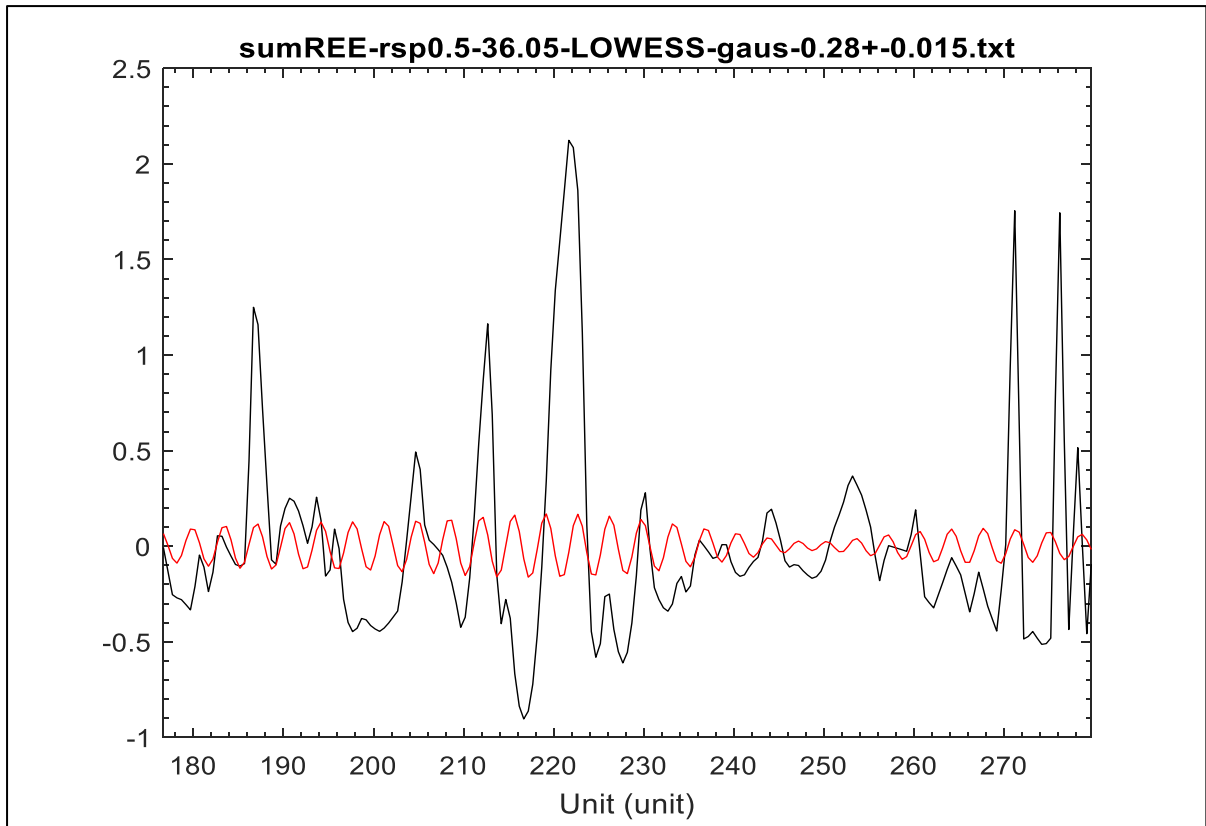


C3b: sumREE ~2.9m filter

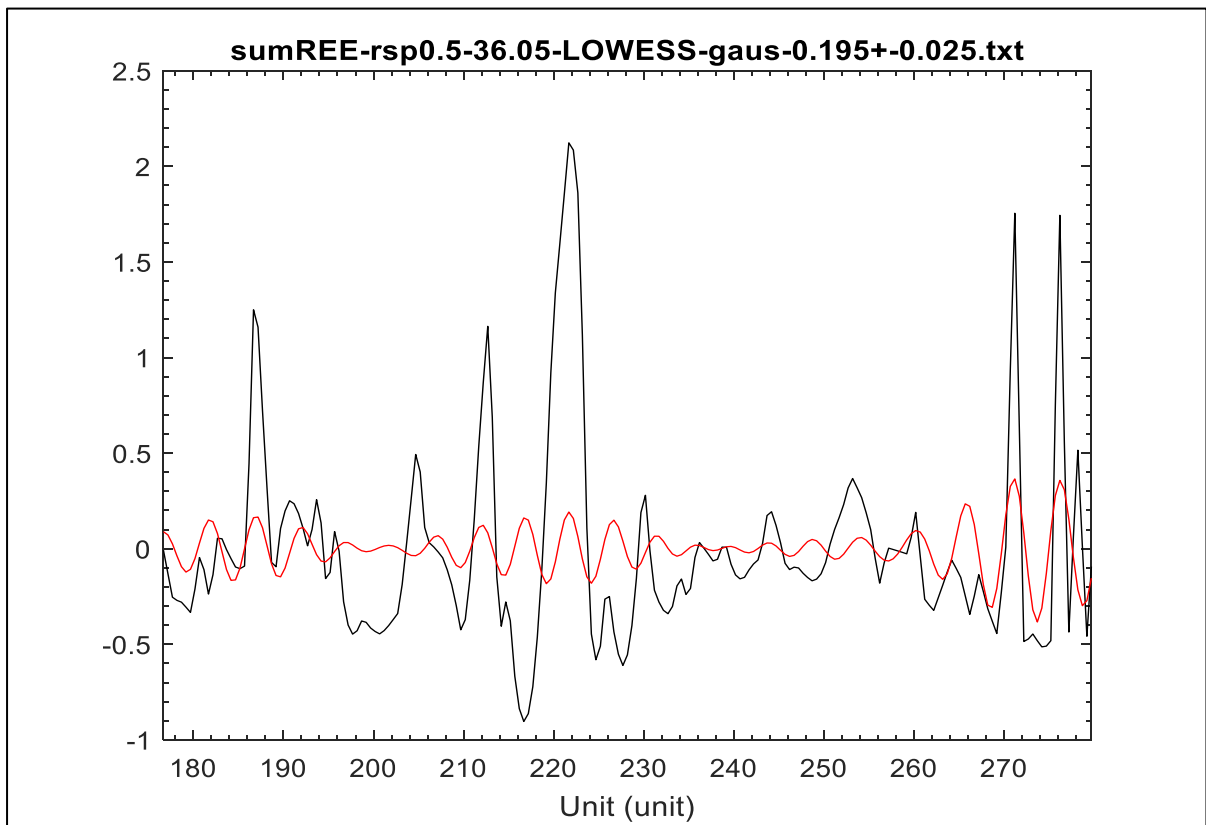


Appendix

C3c: sumREE $\sim 3.6m$ filter

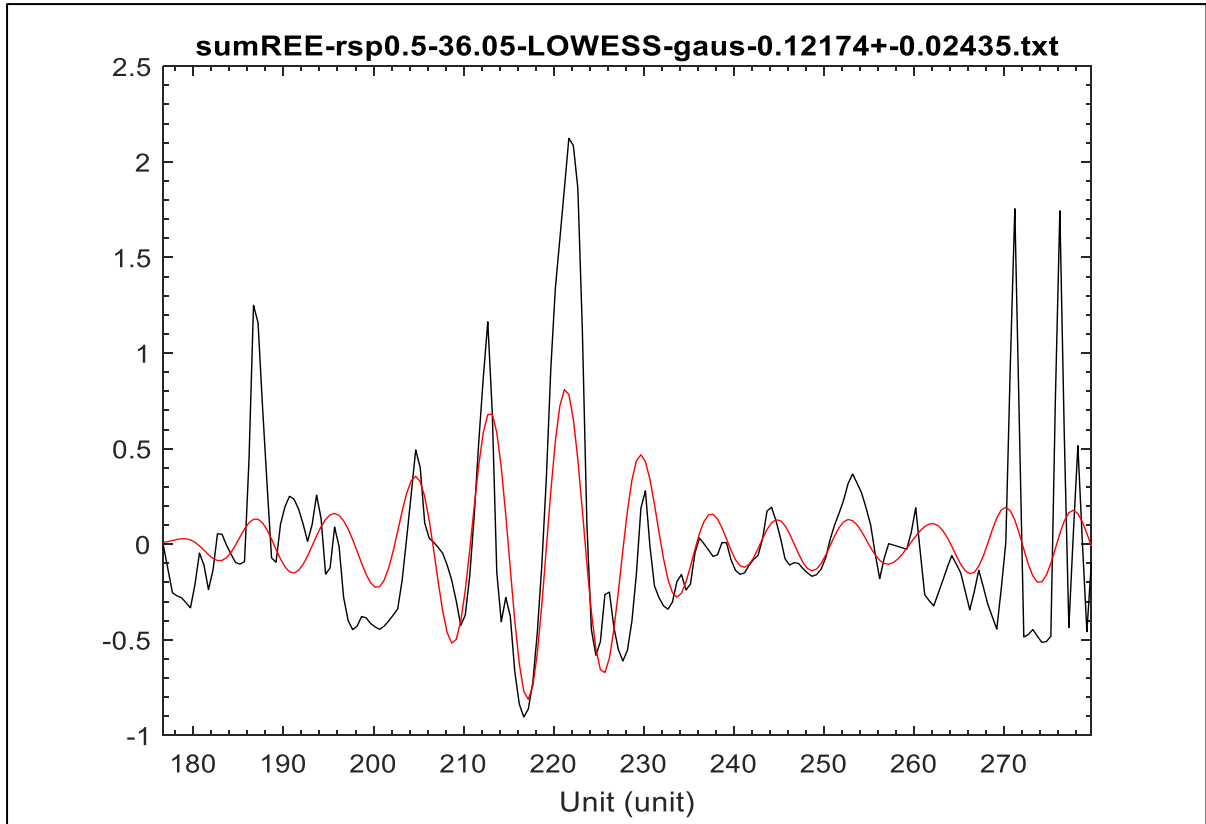


C3d: sumREE $\sim 5.1m$ filter

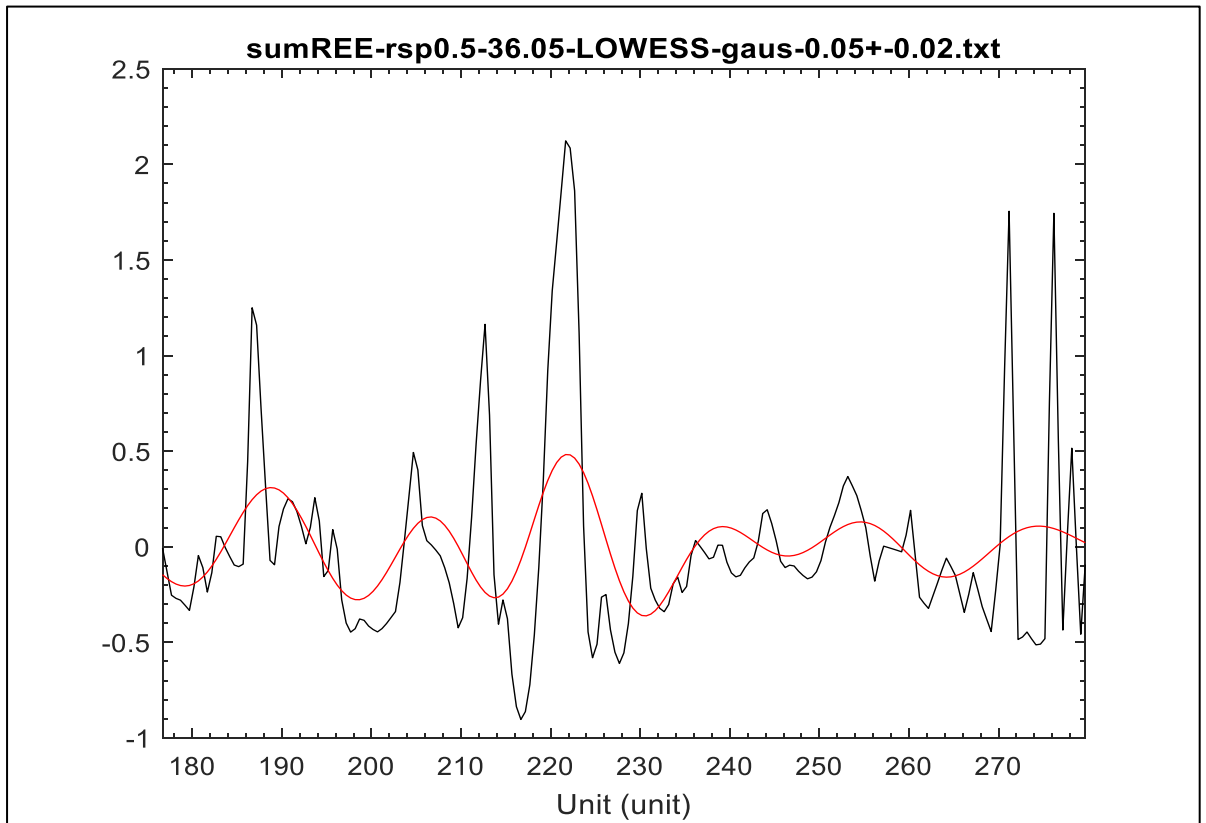


Appendix

C3e: sumREE ~8.2m filter



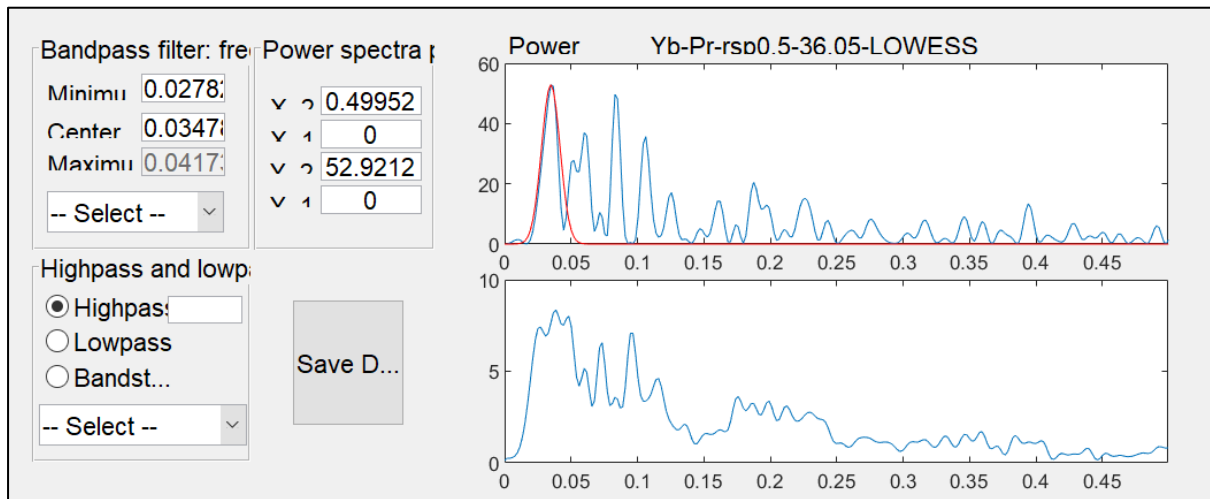
C3f: sumREE ~20.0m filter



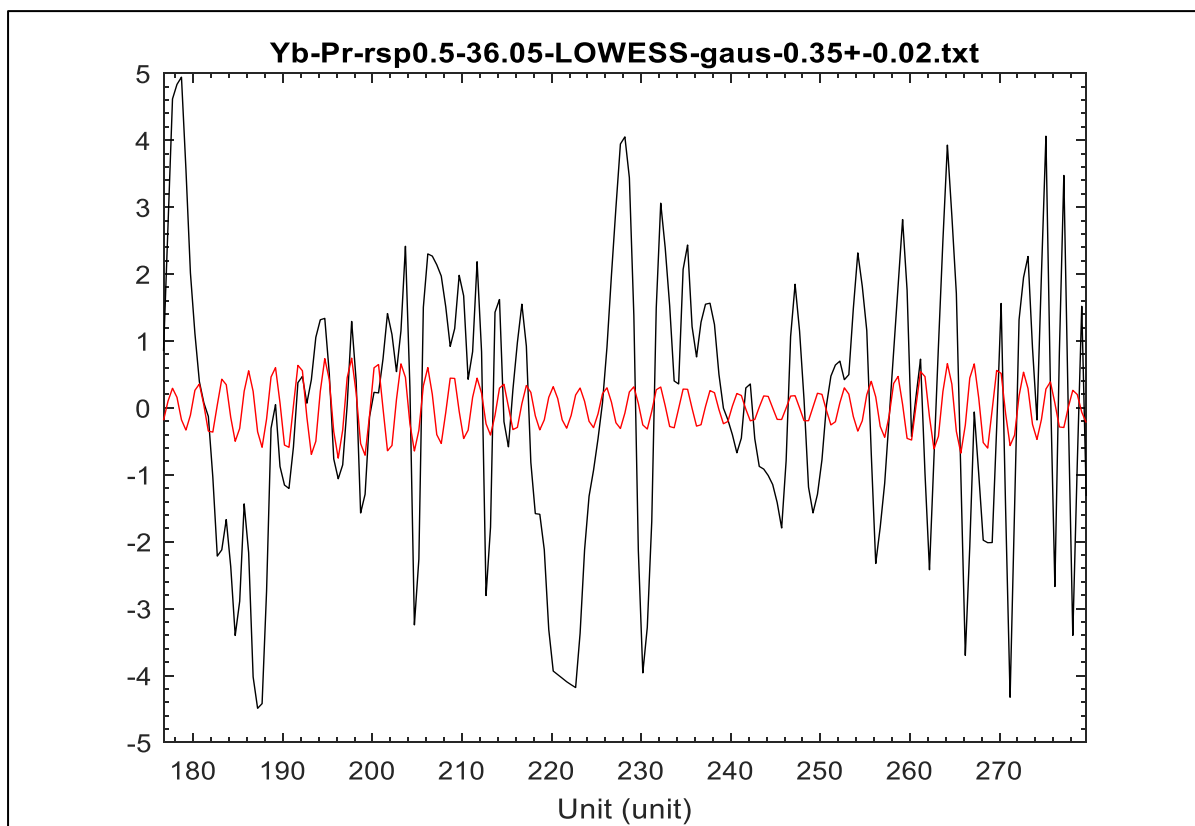
Appendix C4: Yb/Pr

The ~2.9m filter is the best fit in the upper and lower parts of the stratigraphy. The ~4.0m filter is a strong fit in the lower stratigraphy and to a lesser extent in the rest. The larger bands are best captured by the ~8.9m filter. The ~21.3m cycle is pronounced throughout and is strongest in the middle stratigraphy.

C4a

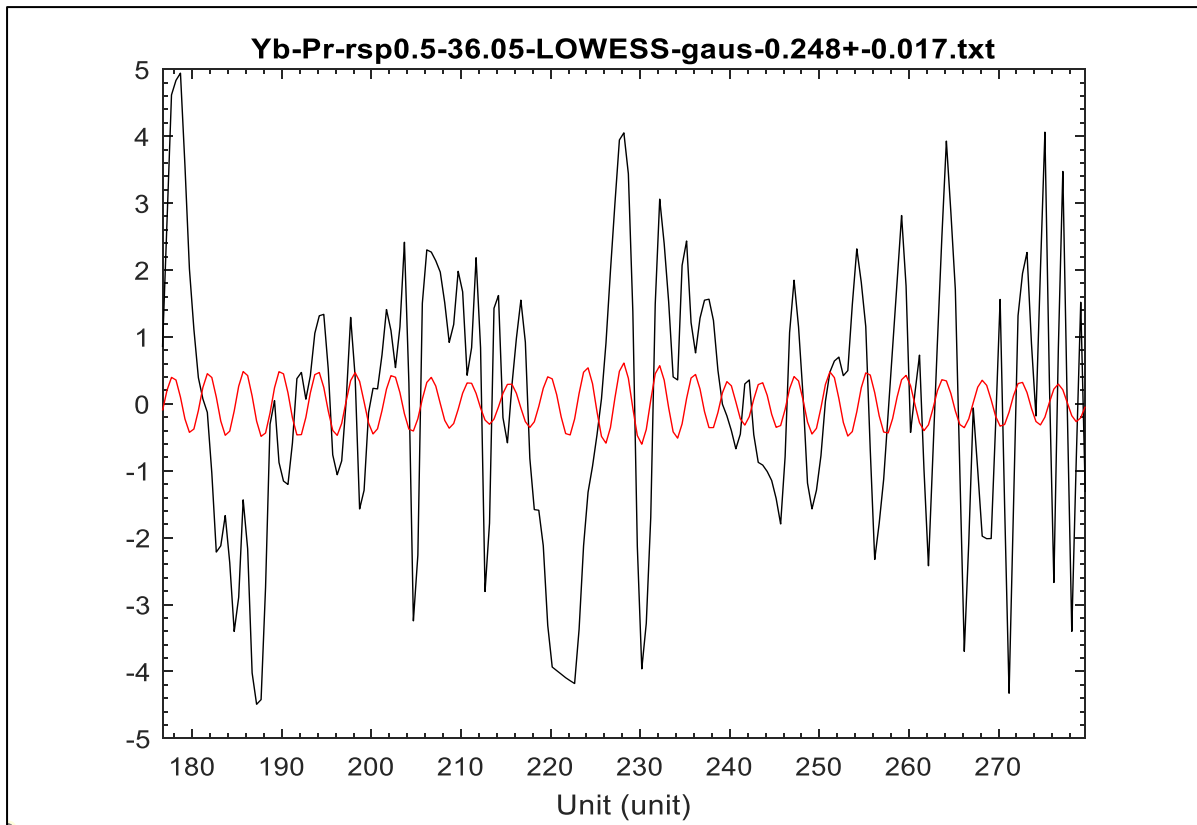


C4b: Yb/Pr ~2.9m filter

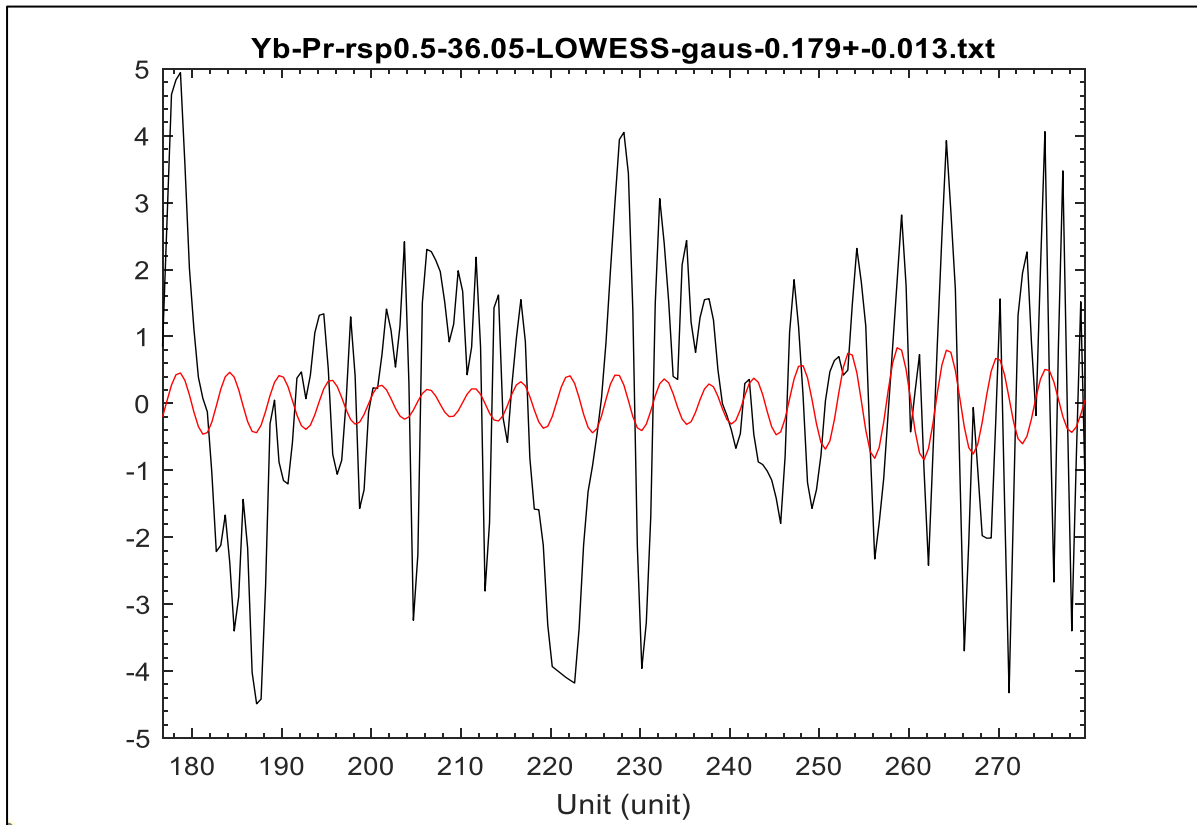


Appendix

C4c: Yb/Pr \sim 4.0m filter

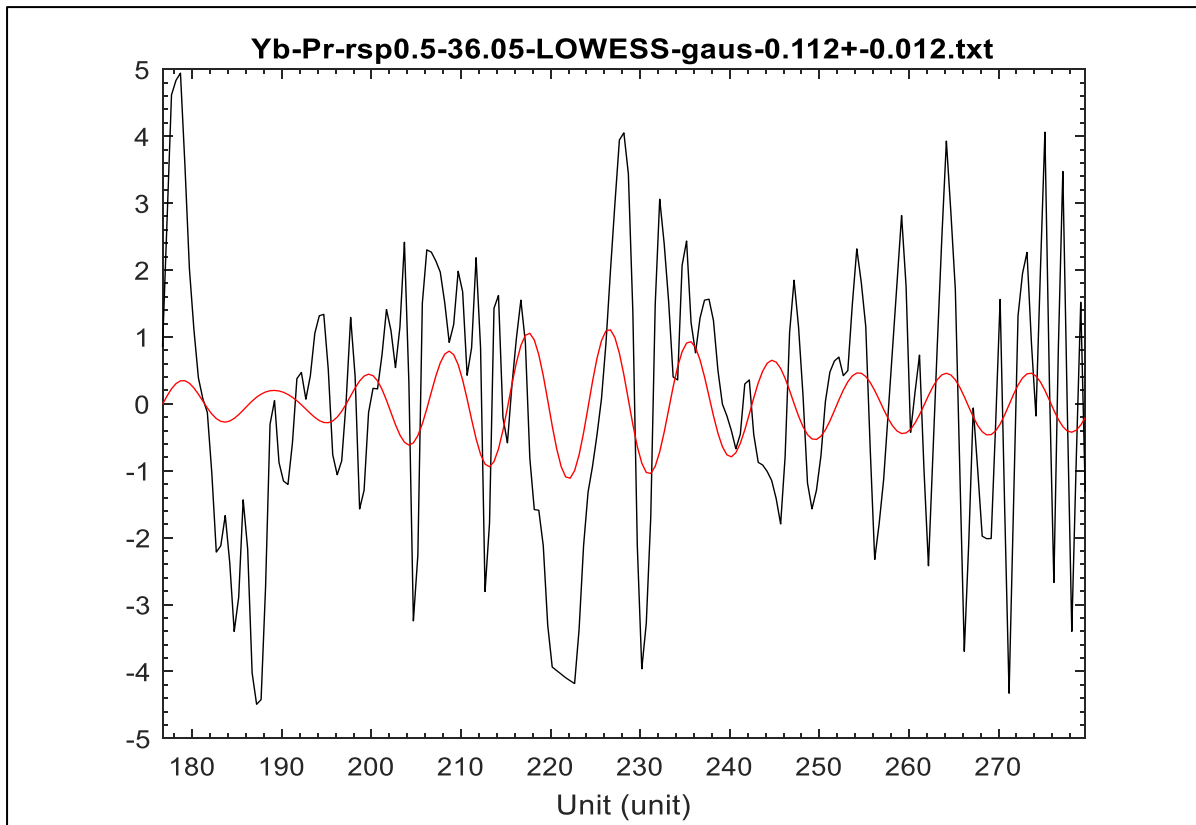


C4d: Yb/Pr \sim 5.6m filter

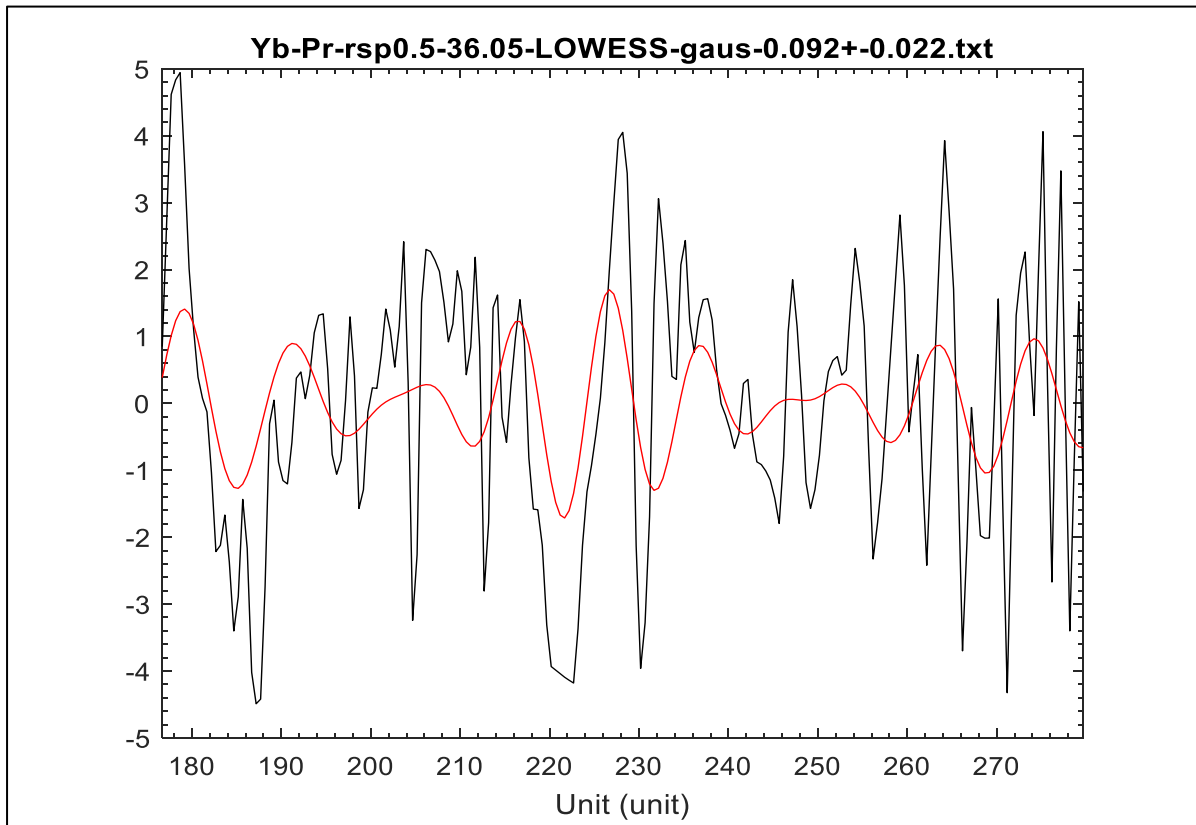


Appendix

C4e: Yb/Pr \sim 8.9m filter

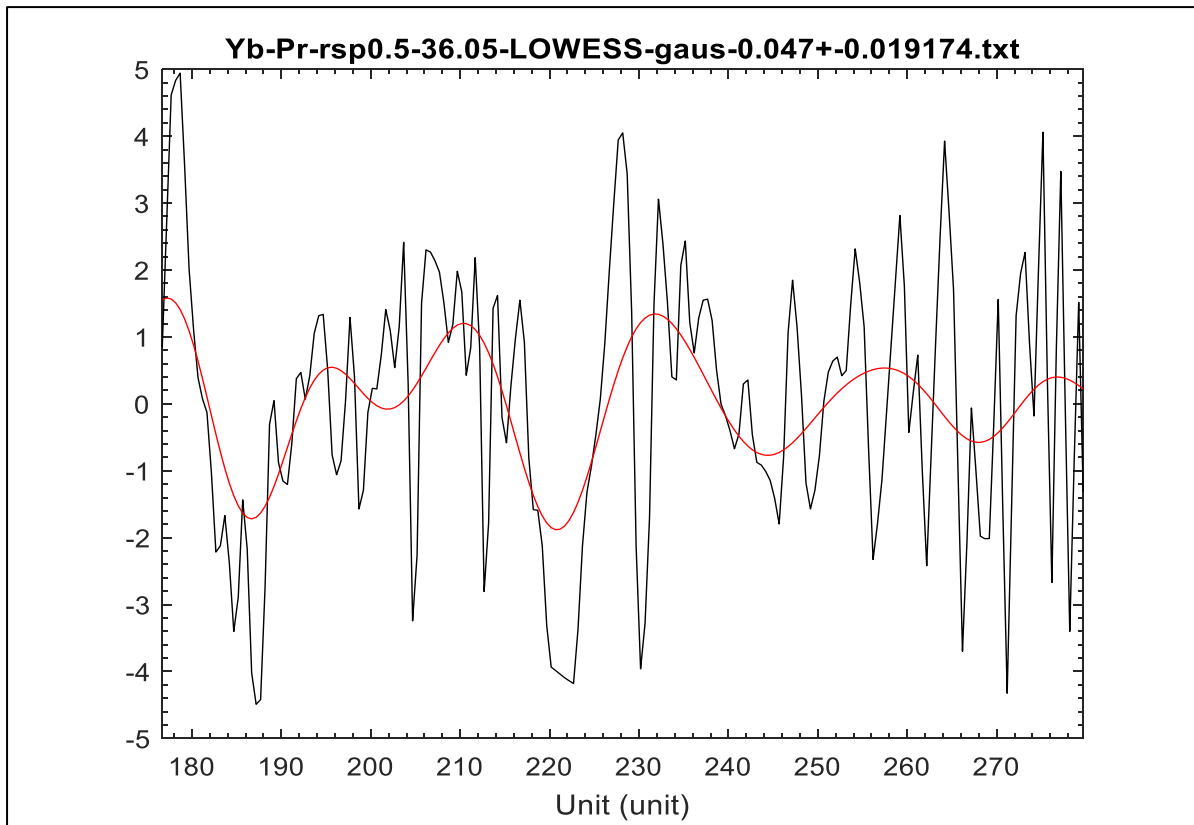


C4f: Yb/Pr \sim 10.9m filter



Appendix

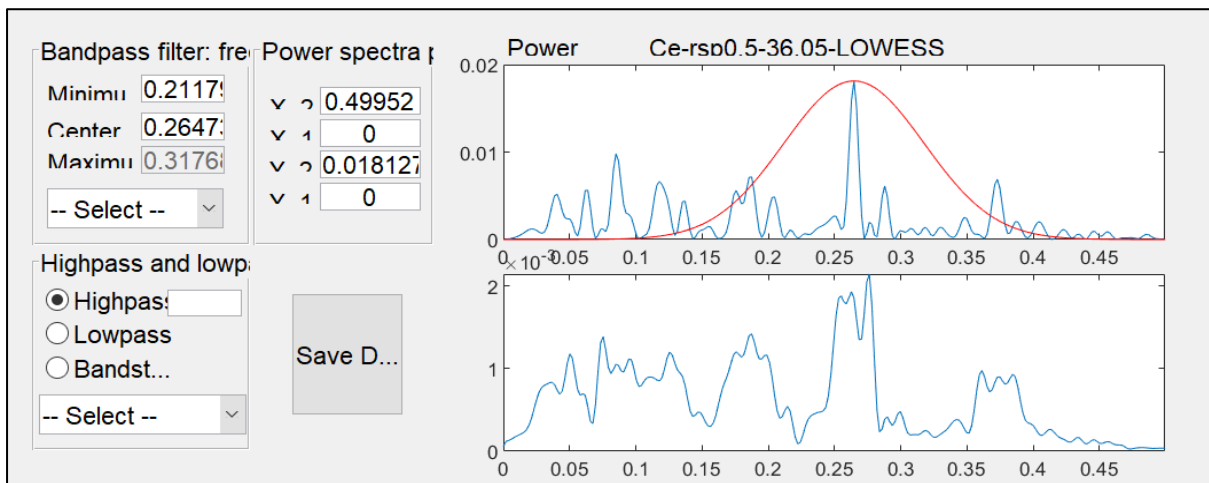
C4g: Yb/Pr ~21.3m filter



Appendix C5: Ce

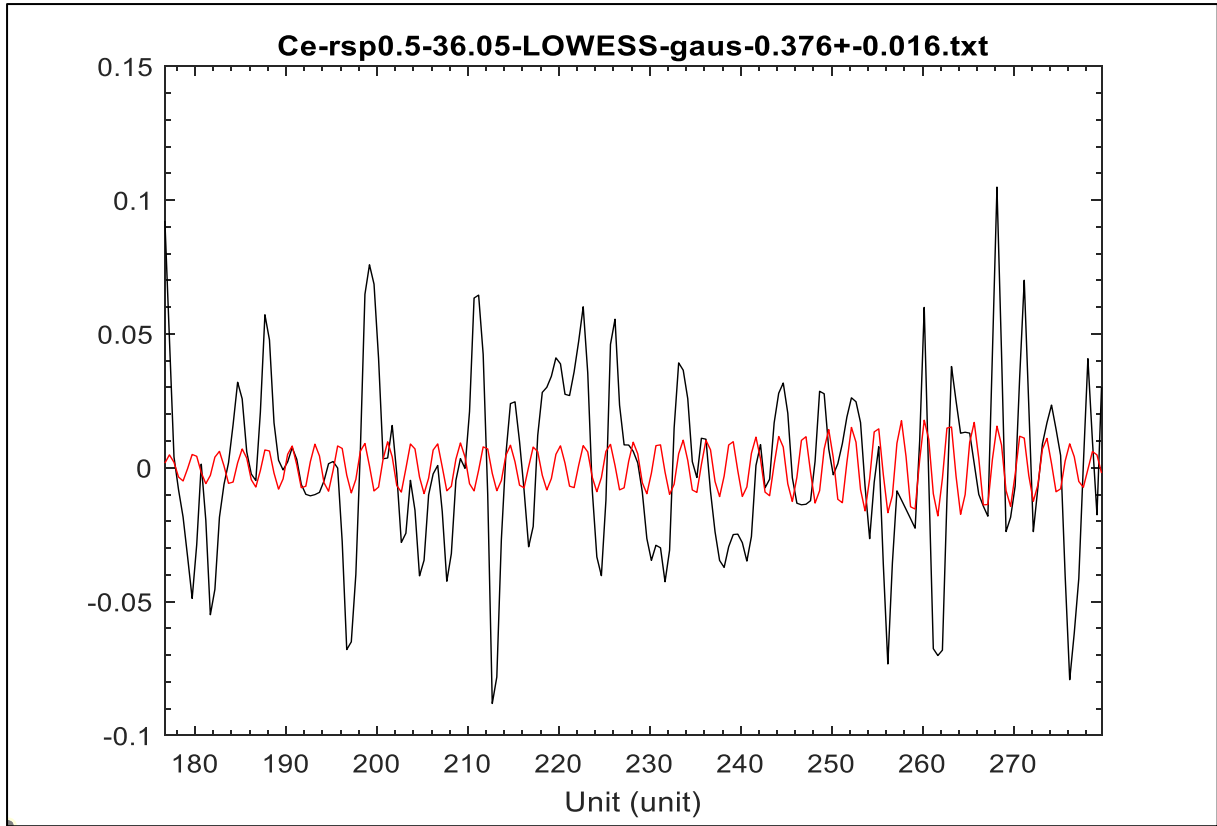
The smallest peaks throughout are well captured by a combination of the ~2.7m and ~3.8m filters, with the ~2.7m filter being particularly strong in the lower stratigraphy. The intermediate cycles (~5.3m and ~8.0m) are a good fit throughout, with the ~8.0m being a better fit in the middle stratigraphy. The ~19.8m cycle is very weak, displaying significant cycles only in the lower stratigraphy.

C5a

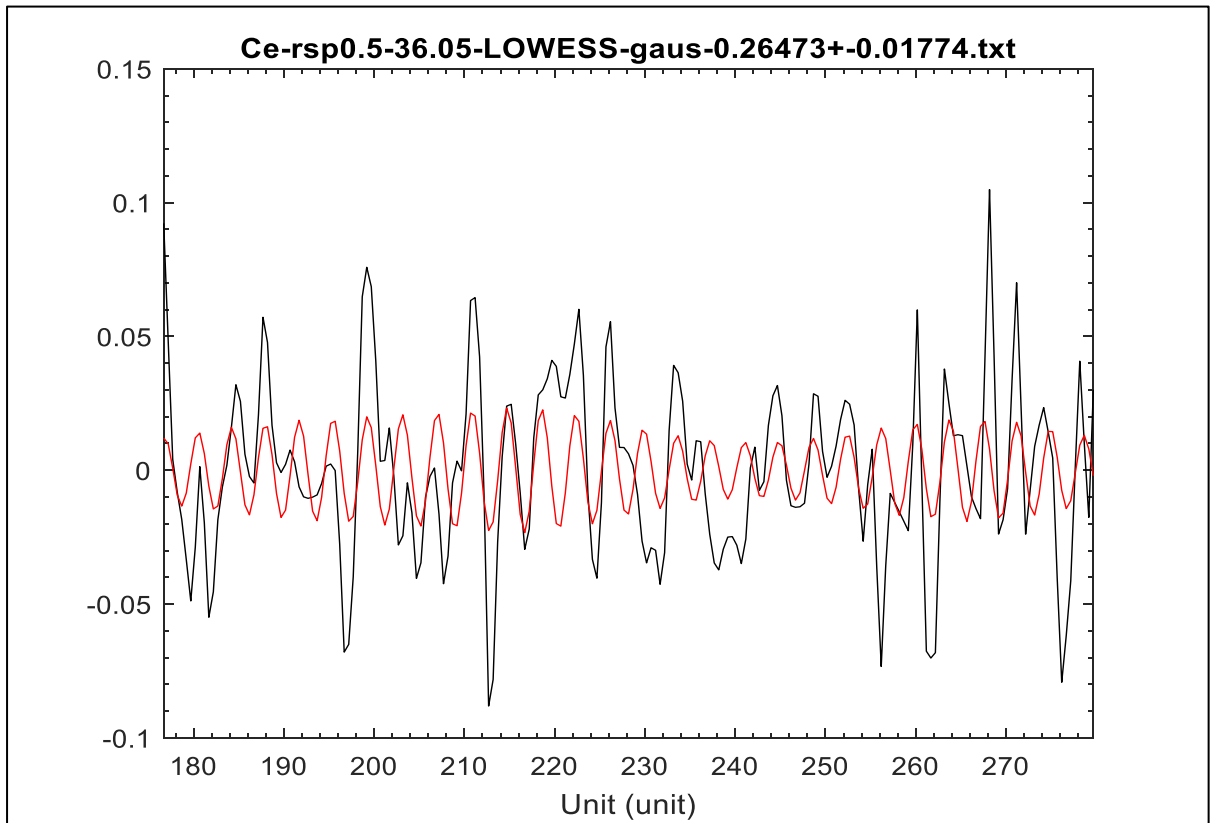


Appendix

C5b: Ce ~2.7m filter

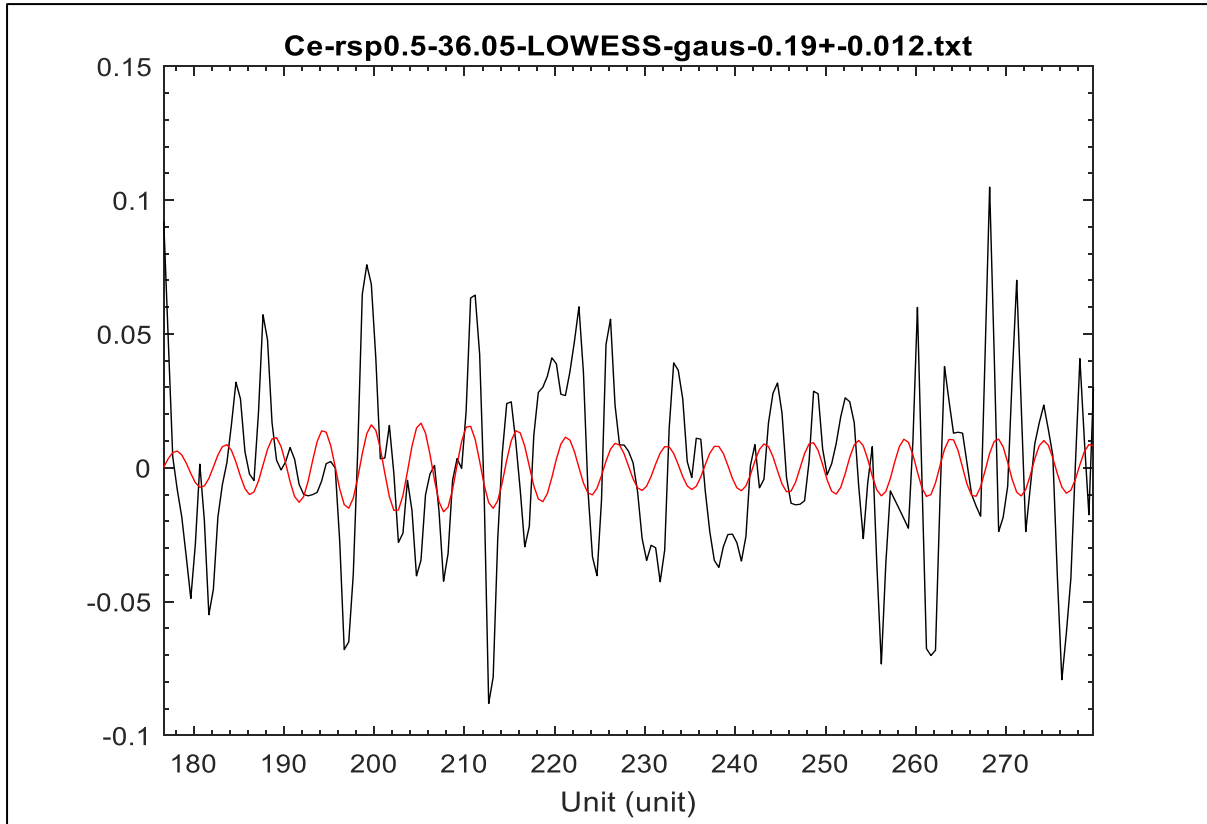


C5c: Ce ~3.8m filter

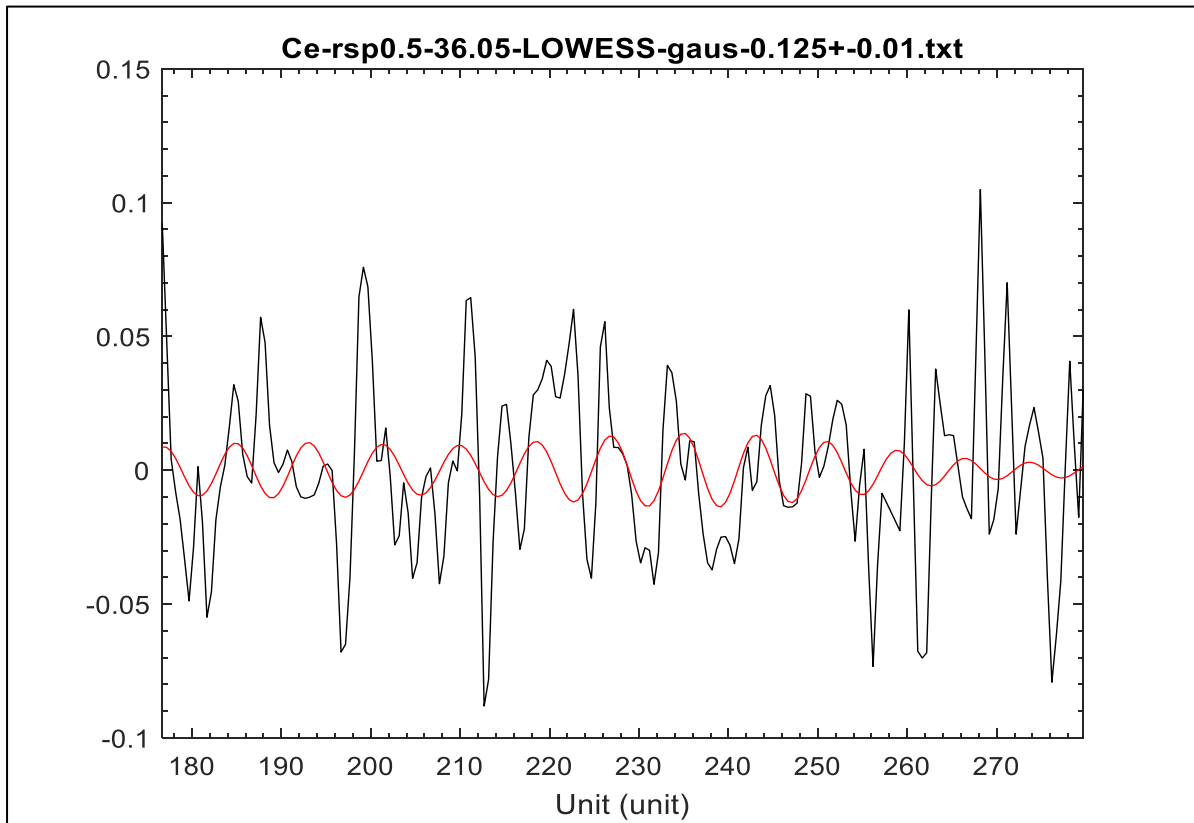


Appendix

C6d: Ce ~5.3m filter

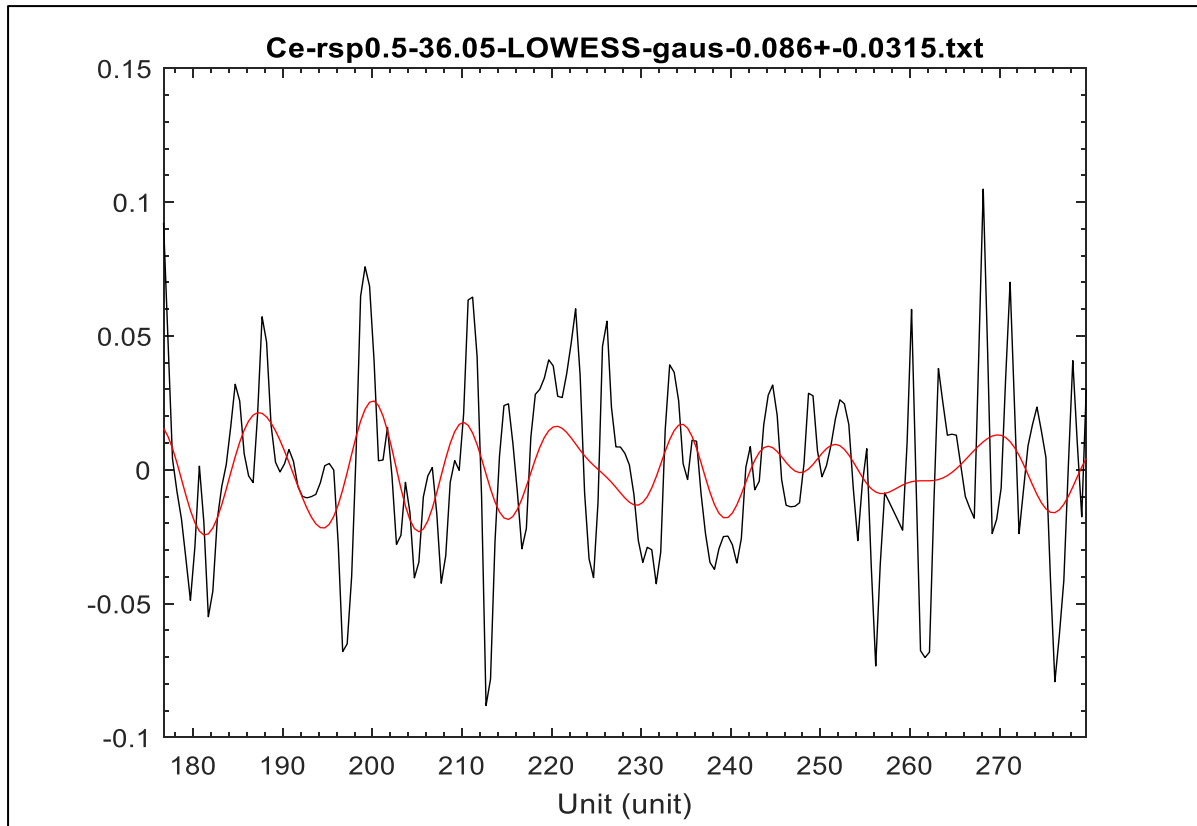


C5e: Ce ~8.0m filter

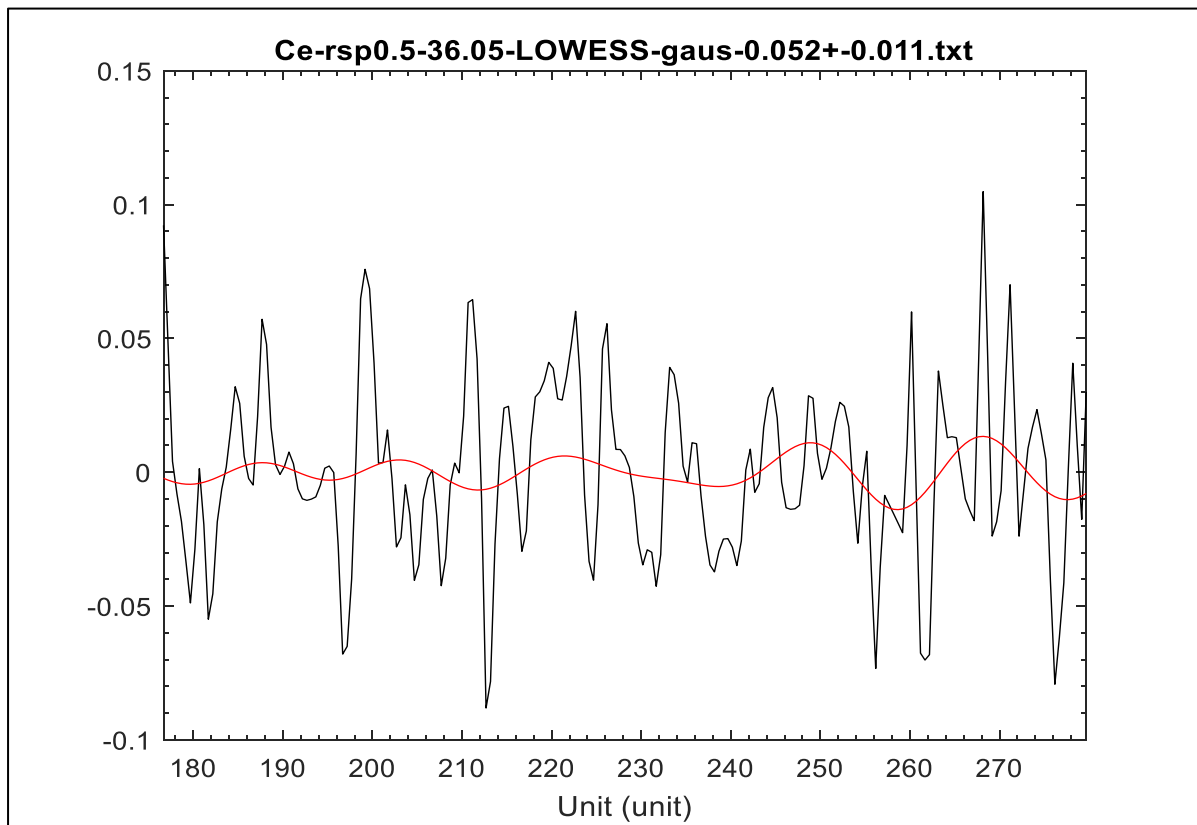


Appendix

C5f: Ce ~11.6m filter



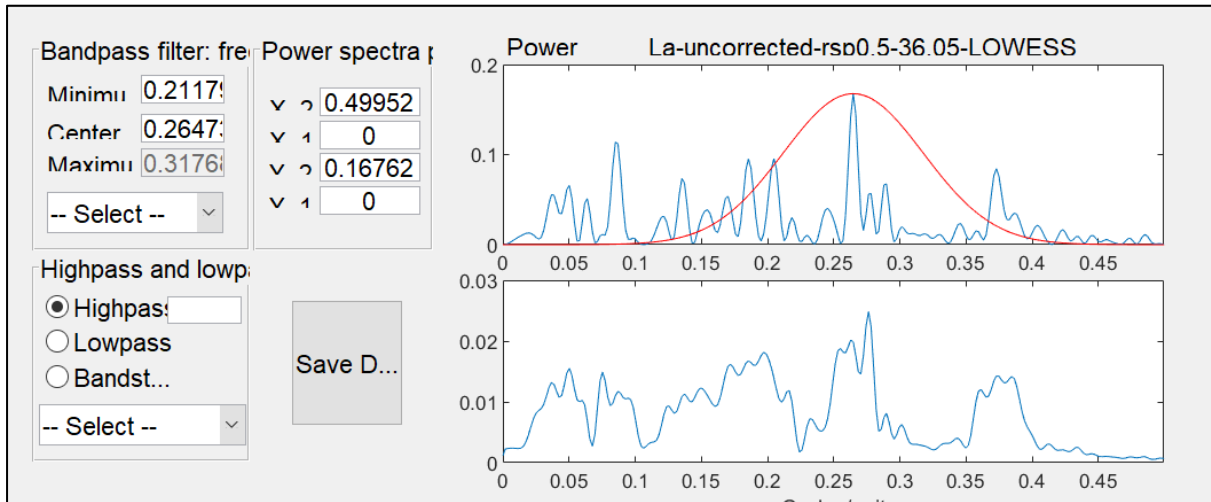
C5g: Ce ~19.6m filter



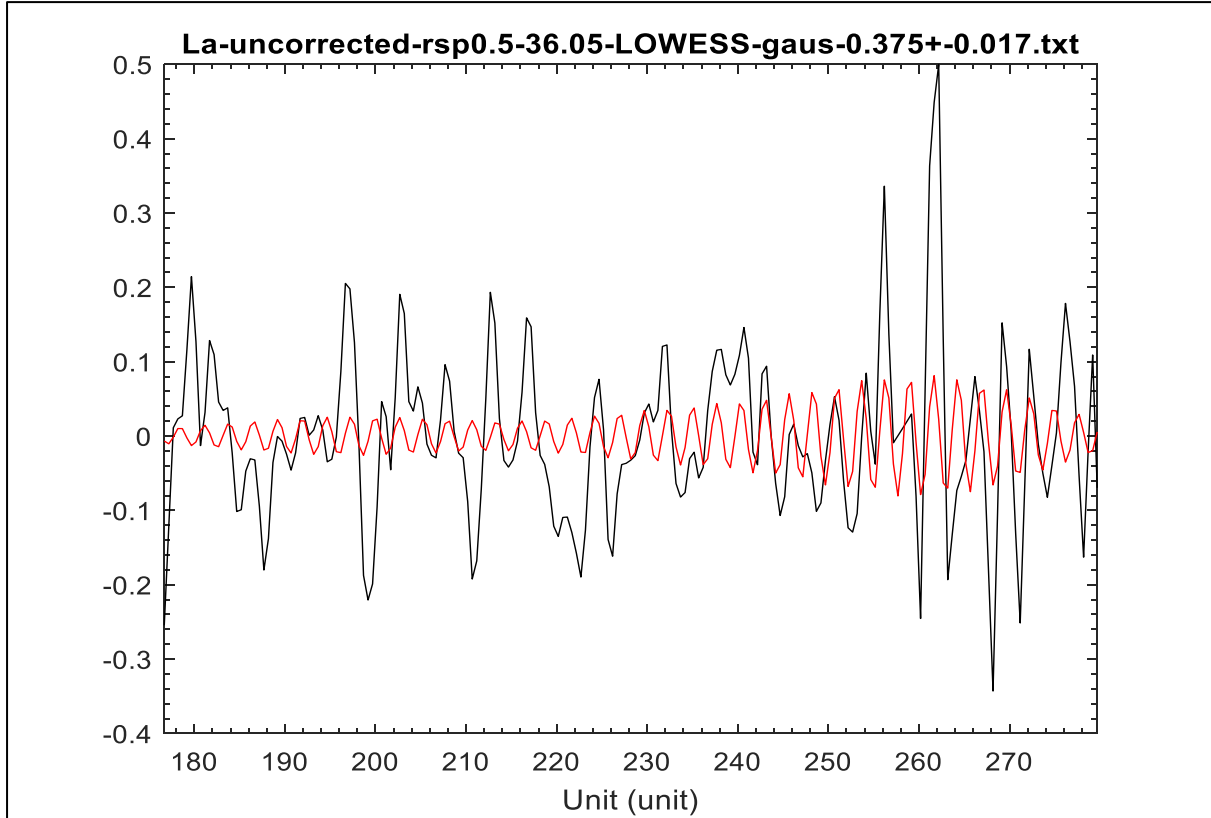
Appendix C6: La

The ~2.7m and ~3.8m capture the small peaks throughout entirely, with the ~2.7m filter being the strongest in the lower stratigraphy. The ~5.3m filter is strongest in the upper and lower stratigraphy, while the ~6.8m is best at capturing the bands in the middle stratigraphy. The ~20.0m cycle is weak throughout with the strongest signal being in the lower stratigraphy.

C6a

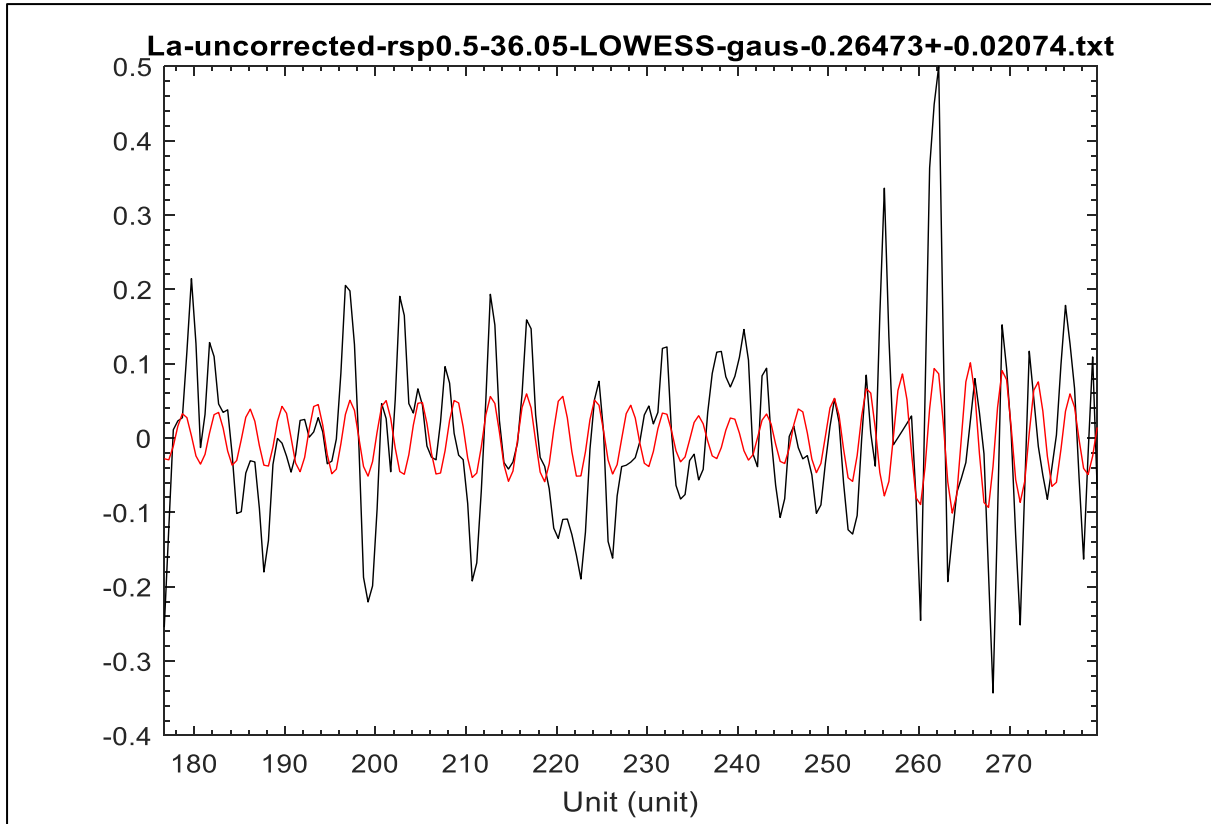


C6b: La ~2.7m filter

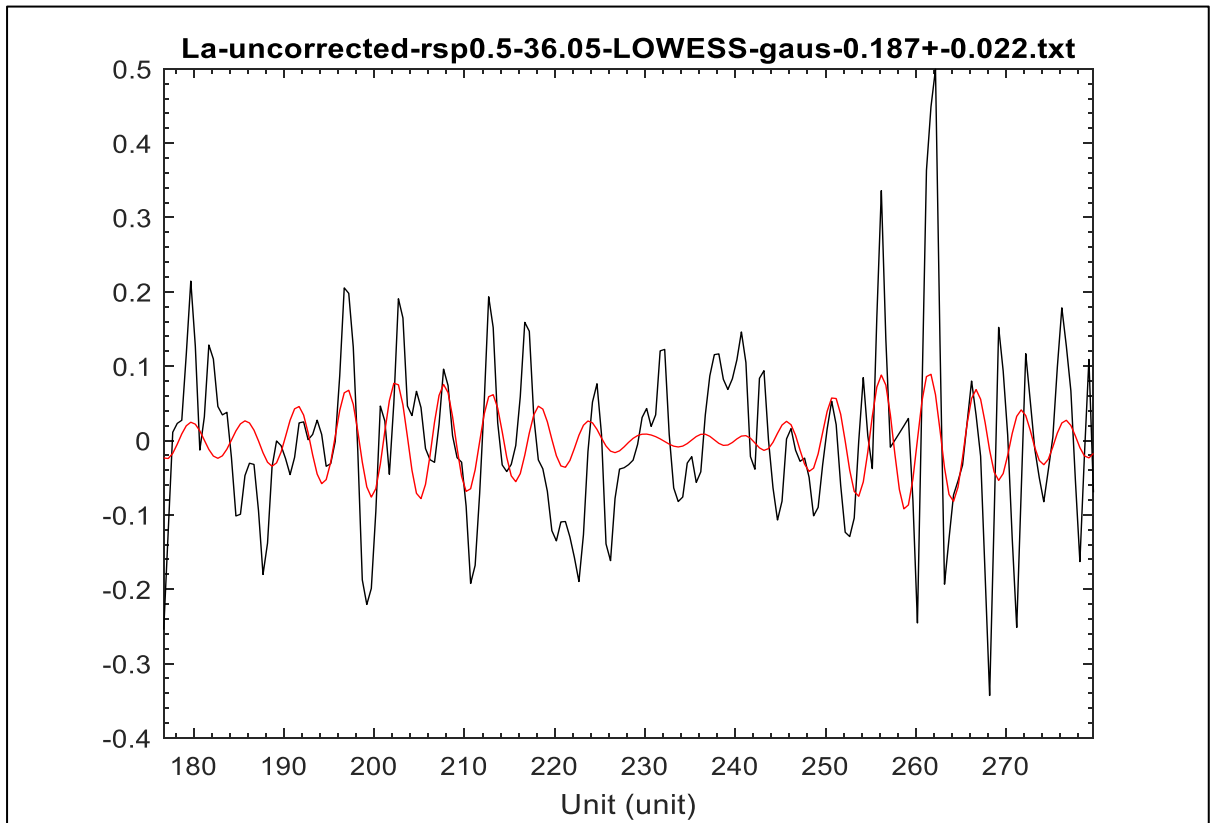


Appendix

C6c: La $\sim 3.8m$ filter

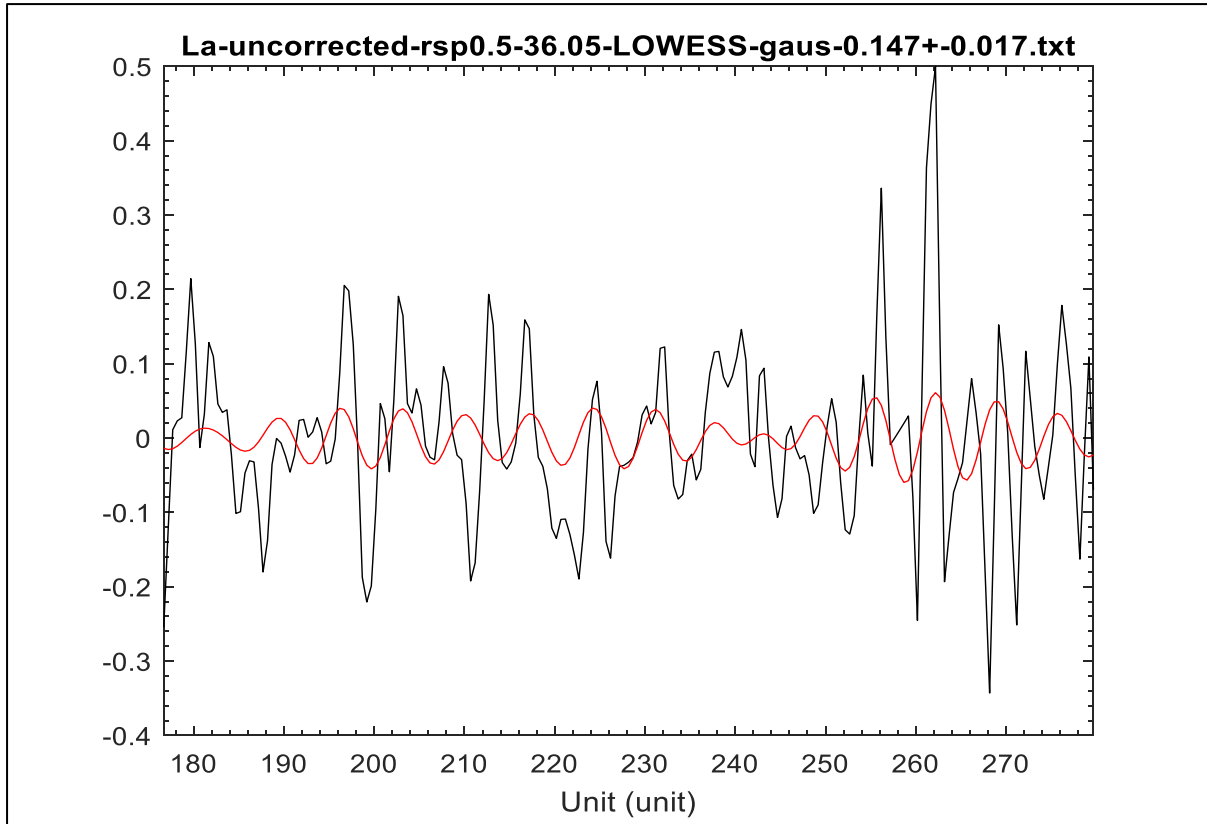


C6d: La $\sim 5.3m$ filter

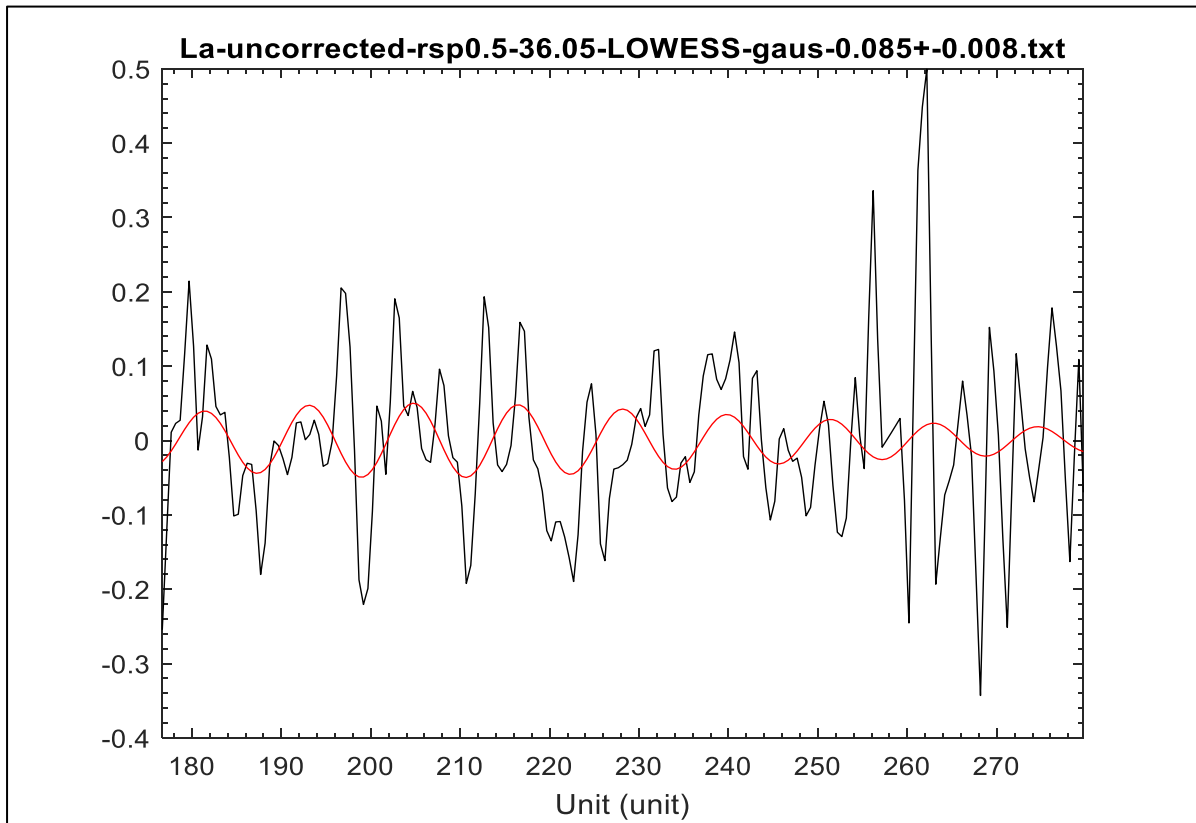


Appendix

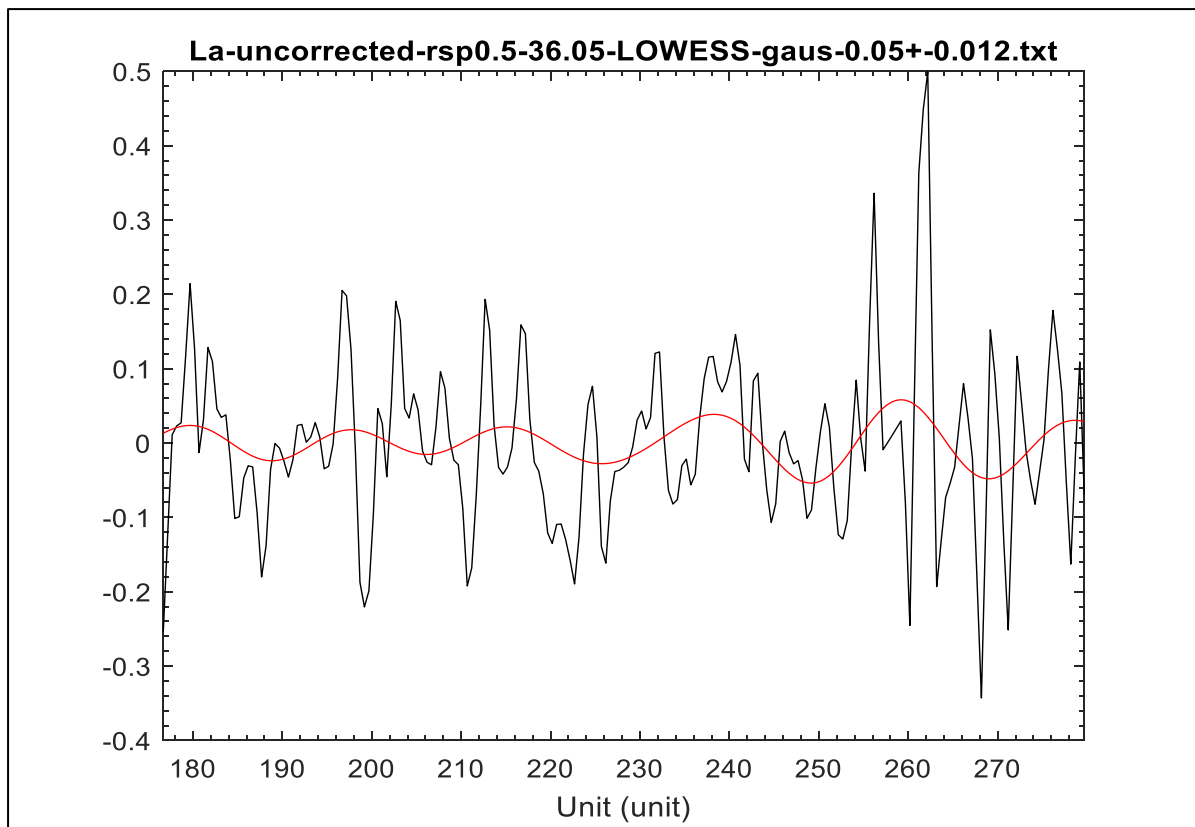
C6e: La $\sim 6.8\text{m}$ filter



C6f: La $\sim 11.8\text{m}$ filter



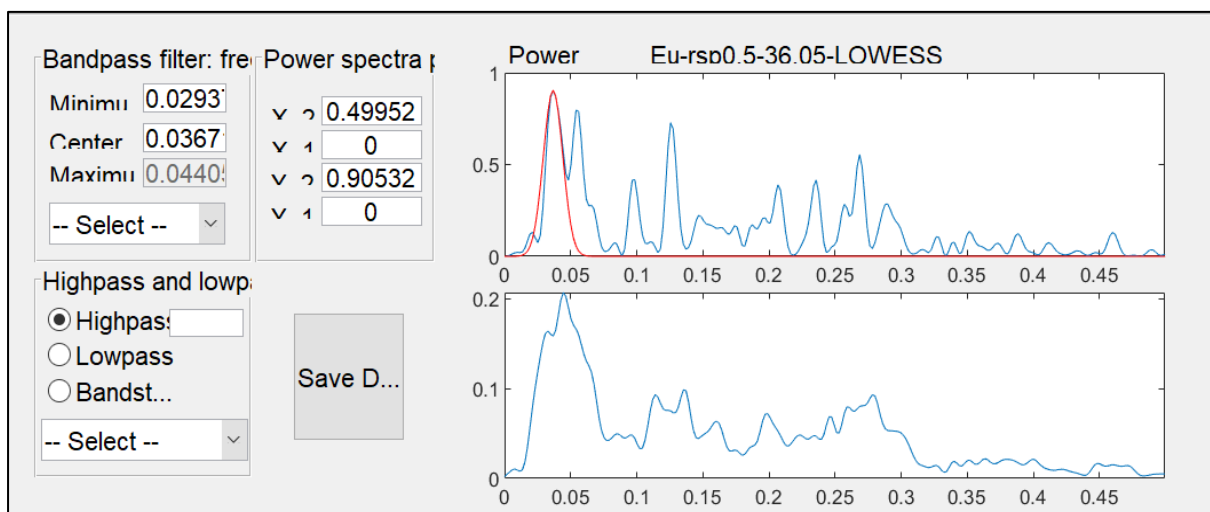
C6g: La ~20.0m filter



Appendix C7: Eu

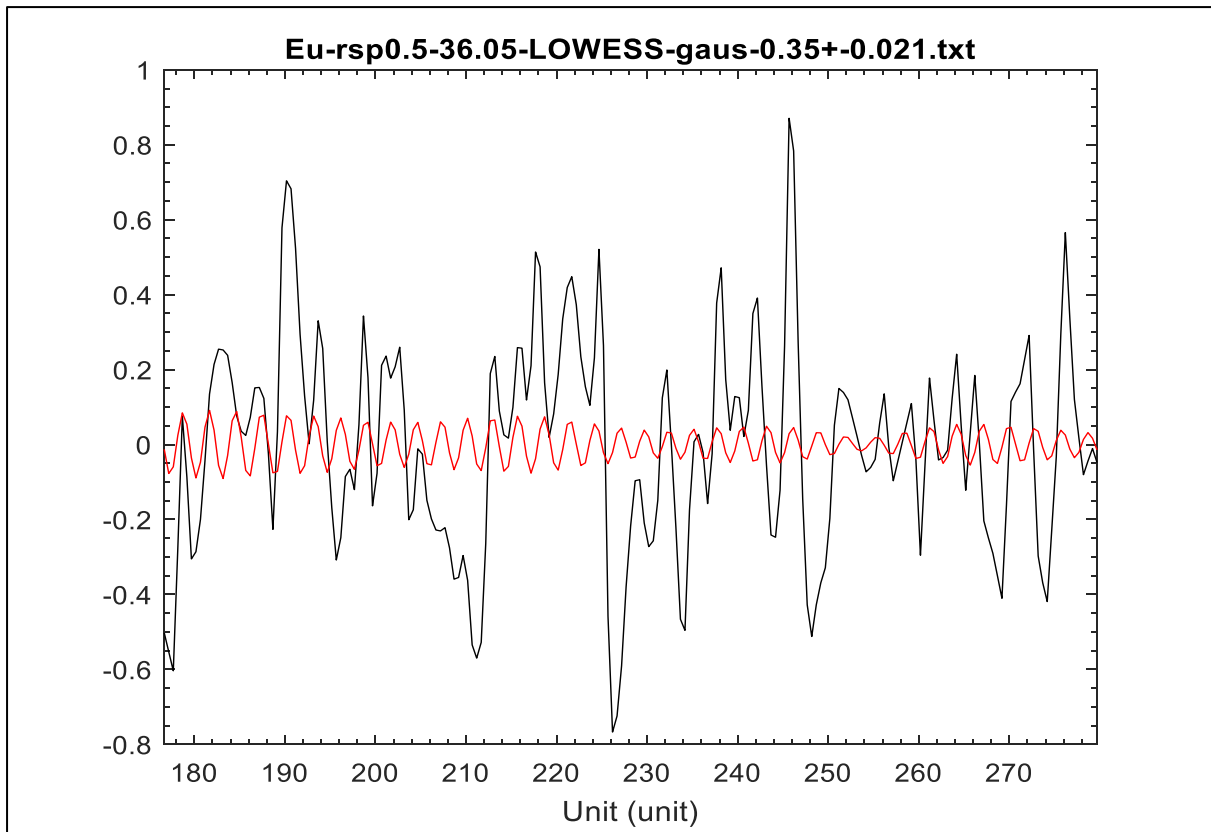
The ~3.8m filter captures the signal well throughout the entire profile, with the signal being the weakest at ~260m where the ~2.9m period is a stronger fit. The ~5.5m is relatively weak throughout but strong in the lower stratigraphy. The ~8.5m filter captures the larger bands well throughout. The ~21.7m cycle is pronounced throughout with the strongest signals being found in the middle part of the stratigraphy.

C7a:

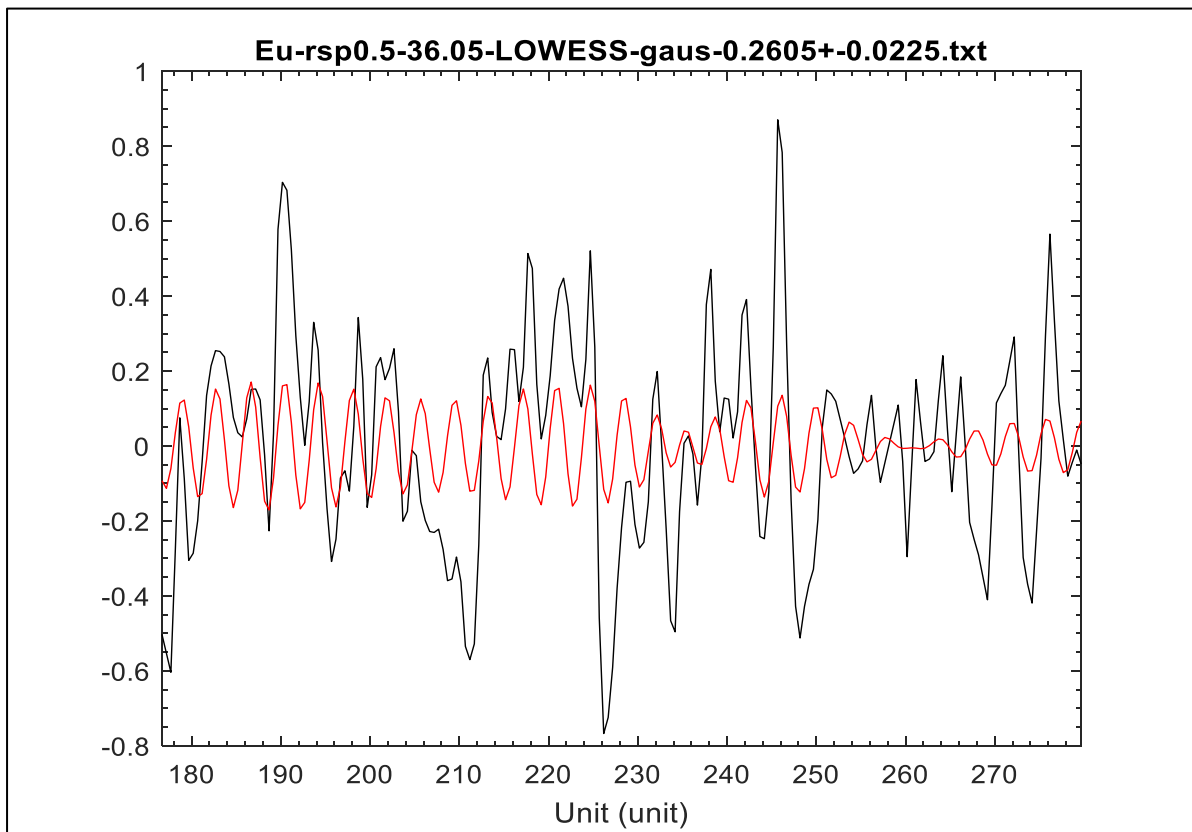


Appendix

C7b: Eu $\sim 2.9m$ filter

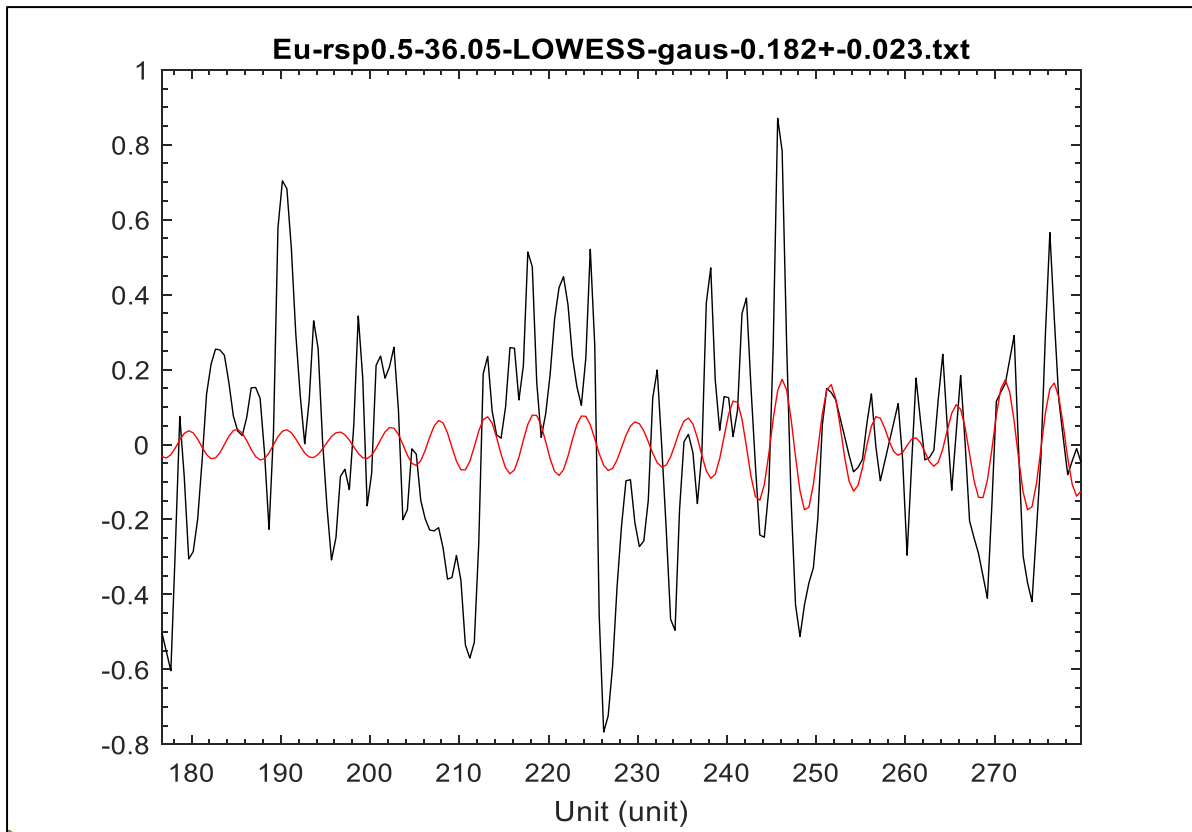


C7c: Eu $\sim 3.8m$ filter

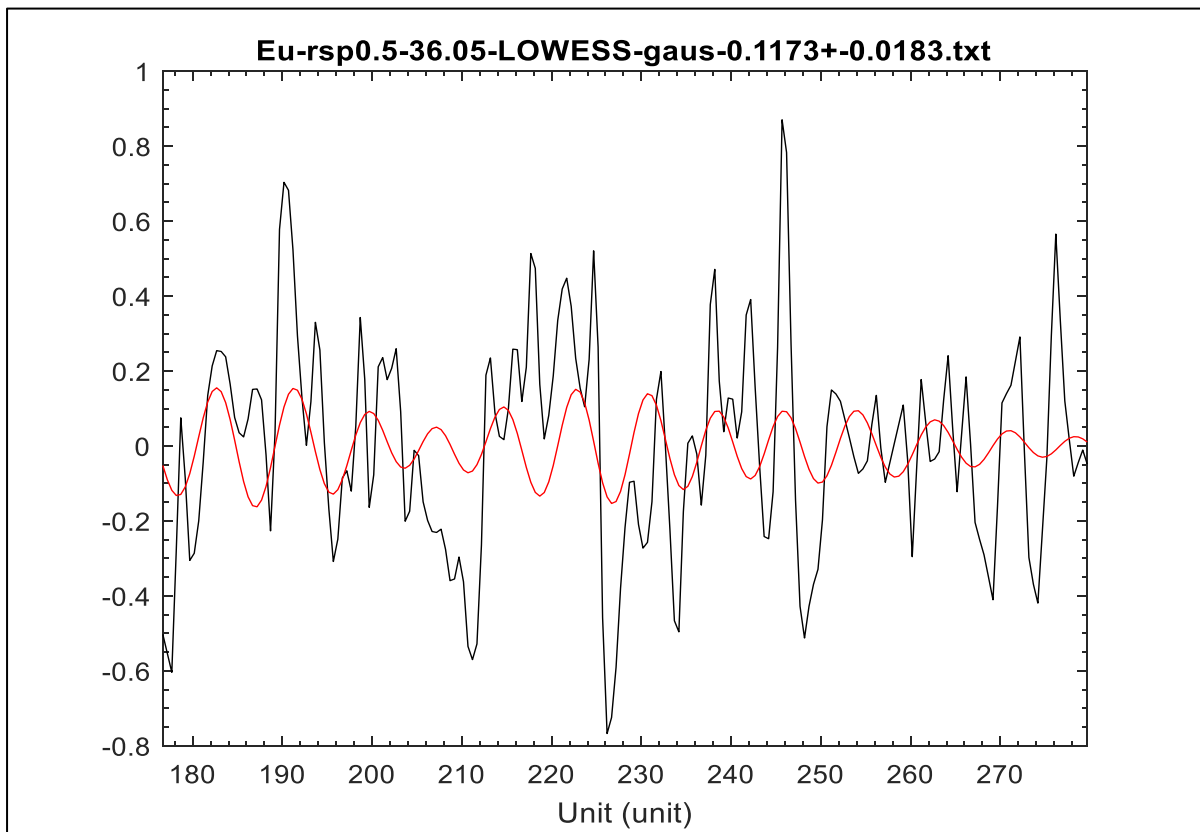


Appendix

C7d: Eu ~5.5m filter



C7e: Eu ~8.5m filter



Appendix

C7f: Eu ~21.7m filter

