More comments on Assessing Atmospheric GravityWave Spectra in the Presence of Observational Gaps

Mohamed Mossad, Irina Strelnikova, Robin Wing, and Gerd Baumgarte

Thank you for the generally useful clarifications and responses. Below, I still have a few comments that should be addressed.

Line 48: Why does $\beta>2$ necessarily lead to bias?! It will do so if there are data gaps, but why otherwise (assuming that a window was used before taking the spectrum)? Also, the existence of low frequency variability ("longer periods that the observations..") is ubiquitous in geoscience, but why is this different than the usual problem that is solved by windowing?

Line 53: I think the problem here is that the authors have set themselves the problem of identifying periodic components that stand out in the presence of a scaling "background". In this case, the main methods of astronomy and seismology are not necessarily very helpful since they mostly focus on finding the exact frequency and phase of spectral peaks, not in estimating the scaling properties of "background" spectra (although there are exceptions…). The problem of accurately estimating the "background" i.e. a signal from a wide range of frequencies is more typically a turbulent, hence atmospheric, oceanic problem.

Line 74: The L-S and MTM together are still poor when the spectrum is scaling and with gaps, see comment on line 110 below.

Line 93: As mentioned in my previous comment, determining spectra from series with missing data using interpolation will lead to a bias, unless the interpolation method has the same exponent β as the series i.e. in general, fractal (not linear) interpolation is needed. But the right exponent is needed before such interpolation can be done! Perhaps a "bootstrap" method of iteratively interpolating with closer and closer approximation fractal would be possible…

Line 110: As indicated in the previous comments, the problem with Lomb-Scargle is that there is massive spectra leakage when either the spectral spike to too big, or the low frequencies have too much power (the exponent β is too big, $\beta\approx>1\text{-}2$). This is because L-S is a regression technique that does not conserve the total spectral power. Adding MTM is not justified when there is missing data since the weighting functions are not orthogonal on nonuniform bases. The MTM often performs very poorly in scaling series with gaps.

Line 125: The Haar order q = 2 exponent is exactly equal to β-1 irrespective of the size of the intermittency correction: the exact general result is $\xi(2)=2H-K(2)$ whereas the result for spectral exponent is spectral exponents are exactly $\beta = \xi(2)+ 1$. The Haar fluctuations are very good for scaling processes, but are not optimal if there are large periodic components superposed on it.

Line 179: I don't understand the simulation. There are 35 frequencies and 35 phases. We are told that the frequencies are chosen from a uniform probability distribution, but what about the phases? Please write down the theoretical spectrum that this model generates. It shouldn't be too difficult, and it is needed to clarify the properties of the process which are not self-evident.
There are also potential issues of convergence since using only 36 sinusoids for each simulation, seems like a small number.
At the moment, I can't evaluate the model. The authors haven't clearly responded to this key question raised in the earlier comments.

Line 243: I don't see how aliasing can enter here. Isn't the lowering of the high frequencies and raising of low frequencies simply due to the smooth (linear) gap filling line having a paucity of high frequencies compared to the signal? We're replacing a signal with lots of high frequencies with one with only low frequencies. That's why interpolation is a bad idea!

Line 335: Spectral leakage occurs for any finite nonperiodic signal, it doesn't matter what the lower frequencies would have been had they been present.