EGUsphere, referee comment RC1
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Comment on egusphere-2022-944

Anonymous Referee #1

Referee comment on "A turbulence data reduction scheme for autonomous and expendable profiling floats" by Kenneth G. Hughes et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-944-RC1, 2022

I think this is an interesting paper describing a good method, but I'm not entirely convinced that there is a great reason for doing the fits on a constant frequency band, besides the convenience. The on-board processing is already complicated enough - ultimately I don't understand why the on-board processing shouldn't be more complete (doing the fits on fixed spatial scales on the wavenumber scaled spectra?) or much simpler (by sending back a more representative voltage spectra and doing the fit on shore)?

Getting a good estimates when the vertical velocity is not the nominal 0.2 m/s (e.g, near the top of the profiles, as the float comes to the surface) seems to be a very important aspect for the specific instrument discussed.

As far as I understand, the results are only obtained by fitting frequencies between 1 and 5 Hz. That corresponds to only 10 points in the spectrum… Separating this results on doing the fit on 5 points. Going from the full-spectrum (100 Hz for 5 sec. = 500 points) to 10 points is ultimately the core of the data reduction scheme. The paper claims that one can estimate accurate rates of dissipation from this narrow frequency range (without fancy despiking or using acceleration data). For these 10 points (for each channel), the fitting method returns 2 fitted values (factor of 5). This additional factor of 5 certainly a nice reduction. I also wonder at what precision that data is returned. Choosing a different number representation, or compression could also help here.

That being said, the paper is generally clear and the method is well documented. Particularly if the profiling (or horizontal velocity) varies a bit more widely, I would hesitate to really champion that method (because of the relatively narrow and fixed frequency band were the fits are done), but I can see how it might be useful and accurate for the application in question.

A few more comments:

Line 23-24: It would be useful to state the size of a typical dataset from an Argo float (one profile every 10 days). Something like "In contrast, a typical Argo profile (once every 10 days) contains XXX kB of data).

Line 54: Why is there a 3-axis accelerometer, compass, and pitot tube? What is done with that data? In addition to the data compression, if might be worth it to discuss power consumption…

Line 148: Could horizontal velocities impact the estimate of W? In particular, wave motion will have some horizontal component that is not present in pressure, but does advect turbulence past the sensor, no? In other words, are there situations where the flow past the sensor is not strictly vertical?

L170: "two-stage approach". This phrasing, and the following sentence, made me expect that a description of the second stage would immediately follow. As it is now, I'm not sure I can readily identify the second stage (not mentioned until line 188).

When initial fit on the voltage is done on a frequency range past the inertial subrange, it seems that the least-square fit would be really dominated by the lower frequency elements of the band, since the spectrum rolls of so rapidly. The fit then doesn't really help with any noise (for example, in Fig 3b). That is presumable captured in the score,

All the fits in Fig 4 have about the same value of epsilon. It might be interesting to have a column in Fig 4 for much smaller values (10^{-10}), and larger (10^{-6}, say), to see how the the fit is affected by what frequency/wavenumber range it is done over…

Raw data are typically not going to be recovered… What is reason for sampling so fast, if only data up to 5 Hz are used? Naively, perhaps, an analog filter could be used and microstructure signal could be sampled slower, no? Would that save power?