Errata

30 October 2019


The mean AVISO zonal wavenumber spectrum used by Samelson et al. (2016) was computed incorrectly. A corrected mean AVISO zonal wavenumber spectrum, computed from the 16 zonal wavenumber-frequency spectra used by Samelson et al. (2019), has relatively less energy at high wavenumbers and relatively more energy at low wavenumbers (Fig. 1). The Samelson et al. (2016) analytical model isotropic two-dimensional wavenumber power spectrum

\[ S_{2d}(k, l) = S_K(K) \]

where \( K = \left( k^2 + l^2\right)^{1/2} \), can be written in an equivalent form as

\[ S_K(K) = W_{sm}(K) S_\rho(K), \]

where the “true” spectrum \( S_\rho(K) \) is given by,

\[ S_\rho(K) = \frac{S_0}{\left[1 + (K/K_s)^{s_1 s_0}\right]^{1/s_1}} S_{low}(K), \]

with

\[ S_{low}(K) = \begin{cases} 
1, & K \geq K_{low} \\
(K/K_{low})^{-c}, & K < K_{low} 
\end{cases} \]

and the effective smoothing filter \( W_{sm} \) is given by

\[ W_{sm}(K) = \frac{\exp\left( -K_1^2 / K_2^2 \right)}{1 + (K/K_b)^b}. \]

The corrected parameter values derived by fitting the corrected mean AVISO spectrum are: \( S_0 = 2.4 \times 10^6 \) cm² cpkm⁻², \( K_s = 2\pi/450 \) km⁻¹, \( s_0 = 4, s_1 = 3, K_{low} = 2\pi/900 \) km⁻¹, \( c = 2.5 \), \( K_a = 2\pi/170 \) km⁻¹, \( K_b = 2\pi/80 \) km⁻¹, and \( b = 6 \). The spectrum \( S_K \) is defined for all \((k, l)\) with \( K_0 \leq \{|k|, |l|\} \leq K_1 \), where \( \{K_0, K_1\} = \{0.4, 30\} \times 10^{-3} \) cpkm. This form for \( S_K \) then gives, after integration over meridional wavenumber \( l \), an accurate fit to the corrected mean AVISO zonal-wavenumber spectrum over the entire mesoscale range (Fig. 2).

The empirical scale-correction factor \( \gamma = 1.2 \) that was found necessary in Samelson et al. (2016), in order that the model fit the observed eddy statistics, evidently compensated for most of this error in the assumed mean AVISO spectrum: the scale-adjusted model spectrum (Fig 1, dashed blue line) from Samelson et al. (2016) nearly matches the new, corrected mean AVISO spectrum (Fig 1, red line). Had the mean AVISO spectrum been computed correctly,
the introduction of the scale factor $\gamma$ in Samelson et al. (2016) would likely not have been necessary. This explanation for the otherwise unexplained scale-correction factor could be tested directly by regenerating the stochastic model SSH fields using the corrected $S_K$ and then repeating the eddy identification and tracking analysis.

References


List of Figures

1. Fig. A1 in Samelson et al. (2016) with addition of corrected mean AVISO spectrum. One-dimensional, zonal wavenumber power spectra of SSH: corrected mean AVISO spectrum (red), with original, incorrect mean AVISO (black) and spectra computed from model $S_K(K)$ (blue solid), $S_K(\gamma K)$ with $\gamma = 1.2$ (blue dashed) and $S_\rho(K)$ (blue dotted), from Fig. A1 in Samelson et al. (2016). The corrected mean AVISO spectrum was computed as the mean of the spectra in Fig. 20 of Samelson et al. (2019), after integration over frequency. 4

2. Corrected version of Fig. A1 in Samelson et al. (2016), over a broader spectral range: corrected mean AVISO spectrum (red), with corrected model $S_K$ (blue solid) and $S_\rho$ (blue dashed) spectra for parameters given in the text. For comparison, the original, incorrect mean AVISO spectrum from Fig. A1 of Samelson et al. (2016) is again shown (thin black line), along with a reference line for the $k^{-3}$ power-law spectral slope (dotted). 5
Figure 1: Fig. A1 in Samelson et al. (2016) with addition of corrected mean AVISO spectrum. One-dimensional, zonal wavenumber power spectra of SSH: corrected mean AVISO spectrum (red), with original, incorrect mean AVISO (black) and spectra computed from model $S_K(K)$ (blue solid), $S_K(\gamma K)$ with $\gamma = 1.2$ (blue dashed) and $S_{\rho}(K)$ (blue dotted), from Fig. A1 in Samelson et al. (2016). The corrected mean AVISO spectrum was computed as the mean of the spectra in Fig. 20 of Samelson et al. (2019), after integration over frequency.
Figure 2: Corrected version of Fig. A1 in Samelson et al. (2016), over a broader spectral range: corrected mean AVISO spectrum (red), with corrected model $S_k$ (blue solid) and $S_\rho$ (blue dashed) spectra for parameters given in the text. For comparison, the original, incorrect mean AVISO spectrum from Fig. A1 of Samelson et al. (2016) is again shown (thin black line), along with a reference line for the $k^{-3}$ power-law spectral slope (dotted).