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Frequency Content in Glider Data

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In the present work, a methodology to analyse the spectral content of Glider data is put forward, by showing the application to temperature series taken during the glider mission TENUSE-LIDEX in the Tyrrhenian Sea between 3 and 21 July 2010. An initial processing is made to ensure that every datum has a spatio-temporal reference, to correct the sensor lag errors, as well as to provide a basic quality control and eliminate unrealistic data (e.g., outliers, spikes).

The main problem to overcome is the identification and separation of spectral content due exclusively to the experimental settings. Trajectory and bathymetry have an effect on the time span between a consecutive pair of a downcast-upcast profiles. The proposed procedure is based on the reconstruction of data series for fixed depths as a function of time. The main effect of the downcast-upcast sampling scheme is avoided by taking only the downcast profiles. Thus, the Fourier transform is applied to the reconstructed temperature series for every level and their power computed. Several groups of frequency with relatively high energy appear at selected depths. Oscillations of about 2.5 hours periodicity appear between 6 and 13 meters depth. Some periodicities of 11h, 17h, 21h and 24h also show strong energy peaks in the power spectra, appearing mainly at 9 m depth; while the 24h oscillation shows also reinforcement at 25 m depth. Additional investigation was carried out by estimating the coherence and phase of several groups of frequencies between different depths. For a specific depth, cross-spectra were computed with the series of all the successive levels. Coherent clusters of oscillations were identified at preferential depths between 9 and 30 meters, depending on the frequency, showing in-phase regime. Finally, techniques based on the Wavelet transform were applied in order to assess the stationarity and spatial homogeneity of the oscillations found in the analysis.