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Stochastic Heterogeneity Mapping to quantify turbulence in horizon layers of thermohaline staircases in the Mediterranean Outflow Water

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Multichannel seismic data acquired in the Gulf of Cadiz in April-May 2007 provided images of an oceanic thermohaline staircase. Thermohaline staircases are regular, well-defined step-like variations in vertical profiles of temperature and salinity. In the ocean they are the result of double diffusion driven by the difference in the molecular diffusivities for heat and salt. The feature is thought to have an anomalously weak internal wave-induced turbulence, making them suitable for the estimation of a lower limit of turbulent disturbances in these relatively stable structures.

We apply Stochastic Heterogeneity Mapping based on the band-limited Von Karman function to stacked, migrated seismic data to extract stochastic parameters such as the Hurst number (the exponent in the power law and a measure of surface roughness) and correlation length (scale length). For scale sizes smaller than the correlation length, the von Karman model describes a power law (fractal) process. Lower Hurst numbers thereby represent a richer range of high wavenumbers and therefore correspond to a broader range of heterogeneity in reflection events. We interpret a richer range of heterogeneies as indicative of a greater degree of turbulence. Hence, with the extraction of these parameters we aim to quantify turbulent processes for the particular case of thermohaline staircases.