How biomass diel migration affects the reliability of currents measurements in the Strait of Gibraltar?

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Since 2004, high resolution profiles of the 3D velocity of the water column have been collected at the westernmost sill of the Strait of Gibraltar (Espartel Sill), with the aim of monitoring the Mediterranean water outflow and evaluate its short and long term variability. A 75 kHz up-looking Acoustic Doppler Profiler (ADP) and, more recently, another 500 kHz model installed in down-looking mode, have been embedded in a subsurface buoy, deployed ~20m above the seafloor at a depth of approximately 360m. The averaged profile of the observed along-strait current uses to show local minima ~50m above seafloor, which has been interpreted as the diurnal-semidiurnal interaction of tidal currents (Sammartino et al., 2015). The prevailing semidiurnal tide drives periodic accelerations of the westward Mediterranean current flowing at the bottom, whereas diurnal constituents slow them down, giving rise to a local minimum in amplitude, and prompting severe drops in measurements accuracy. In year 2019, the main ADP was replaced by a 100 kHz model sporting an additional vertical beam that collects high resolution echograms of the water column. This new information reveals the key role of scatterers concentration, which undergoes diel migrations, and affects the reliability of the velocity observations which rely on the amplitude of scattered echo recorded by the instruments. Actually, echo amplitude reaches average correlations of 0.7 with measurement uncertainties. In light of these new insights, an accurate update of the Mediterranean outflow calculations is performed and new values of trend and long-term variability, are estimated.