

## **COUPLED ECHOSOUNDER AND DOPPLER PROFILER TO IMPROVE CURRENT MEASUREMENTS ACCURACY**

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**Abstract:** 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 evaluating its short and long term variability. Initially equipped with a 75 kHz up-looking Acoustic Doppler Current Profiler (ADCP) and a Conductivity/Salinity (CT) probe, the mooring line has been upgraded through years adding more, and more technologically advanced, instruments. In 2016, a 500 kHz ADCP was installed in down-looking mode, with the aim of covering the so far unsampled bottom layer, below the buoy deployed ~20 m above the seafloor. Despite the implicit variability of such a long series, the averaged profile of the observed along-strait current systematically showed local minima ~50 m above seafloor, which have been interpreted as the result of the interaction between diurnal and semidiurnal 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 few meters above seafloor, giving rise to those local minima in amplitude. This mechanism is often related to severe drops in measurements accuracy. In 2019, the main ADCP was replaced by a 100 kHz model capable of collecting high resolution echograms of the water column with an additional vertical beam. This new information reveals the key role of scatterers concentration, which undergo diel vertical migrations, and affect the accuracy of current observations, which in turn rely on the amplitude of scattered echo recorded by the instruments. Actually, echo amplitude reaches average correlations of 0.7 with measurements uncertainty. In light of these new insights, accurate updates of the Mediterranean outflow calculations are performed (García-Lafuente et al., 2021) and new estimations of trend and long-term variability, are provided.

**Key words:** Strait of Gibraltar, Current measurements, Diel vertical migration, Echo sounder, Acoustic Doppler Current Profiler.

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