EGU21-4632
https://doi.org/10.5194/egusphere-egu21-4632
EGU General Assembly 2021

New insights for direct *in situ* measurement of oceanic vertical velocities in fine-scale studies.

Caroline Comby, Stéphanie Barrillon, Jean-Luc Fuda, Andrea Doglioli, Roxane Tzortzis, Gérald Gregori, Melilotus Thyssen, and Anne Petrenko
Mediterranean Institute of Oceanography, Aix-Marseille University, Marseille, France (caroline.comby@mio.osupytheas.fr)

Vertical velocities knowledge is essential to study fine-scale dynamics in the surface layers of the ocean and to understand their impact on biological production mechanisms, in both coastal and offshore environments. Indeed, the general interest in fine-scale and, more precisely, in the determination of vertical velocities, is explained by their key role in global oceanic balance and their impact on the vertical transfer of nutrients and carbon budget despite their low intensity. With the increasing global warming issues linked to the forcing of the carbon cycle by anthropogenic activities, the estimation of vertical velocities becomes an essential information for a better representation of biogeochemical budgets. However, these vertical velocities have long been neglected, simply parameterized, or considered as not measurable, due mainly to their order of magnitude (mm s^{-1}), generally much lower than the one of the horizontal velocities (cm s^{-1}). Consequently, direct *in situ* measurement of vertical velocities is still currently one of the biggest challenges in physical oceanography.

We have been working to develop a new method for direct *in situ* measurement of vertical velocities using data from different Acoustic Doppler Current Profilers (ADCPs) associated with CTD probes, and we performed a comparative analysis of the results obtained by this method. The analyzed data were collected during the FUMSECK cruise (2019, Ligurian Sea), from three ADCPs: two Workhorse (conventional ADCPs), one lowered on a carousel and the other deployed in free-fall mode, and one Sentinel V (a new generation ADCP with four classical beams and a fifth vertical beam), also lowered on a carousel. Our analyses provided profiles of vertical velocities of the order of mm s^{-1}, as expected, with standard deviations of a few mm s^{-1}. While the fifth beam of the Sentinel V has shown a better accuracy than conventional ADCPs, the free-fall technique has provided a more accurate measurement compared to the carousel technique. Some of these measurements were gathered along the edge of the Northern Current and this new information on coastal edge currents represents a key point for the future improvement of coastal altimetry in particular.

Finally, this innovative study opens up the possibility to perform simple and direct *in situ* measurements of vertical velocities, coupling the free-fall technique with a five-beam ADCP. Hence, we plan to deploy a free-falling Sentinel V in offshore areas characterized by intense fine-scale ocean dynamics, but also and above all, in coastal areas, where topographic forcings are

typically the source of high amplitude vertical velocities.