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Continental Shelf Waves and dense water downflow along the Southern Adriatic Margin

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In this contribution we combine observational data and numerical model fields into a characterisation of Continental Shelf Waves dynamics along the Southern Adriatic Margin (SAM, eastern Mediterranean basin). Continental Shelf Waves are oscillatory features controlled by the bathymetric gradient and the current rotation, and their occurrence in the Adriatic Sea was long postulated but never up to now documented with oceanographic measurements.

With reference to the winter-spring period of 2012, characterised by an extreme cold spell that gave rise to significant volumes of dense water, we investigated the southern Adriatic margin dynamics by means of a high-resolution (1 km horizontal grid step) ocean currents-waves coupled model run and a set of five moorings deployed along the continental slope and on the abyssal plain. Starting from the identification of a sequence of high-intensity speed and temperature pulses, appearing in both datasets with period slightly shorter than 2 days, we described these modulations in terms of their rotary spectral properties and the associated transport patterns, obtaining information about the wave length, mode, and propagation speed throughout the continental margin. The comparison of the wave parameters against the theoretical dispersion relation associated with the margin morphology shows that trains of CSWs generate along the northern sectors of the SAM and propagate for several tens of kilometres along the western slope. Observed waves, triggered by the flow of dense water through the shelf break, have length ranging between 35 and 87 km and period between 2 and 4 days. Along their path, they undergo Doppler shift, scattering and energy dissipation in response to background currents and variations in the margin topography.

Besides a new insight on the physical processes underlying the downflow of dense water along the Southern Adriatic Margin and, more generally, the exchange of nutrient and energy between the continental shelf and the abyssal regions, this work opens new perspectives for the comprehension of the dynamics of deep sea ecosystems. Furthermore, the characterisation of the energetic flow features associated with CSWs, together with the availability of numerical models capable of reproducing their occurrence and characteristics, can support a number of more practical applications, such as the deployment of submarine instrumentation and infrastructures or the definition of sealife growth and protection areas.