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The role of Internal Solitary Waves on deep-water sedimentary processes: the case of up-slope migrating sediment waves off the Messina Strait

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Joint marine geology and physical oceanography studies seek to demonstrate the inherited connection between seafloor sedimentary processes and seawater dynamics in a fruitful exchange. While seafloor morphology highlights the long-term action of bottom currents, oceanographic models attempt to explain and predict morphogenetic processes and sedimentary pattern at the seafloor [Blodeaux, 2001; Martorelli et al., 2010; Belde et al., 2015]. A sand waves field we observed off the Messina Strait (Mediterranean Sea) give us the opportunity to demonstrate the value of such a multidisciplinary approach. We interpret these sand-waves as formed by tidal-induced internal solitary waves (ISWs) that generate within the Strait [Alpers and Salusti, 1983; Sapia and Salusti; 1987; Artale et al., 1990; Bradt et al., 1999]. We hypothesize that the deflected pattern (i.e. the depth-dependent orientation) of these sand waves is due to refraction of ISWs occurring at the interface between the Levantine Intermediate Water (LIW) and the Modified Atlantic Water (MAW), caused by interaction with a topographic mound; while the motion of sediment is caused by the bottom velocity field associated with the ISW trough. Both numerical and in situ data provide hints regarding the formation of the observed geometries and give useful information about their dynamics and migration rate. We believe that our work represents an innovative and promising link between the geological and oceanographic communities, adding some insights on the role of ISWs on sedimentary process and the structure of continental margins [Puig et al, 2004; Haren et al., 2013].

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