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Internal solitary wave generation and refraction observed at the Estremadura Promontory off the west Iberian Coast (Portugal)

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A recent study revealed that the Estremadura Promontory (considered to be one of the largest in the world ocean and located off the west Iberian coast) is a hotspot of internal solitary wave generation. SAR images suggest that the waves are mainly generated at the northern and southern flanks of the promontory (which extends from the coast to the west for more than 100 km) when the barotropic tide oscillates meridionally in a near perpendicular direction. A comprehensive dataset of SAR images is used to reveal the full two-dimensional structure of these waves. The main physical properties (such as crestlengths and horizontal scales) are also inferred from the satellite imagery and used to calculate an energy proxy of the internal wave field propagating in the study region. It is found that refraction, owing mainly to bathymetry, diverts the meridionally propagating waves to the east, where they eventually dissipate in the inner-shelf regions close to shore. The barotropic body force (from P. G. Baines, 1982) is also calculated and the most likely generation locations are identified. The tidal forcing seems to be equally divided between both flanks of the promontory. However, the energy analysis suggests that there is more energy coming from the southern flanks. This apparent contradiction is solved using the vertical excursion inverse Froude number (defined by Legg and Klymak, 2008), which indicates that this is probably related to the steeper slopes located in the northern side. The pronounced bathymetry in the north is more likely to generate internal hydraulic jumps and overturning, which may inhibit the disintegration of the internal tide into solitary waves.