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Rhythmic morphology on a microtidal low-energy beach: Trabucador beach, Ebro delta

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The Trabucador is a long (6 Km), narrow (125 m) barrier with a microtidal beach at the SW side of the Ebro delta (Catalonia). Its inner side facing the Alfacs bay is a low energy beach with a sandy shallow terrace featuring an intricate alongshore rhythmic morphology. Sixteen aerial orthophotos from 1946 to 2014 have been analysed and complemented with field observations from 1986 to present. This morphology is dynamic but it is usually characterised by: a) long finger transverse bars (LTFB) (Ribas et al., 2015) and b) large scale shoreline undulations (LSSU) (Arriaga et al., 2018). The LTFB are thin and elongated with a length of the order of their spacing. They are intertidal and typically attach to the shoreline by a megacusp, commonly opening an anti-clockwise angle of 10o-40o with the shore normal. There can be many, up to 90, with both the mean and the most frequent alongshore spacing in the range 15-25 m. Spectral analysis always shows peaks in this range and sometimes additional peaks in the range 30-65 m that correspond to the spacing between the largest bars with smaller bars in between. The LSSU typically have wavelengths in the range 150-250 m.

Although they might interact, the LTFB and the LSSU are clearly two distinct morphological units. Separate numerical modelling for each feature shows that both could emerge out of feedbacks between hydrodynamics and morphology during the SW wind events. However, the specific mechanisms which are responsible for each feature would be different. The LTFB would emerge from the deflection of the wave-driven longshore current by the bars combined with the refractive wave focusing by them (Ribas et al., 2015). The LSSU would instead emerge from the high-angle wave shoreline instability (Ashton et al., 2001). This means that these large scale undulations are associated to similar undulations in the mean bathymetry (i.e. filtering out the smaller scale surf zone features) in both the surf and the shoaling zones. The corresponding feedback occurs between these undulations and the wave transformation in the shoaling zone through the corresponding alongshore gradients in wave-driven transport. Although both features are investigated here with different models, i.e. the modelling study does not account for the possible coupling, it is the first time that both are reported as coexisting in nature.

References:

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