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Shoreface-connected sand ridges: modelling the effects of waves and 3D processes on their formation and sorting characteristics

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The effect of wave-topography feedbacks and three-dimensional processes on the formation of shoreface-connected sand ridges (sfcr) and the spatial distribution of the mean grain size and sediment sorting is examined. This is done by applying a stability analysis to a process-based model, which simulates the growth of sfcr due to the positive coupling between waves, storm driven currents and a sandy bed. Transport of sediment mainly takes place as suspended load. The characteristics of sfcr strongly depend on the wave characteristics far offshore. It is found that for most wave conditions, the modeled ridges resemble observed sfcr, i.e. up-current orientation, downstream migration and finer mean grain size on the downstream side of the ridge. The effect of 3D processes is included by assuming that the storm-driven flow has a logarithmic distribution over the vertical and that the suspended sediment concentration has a Rousse profile over the vertical. For realistic values of bed roughness and Rousse number both the growth rate and migration speed of the ridges reduce to 80% of the values obtained in case 3D effects are ignored.