EGU22-9218, updated on 13 Aug 2022
https://doi.org/10.5194/egusphere-egu22-9218
EGU General Assembly 2022

Slope fans and aprons dominated by supercritical bedforms: topographic and feeding system controls (Southeastern Tyrrhenian Sea)

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In the marine environment, turbidite supercritical bedforms have been widely reported from channel-axis and overbank wedges. On the contrary, their dominance in the make-up of fans and apron, apart from local areas such as channel mouths, is at present not recognized. However, since it has been postulated that turbidity currents reach the supercritical conditions for slope > 0.5°, submarine slopes should contain abundant supercritical flow deposits. Here, we provide a review of different types of slope fans and aprons dominated by supercritical bedforms, based on examples from the modern seafloor. We compare depositional elements located in different intraslope basins of the Tyrrhenian Sea, through high-resolution bathymetry, chirp subbottom section and, where available cores. The variable geological context results in axial and transvers slope fans with highly variable sizes (few to tens of kilometres) and geometries, dependent upon the erosive and/or depositional processes involved, as well as the seafloor topography of the area. In particular, we have recognized two types of lobe-shaped deposits characterized by supercritical bedforms: channel-attached fans and detached aprons. The first ones are connected to a canyon-channel system and develop on slope gradients of 0.5° to 1.2°, display small-scale bedforms (wavelength of about 150 m and height < 10 m), with upslope asymmetric or symmetric cross-sections, interpreted as cyclic steps and antidunes. According to the amplitude of the reflections, cores, and to the bedform aspect ratio, the channel-attached fans are interpreted to be composed of coarse-grained sediments. Our examples highlight that cyclic steps and antidunes dominate the channel-attached fans both in axial and lateral portion while scours mark topographic changes such as breaks in slope or laterally confined areas. Detached aprons develop from the un-incised shelf edge on steep slopes of about 1.2° to 3° and are composed by large-scale bedforms (wavelength of about 500 m and height of about 5 m) mainly upslope asymmetric, associated with cyclic steps. The low amplitude of the seismic reflections suggests the fine-grained nature of the aprons. This study shows that there are significant differences in the distribution and character of supercritical bedforms in slope settings according to the type of feeding system, the degree of flow confinement and the seafloor topography. The analysis of the downslope evolution of turbidity currents, and of the character of associated bedforms in deep-water systems can contribute new perspectives to refine our models of deep-sea depositions.