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Bottom sediment dynamics driven by deep sea contour currents and mesoscale eddies on the Jianfeng slope, northern South China Sea

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By combination of 3D reflection seismic data and process-based numerical modelling, we present a detailed study on the current-topography interaction associated with a complex deep-water sedimentary system at water depth between 1700 and 2200 m on the Jianfeng slope of the northern South China Sea. The objective of this study is to investigate the morphogenetic linkage of a confined mounded drift ($\sim$20 $\times$ 15 km) to its adjoining topographic units, including two submarine canyons at its both sides, an erosional depression in its upper part and migrating sediment waves in its lower part. Based on hydrographic measurement of deep sea contour currents, high-resolution three-dimensional modelling is applied to explore possible scenarios of sediment resuspension, transport and sedimentation in the study area induced by a combined effect of a quasi-steady contour current associated with the South China Sea Deep Water Circulation and passing-through of deep-reaching mesoscale eddies. Simulation results and seismic data show that (1) quasi-steady contour (geostrophic) currents are able to transport fine-grained sediment for long-distance, however, they are too weak to resuspend seafloor sediment. (2) Morphology of the continental margin of the northern South China Sea is a combined result of turbidity flow, contour currents and mesoscale eddies. Specifically, the mounded contourite drift body and sediment waves developed from the Pliocene (5.2 Ma) onwards, overlying the slope fans developing from 15.6 Ma onwards. It may indicate that the mounded drift should be generated and converted dominantly from the slope fans, under the consistent influence of the westward South China Sea Deep Water Circulation bottom currents. (3) Interaction between the complex slope topography and the mesoscale eddies results in an enhanced dissipation of the eddy energy, which is transferred into submesoscale motions that are critical for shaping of the slope morphology. (4) The strongest impact of the eddy on sediment remobilization is at its front. (5) Local sediment source from adjoining sediment wave field and the canyons also contributes significantly to the drift growth. Although both eddies are able to trap fine-grained sediment in their cores and transport it for a long distance, growth of the drift seems to be mainly attributed to deposition of sediment that is from erosion of the adjoining sediment wave field and the canyons. Hemipelagic deposition of sediment from the large-scale quasi-steady contour current associated with the South China Sea Deep Water Circulation may also contribute to a certain extent.