Numerically modelling Miocene stratigraphic sequences on the New Jersey shelf

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We have constructed a two-dimensional numerical model that produces realistic marine deltaic sedimentary structures over geological time. Fluvial sediment is supplied to the model basin from an updip origin, and is delivered to a continental shelf while maintaining an equilibrium profile that adheres to the basic principle of sedimentary mass balance. Changes in accommodation space relative to changes in sediment supply drive the spatial variation in sedimentation through time. Accommodation varies as sea level rises or falls, sediments compact, an elastic lithospheric plate is flexurally loaded, and the crust thermally subsides. The model is simple, but incorporates the primary geological and geomorphological processes that influence stratigraphic development in sedimentary basins on passive continental margins.

We tested the model against Miocene data obtained on the New Jersey continental shelf comprising 6500 km of high-resolution 2D seismic profiles integrated with three IODP Expedition 313 core sites. The seismic stratigraphic interpretations of sequence boundaries, lithofacies, paleowater depths, and chronostratigraphy were obtained from published materials (Miller *et al.*, 2013). The dated seismic surfaces were converted from TWTT to depth using a velocity depth function developed for this region (Mountain and Monteverde, 2011). Two-dimensional backstripping was performed to reconstruct the seafloor topography through the Miocene, progressively accounting for the effects of compaction, flexural loading, and thermal subsidence. The model was set to run forward using the topography of the oldest backstripped layer as a starting point. At each time step, the topography produced by all permutations of a reasonable range of sea-level and sediment supply values were tested against the 'coeval' backstripped surface to select the best possible fit, producing a history of sea-level and sediment flux.

The results are considered within the context of well-constrained paleodepth data from the IODP Expedition 313 cores and Miocene global mean sea-level (GMSL) records based on both Mg/Ca-$\delta^{18}O$ and onshore backstripping. We will force the model using the $\delta^{18}O$-based GMSL estimates to constrain and assess the sensitivity of the parameterized physical processes, including the shape of the equilibrium profile, flux of sediment input, the elastic thickness of the flexurally loaded crust, and the rate of thermal subsidence.

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