Geophysical Research Abstracts
Vol. 14, EGU2012-673, 2012
EGU General Assembly 2012

Impacts of past and future sea-level rise on shelf sea sediment dynamics

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Past changes in climate have resulted in major changes in sea level with implications for global and shelf sea tidal dynamics. Changing tidal dynamics on shelf seas can impact on the location of tidal mixing fronts, levels of tidally-driven mixing, changes in wave climates, shelf sea biogeochemistry and sediment transport. Global sea levels were around 130 m lower than they are today at the Last Glacial Maximum (LGM, ca. 21 thousand years ago). Ocean-land loading and unloading by ice, referred to as glacial-isostatic adjustment (GIA), also influences the spatial variability of relative sea levels, particularly in formerly glaciated regions such as the British Isles. The numerical modelling of both tides and GIA has progressed significantly in the last few years with advances in observational and computational techniques. Although the accuracy of these models and techniques is improving, it is clear that there is still work to be done to produce good fit between model and data across entire domains. This palaeo-study of the period since the LGM focuses on the impact of the evolving tides and the hydrodynamics of the northwest European shelf seas on large-scale sediment dynamics. The study uses some of the recent GIA model outputs for the British Isles as palaeobathymetries within the Regional Ocean Modeling System (ROMS) to simulate tidal conditions at various time-slices since the LGM. The aim is to enhance data-model comparisons via new data from sediment sequences from the northwest European shelf seas to constrain palaeotidal model outputs. Increasing model output reliability through comparison with sedimentary sequences is not limited to this single variable and applies to other model outputs. Validated and constrained tidal models are powerful tools for predicting the evolution of the European coastline in response to future predicted sea-level change, with clear policy relevance.