Geophysical Research Abstracts
Vol. 13, EGU2011-3329, 2011
EGU General Assembly 2011

Regional Modelling of Hydrodynamic Changes as a Result of Cumulative Marine Aggregate Dredging, South Coast, UK

Dafydd Lloyd Jones and Joni Thomas Backstrom
Emu Limited, 1 Mill Court, Durley, Southampton, United Kingdom (dafydd.lloydjones@emulimited.com)

Offshore dredging of marine aggregates has the potential to cause impacts to local hydrodynamics, associated sediment transport and hence may potentially affect the stability of local coastlines.

Over the past forty years marine aggregates have become a significant contributor to the supply of building materials in southern Britain, with between 4.5 and 5.5 million tonnes per year of marine aggregate being extracted from licence areas west and east of the Isle of Wight, from offshore Dorset to West Sussex. In this region aggregates are extracted from thirteen separate licence areas, some of which have existed since the 1970's.

The licences for several of these areas are due to expire in the next few years and in addition, some companies in the region are seeking Government permission to dredge on a number of new areas of seabed. As part of the renewal process, regional-scale numerical modelling of the effects of aggregate extraction on wave height and tidal currents, and their interaction with local coastlines, was commissioned to support a Marine Aggregates Regional Environmental Assessment for the south coast of the UK.

Three bathymetric conditions were used as model inputs - a pre-dredging bathymetry, where seabed levels in each existing or previous licensed area represent the situation before any extraction commenced; a present day bathymetry in which seabed levels in each existing or previous dredging area have been established using the latest survey of those areas; and a future bathymetry in which predicted seabed levels are defined by combining present-day bed levels and future extraction plans for marine aggregate extraction through to approximately the year 2030.

Current guidance used in coastal defence engineering designs recommends that wave heights and periods be increased by 10% and 5% on 1 in 200 year events, respectively, in order to examine the consequences of (possible) increased storminess as a result of global warming. These scenarios were used as part of the wave modelling, and the potential effect of more frequently occurring high-energy events on wave dynamics was also investigated using a 5% exceedence condition which approximates to wave heights that occur, on average, for 6 days per year.

Results from the wave modelling indicated that while increases in significant wave height of up to 14% occurred within licence boundaries no changes to wave heights, under either the 1 in 200 year or global warming scenario, reached the coastline of the study region. Using the 5% exceedence condition, wave height increases of 2-5% were predicted to reach localised shorelines near Portsmouth and along the eastern margins of the Isle of Wight.

Modelling results also indicated that changes in peak tidal current speeds may be as high as ± 30-40% within the aggregate extraction areas but are reduced to approximately ±10% outside of licence area boundaries. Importantly, changes to tidal current speeds were not predicted to occur anywhere along the coastline studied.

It is recognized that numerical modelling has inherent limitations due to the difficulty of validation; however this paper shows that it provides an important tool for examining the potential impacts of marine aggregate extraction at the coastline, at a regional scale.