SHORELINE CHANGE MODELING - IN RELATION TO THE SEDIMENT BUDGET

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INTRODUCTION

UNIBEST (Delft Hydraulics, 1994), a one-line shoreline change model, was used to study historical shoreline change, to make future predictions, to give information about sediment transport directions and magnitudes, and to give feedback guiding sediment budget calculations.

UNIBEST runs were performed for the last 50 years for the North Beach, Grayland Plains, and Long Beach sub-cells. A regional sediment budget, based on bathymetric and topographic change, acted as a framework for the UNIBEST model runs. Waves were shoaled from the Grays Harbor buoy to the UNIBEST offshore boundary using linear wave theory or with the wave propagation model SWAN (Booij *et al.*, 1999). The tidal currents used in UNIBEST were derived from the hydrodynamic ADCIRC model (Luettich *et al.*, 1992). A sensitivity analysis shows that UNIBEST is most sensitive to directional changes of the wave climate and changes in the sediment fluxes at the northern and southern boundaries of the study area.

RESULTS

An example of the calibration runs and predictions for the North Beach sub-cell are presented here. UNIBEST runs were performed for the period 1950 to 1995 over the southern 22-km of the sub-cell, assuming closed boundaries in the north and south. In the calibration runs it was assumed that about two-thirds of the 55 million m^3 of accreted land came from the Grays Harbor ebb-tidal delta, either from erosion or bypassing, and one-third from the lower shoreface (based on Woxell (1998)). Model results show a net sediment transport to the north. Shoreline change predictions to 2020 are presented in Figure 1. The predictions reveal net erosion of the shoreline within 5-8 km of the Grays Harbor North Jetty and net accretion further to the north. In all cases, the ebb-tidal delta supplied no sand after 1995. The case based on waves shoaled with SWAN and cross-shore feeding results in minimum shoreline retreat of 85 m at the North Jetty. The prediction using waves shoaled with SWAN and no cross-shore feeding shows maximum retreat of 150 m at the North Jetty. The model results for linear shoaled waves and no feeding are between the model results using waves shoaled with SWAN.

CONCLUSIONS

Preliminary model results show that over the next two decades, net sediment transport is directed away from the stabilized entrances of Grays Harbor and the Columbia River. In order to maintain the present shoreline configuration sand must be supplied by the ebb-tidal deltas and the shoreface (and/or the Columbia River for the Long Beach and Clatsop

sub-cells). It is important to note that in no case does the shoreline reach equilibrium by 2020. The sediment budget analysis reveals that the erosion of the deltas cannot solely account for the accretion of the barriers. In this analysis the budget was balanced with sediment supplied from the shelf.

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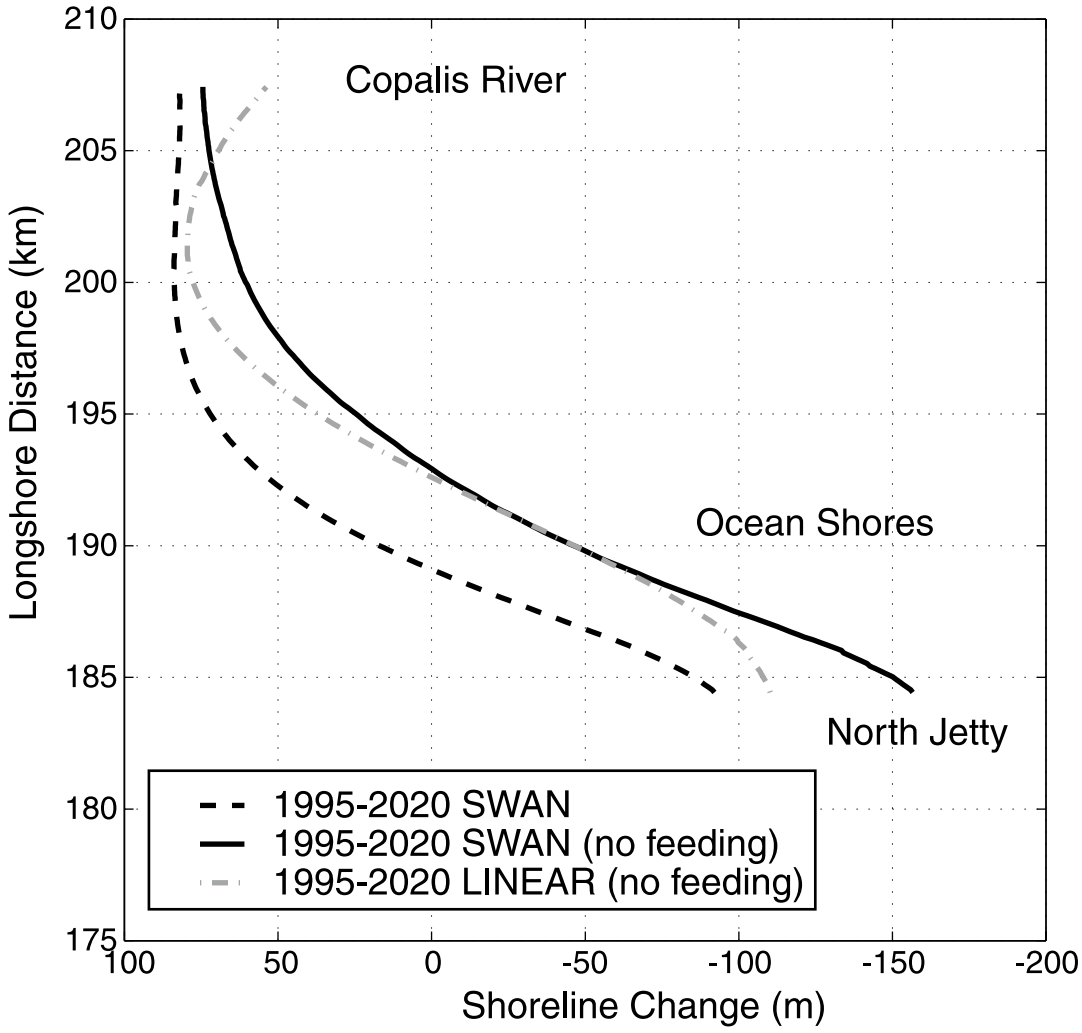

Figure 1. Predicted shoreline change in North Beach sub-cell under various scenarios.