Modeling gravity-driven deposition on the East China Sea continental shelf

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INTRODUCTION

- Sediment gravity flows occur on relatively gentle slopes of continental shelf when wave and tidal currents provide sufficient turbulence to keep the fine-grain sediment in suspension in bottom boundary layers.
- Two types of clinoforms, convergence and paralled ones, are reported in the distal mud area of Changjiang River, mostly in Zhejiang Fujian mud wedge area.
- The process-product relationship between sediment gravity flows and clinoforms need to be settled through in-situ observation data and modeling.

SITE DESCRPTION & MODEL INPUT

- Area studies & observation design. (Fig. 1)
- In-situ observations of flow profiles and suspended sediment concentrations (SSC) through four tidal cycles and two transects. (Fig. 2)
- Sea surface waves through the buoy for a month off the Oujiang River mouth. (Fig. 3)

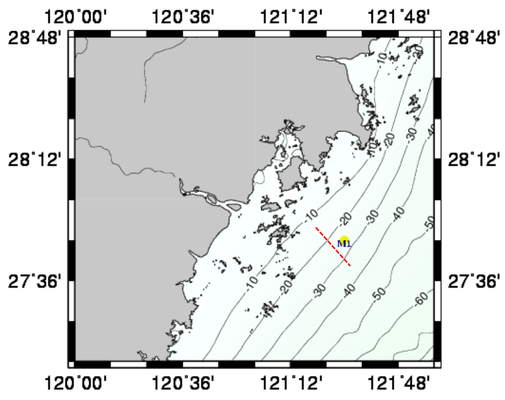

Figure. 1

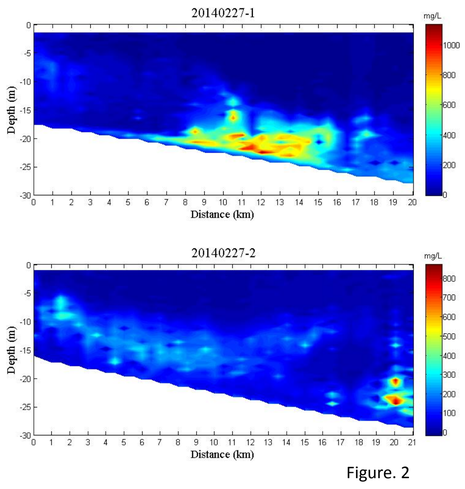

Figure. 2

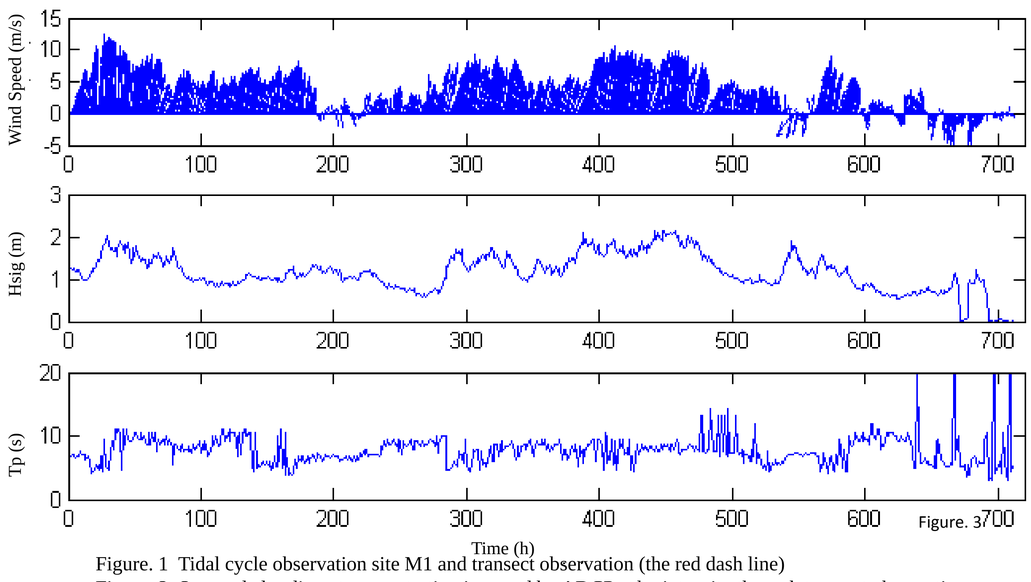

Figure. 3

Figure. 1 Tidal cycle observation site M1 and transect observation (the red dash line)
Figure. 2 Suspended sediment concentration inversed by ADCP echo intensity through transect observation.
Figure. 3 Characteristic values of winds and waves through buoy.

MODEL IMPLEMENTATION

- 1-D topography evolution model with the constant slope of initial bathymetric profile.
- Theoretical development with the Chezy Equation and control of Richardson number (Ri) from Wright et al. (2001) and Scully et al. (2002). The critical Ri (Ri_{cr}) is set as 0.25.
- 40 km model range and the 500 m spatial.
- 1 month temporal duration modeling with observation data; the long term modeling with the mean data.
- Without consideration of subsidence and extreme weathers.
- Five spatial low-pass filter before updating the bathymetry in every time step.

RESULTS

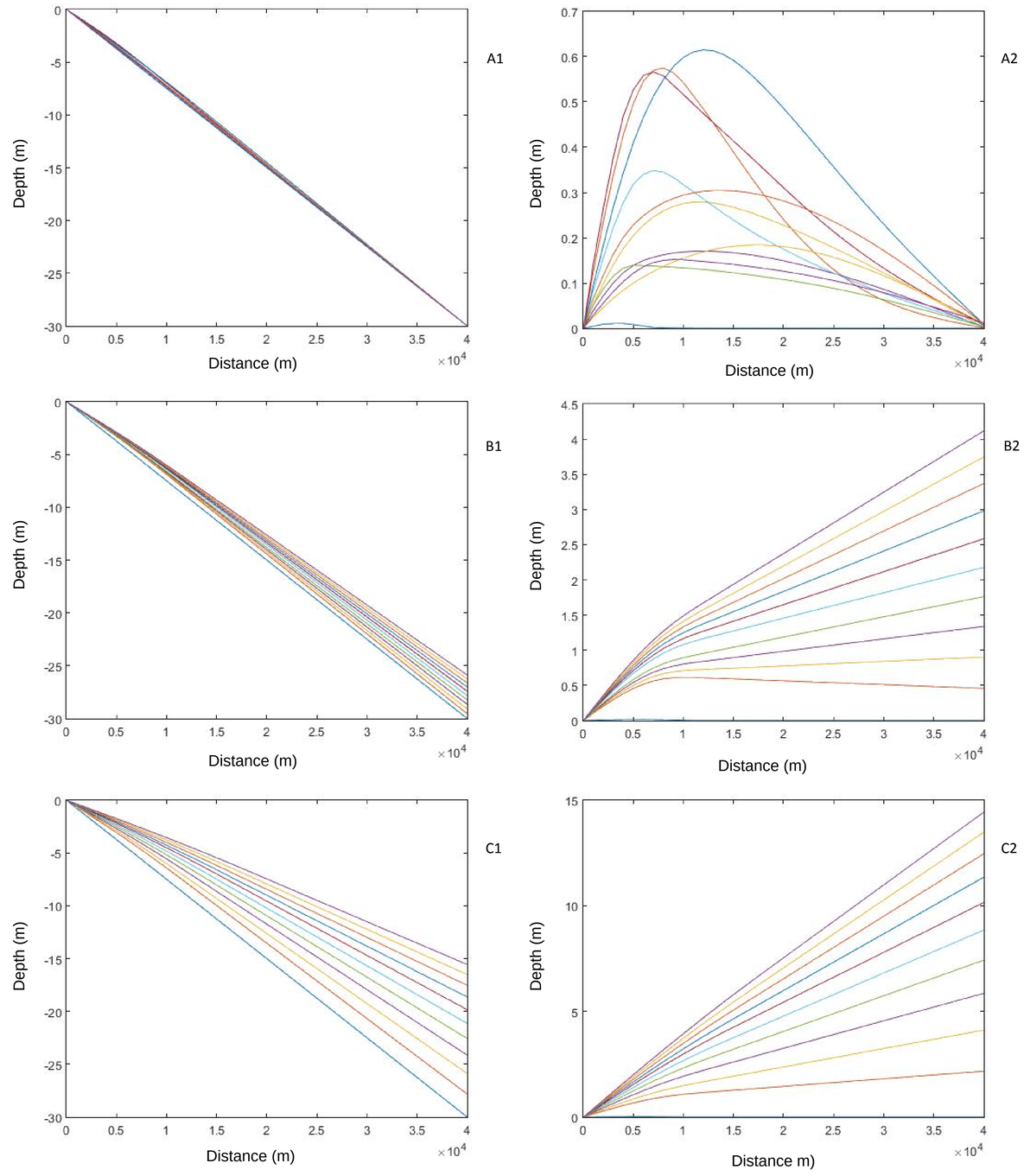

Figure. 4 Model results for the bathymetric profile.
A1, B1, C1 represent the bathymetric profile with 1 month, 100 years and 500 years of the model run time, respectively;
A2, B2, C2 represent the deposition thickness with 1 month, 100 years and 500 years of the model run time, respectively.

CONCLUSIONS

- Observations for a month seem to capture the sediment gravity flow signal with the maximal SSC ~ 800 mg/L.
- 1 month results correspond the evolution of convergent clinoforms, with the depocenter at the distance of ~ 10 km.
- Longterm results correspond the formation and evolution of paralled clinoforms, and the depocenter moves downslope with the extension of time duration.
- The evolution of clinoforms can be separated into two stages: the fast progradation stage with the morphology of convergenct clinoform, and the stable progradation stage with the morphology of paralled ones.

The study is financially supported by the Ministry of Science and Technology, China, through the project “Land–ocean boundary processes and their impacts on the formation of the Yangtze deposition system” (Grant Number 2013CB956500).

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