Development of an Integrated Wave-Current-Wind Forecasting System for Cook Inlet: Supplementing NCEP's Forecasting Efforts

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In past progress reports, the wave model (SWAN) and circulation model (EFDC) were considered to establish an operational system to provide forecasts of waves, surface elevations and currents for Cook Inlet, AK. The operational system also simulates the extent of "wet" and "dry" regions in coastal areas. These forecasts are updated daily on TAMUG website http://www.tamug.edu/mase/Wave_file. Our research work related to the development of the forecasting system was presented in AGU fall meeting 2013 held in San Francisco, CA. The title and the abstract of the presented work are given below:

Title:

Operational Coupled Forecasting of Waves and Coastal Inundation in Cook Inlet, Alaska.

Abstract

The Cook Inlet (Alaska) region exhibits the largest tidal fluctuations in the United States, and hence the nearshore regions encounter significant flooding and drying which poses threats to a variety of activities in coastal regions. A coupled wind-wave-current system is developed to obtain daily forecasts of waves and circulation pattern. The SWAN wave model and the quasi three-dimensional EFDC flow model are considered with high-resolution WRF winds. The coupled system also predicts the extent of "wet" and "dry" regions during a particular forecast cycle. The nested grid approach is utilized with high-resolution grids for two separate regions, namely the Kachemak Bay (KB) and the Upper Cook Inlet (UCI) region. The performance of these models is first verified using hindcast simulations. Good agreement between data and model results demonstrate the efficiency of the coupled system for operational forecasting.

Exploration of Satellite data/images

To validate the extent of wet and dry regions predicted by the model, we explored the available satellite data from Terra (MODIS) satellite. This work is in its early stages, and detailed work will be carried out in near future. However, during this period, we collected satellite data/images from different sources, and some of these images are shown here in Figs. 1-2. The images shown here depict two extreme situations of low tide and high tide. During the low tide event, the extent of "dry" regions is clearly visible in Fig. 1 from both modeled results and satellite images. Similarly, during high tide, the dry regions in Fig. 1 are not visible in the modeled

results and satellite data shown in Fig. 2. Two types of satellite images, the true color image and MODIS land reflectance (band 1-2) image are shown in Figs. 1-2.

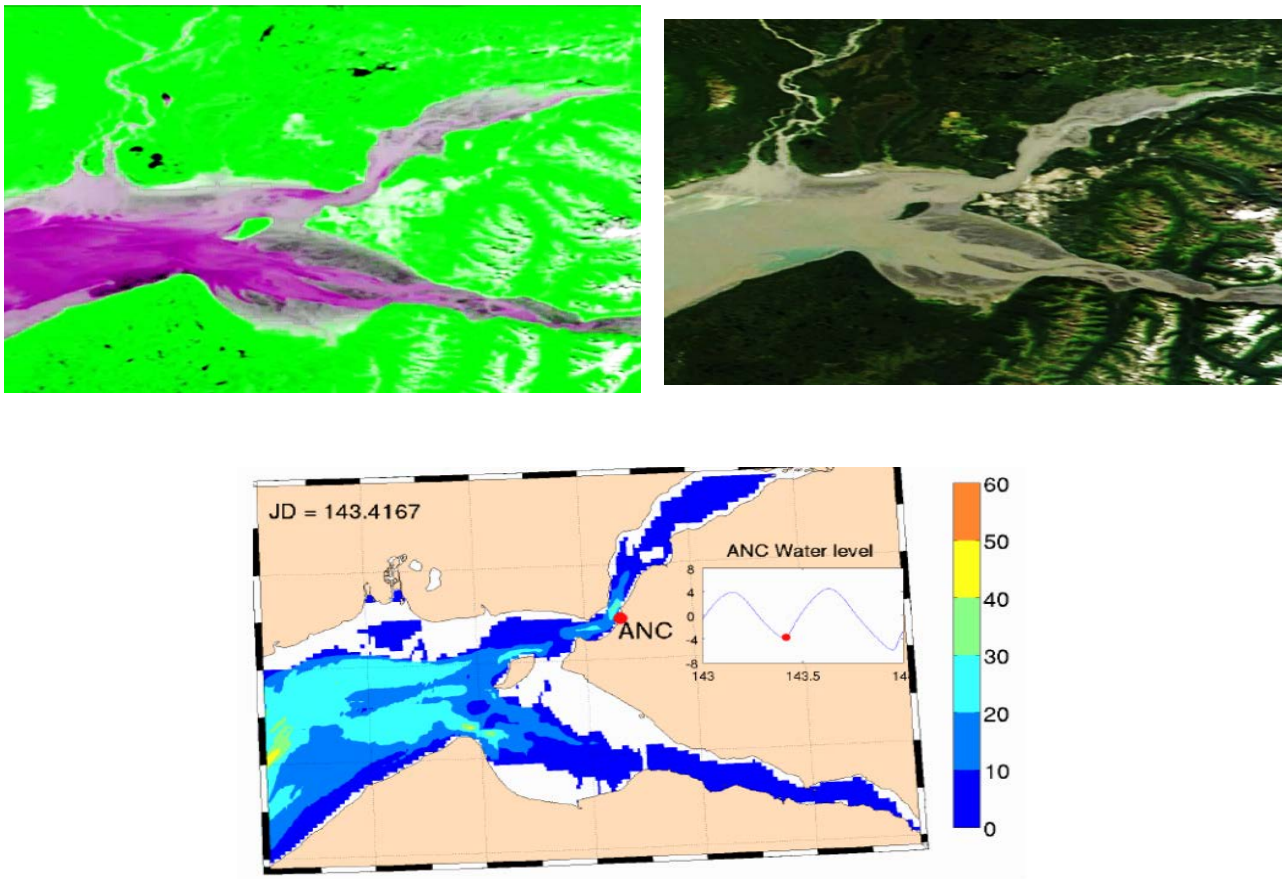

Fig. 1 A low tide event. True color satellite image (top-left) and land reflectance (band 1-2) image (top-right); Modeled results of sea surface elevation (bottom).

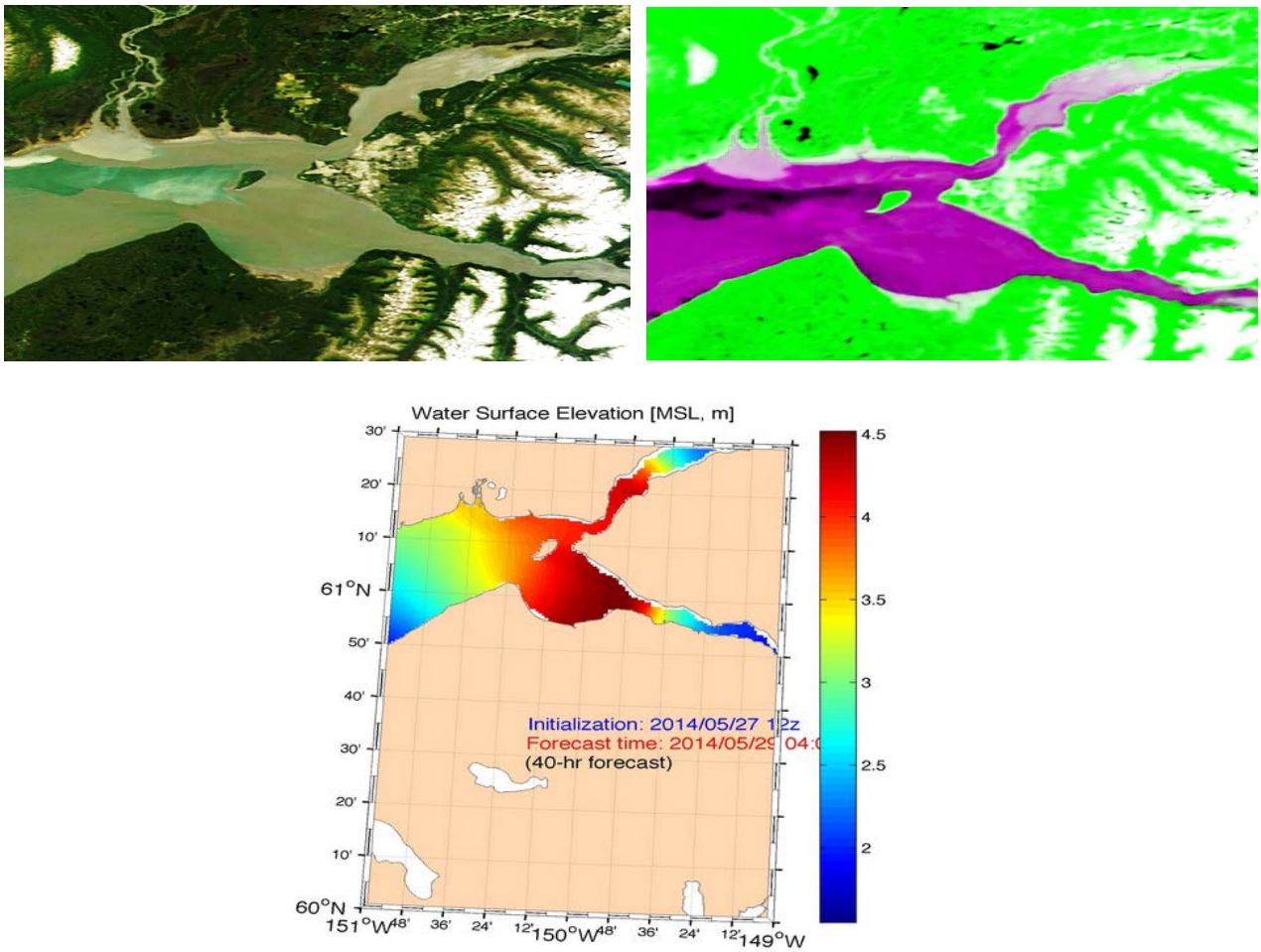

Fig. 2 A high tide event. True color satellite image (top-left) and land reflectance (band 1-2) image (top-right); Modeled results of sea surface elevation (bottom).

During this reporting period, we also worked towards exploring the possible ways of technology transfer from TAMUG to the NWS Anchorage office. We communicated with Mr. James Nelson and his colleagues at the NWS office to discuss these options. It was decided that we will receive a computer from the NWS office to which our forecasting protocol together with other the required software will be transferred. In addition, Mr. James Nelson suggested that we use the WRF winds forecasted at the NWS office, instead of (or in addition to_) the windfield we are presently using (i.e. those developed by Dr Peter Olsen at the University of Alaska). An ftp link will be established in near future for receiving the WRF windfields to be provided by Dr Nelson.