Comparison of Longshore Currents with NGOFS Predictions
Dell, Larry, Picarazzi, Gabriel, Picarazzi, Francesca and Tissot, Philippe
Texas A&M University-Corpus Christi
Conrad Blucher Institute

Introduction/Background
Accurate nearshore measurements and predictions are important for oil spill responders, development of infrastructure along the coast, rip current warnings, and overall understanding of coastal processes. Two current profilers and wave sensors were installed on Bob Hall Pier at the end of Spring 2014 providing such measurements. During the same time frame the National Oceanic and Atmospheric Administration has made available predictions from its new Northern Gulf of Mexico Operational Forecast System or NGOFS. This new hydrodynamic model computes predictions for multiple data sets including water levels, currents, water temperature and salinity. NGOFS resolution is high and includes the full coast of Texas making it a promising tool. The goal of this project is to compare predictions and measurements and answer the following questions:

- How accurate is NGOFS for nearshore predictions in the Coastal Bend?
- Can NGOFS predictions be used instead of actual measurements?
- If the model is accurate what can we learn from NGOFS predictions?

Description of NGOFS
The NGOFS model (Wei et al. 2015) was built using the Finite-Volume Coastal Ocean Model (FVCOM), an unstructured three-dimensional primitive equation based hydrodynamic model. The NGOFS grid is presented in Figure 1. Resolution ranges from 10 km in the open ocean to 600 meters close to shore. Predictions include water levels, water currents, water temperatures, water salinity, and wind velocity.

Methods
Comparison of the differences between measurements and model predictions were computed based on the following:

- A data base (Cassandra) was designed and populated with NGOFS nowcasts for the Bob Hall Pier location.
- Time series of longshore current measurements from a SonTek Argonaut SL-500 current profiler for a distance of 54 to 65m away from the sensor. Bin 5 is the furthest stable current bin for this experiment (Tissot et al. 2015).
- Average NGOFS longshore current predictions (computed based on orientation of the coastline and northward and eastward predicted currents) for sigma layers 8 through 33 to reflect a vertical profiler beam spread of approximately 4.3m at that distance.
- Time series of water level measurements at the NWLON station referenced to mean sea level (msl datum) and NGOFS water level predictions referenced to the same datum.

Discussion/Conclusions
- NGOFS predictions, longshore currents and water levels were compared with measurements at Bob Hall Pier, Texas for the period June 1st, 2014 to March 6th, 2015.
- Longshore current near BHP is under predicted by NGOFS but at a consistent rate. A linear correction to the output could be applied, yielding more accurate predictions with a resulting RMSE improvement from 0.14 m/s to 0.05 m/s.
- Instances of high wind events do not affect the accuracy of the predictions. Current during these events tend to stay near the same trend line for all the data.
- Agreement between water level predictions and measurements is closer. The predicted values are highly linearly correlated to the observed values. A smaller correction would improve the RMSE from 0.09 m to 0.07 m.
- The difference between predictions and measurements is partly due to comparing point measurements to average predictions over a grid cell.
- The statistically corrected model could be useful for coastal emergency responders, and coastal stakeholders in general.
- Future work will include assessing the accuracy over longer-term predictions.
- The performance of an experimental NOAA model, the Nearshore Wave Prediction System (NWPS), is in the process of being analyzed. Water level and significant wave height predictions are compared to measured values at Bob Hall Pier. That model has a considerably lower (square) grid resolution of about 3.76 square miles likely representing considerable lower (square) grid resolution of about 3.76 square miles likely representing a challenge for nearshore accuracy.
- This study will continue at least through July 2015 and will provide a more complete data set for assessments of these models and overall description of the nearshore processes at this important location. Accuracy low winds vs high winds.

References

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