Water Level Verification of Versions 1 and 2 of the Extratropical Surge and Tide Operational Forecast System for the Middle Texas Coast

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ESTOFS Model Characteristics

**Version 1**
- Implemented 09/28/2012
- ADCIRC East Coast tidal database grid (EC2001)
- Coastal resolution 3-5 km
- 254K nodes
- GFS 55 km forcing
- Does not allow inland flooding

**Version 2**
- Implemented 04/25/2017
- Hurricane On-Demand Forecasting System grid (HSOFS)
- Coastal resolution 200 m
- 1.8M nodes
- GFS 13 km forcing
- Allows inland flooding
Coastal Flooding Impacts

- Spring/Fall peak
- Usually lasts several days
- Restricted beach access
- Flooding of roads/property
- Businesses affected
- Economy/Tourism $$

Sandfest 2016
Thursday, April 28th, 2016

High Risk for Rip Currents Today
Coastal Flood Advisory in effect through Midnight Tonight
Water up to the Dunes
How “accurate” are ESTOFS water level forecasts during coastal flooding events along the Middle TX Coast?

Does Version 2 perform better than Version 1?
Study parameters

- 09/26/2015 – 04/02/2017 (Version 1)
- 04/27/2017 – 09/15/2018 (Version 2)

- Bob Hall Pier
  - NWLON

- Tide + Surge

- Coastal Flooding
  - ≥ 2 ft MSL
Study parameters

• “Pure” extratropical events.
  – Events involving Tropical Cyclones in the W Gulf were NOT used.

• Used all 4 runs/day, when available.

• Goal was to have forecasts thru at least 1-2 days associated with each observation.

• 370 Total Observations

• 8223 Total Forecasts
Water Level Observations and ESTOFS Version 1 Forecasts for Bob Hall Pier

Graph showing frequency distribution of water level measurements with observed (OBS) and forecasted (FCST) data. The peaks at 0.3231 and 0.6533 indicate the most common water level MSL measurements observed and forecasted, respectively.
Water Level Observations and ESTOFS Version 1 Forecasts for Bob Hall Pier

3901 Forecast/Observation Pairs
Pearson Correlation Coefficient: 0.279
Linear Bias vs Lead Time of ESTOFS Version 1 Forecasts for Bob Hall Pier
Water Level Observations and ESTOFS Version 2 Forecasts for Bob Hall Pier

Frequency vs. Water Level MSL (m)

- FCST
- OBS

Notable water levels:
- 0.3383
- 0.6861
Water Level Observations and ESTOFS Version 2 Forecasts for Bob Hall Pier

4322 Forecast/Observation Pairs
Pearson Correlation Coefficient: 0.349
Linear Bias vs Lead Time of ESTOFS Version 2 Forecasts for Bob Hall Pier
ESTOFS Verification Summary for Bob Hall Pier

ESTOFS Version 1
• Bias: -0.330162 m
• RMSE: 0.360782 m*

ESTOFS Version 2
• Bias: -0.347794 m
• RMSE: 0.358529 m*

* RMSE 0.2 m for hindcast runs in 2009

Feyen J. et al., Establishing a Community-Based Extratropical Storm Surge and Tide Model for NOAA’s Operational Forecasts for the Atlantic and Gulf Coasts
Questions