

# A Continuous Operational Wind, Wave and Hydro. Hindcast of The Arabian Gulf Using The ADCIRC+SWAN Model

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Alex Crosby   Michael Parsons   Liz Orelup

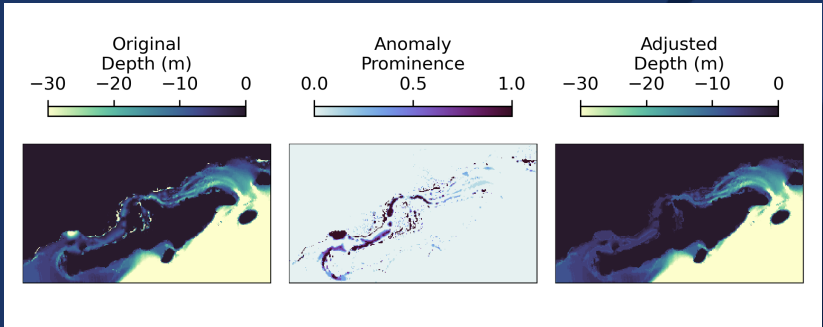
2025-09-23

Oceanweather Inc., Stamford CT, US 06901

# 1 PERGOS-3 *Hindcast Summary*

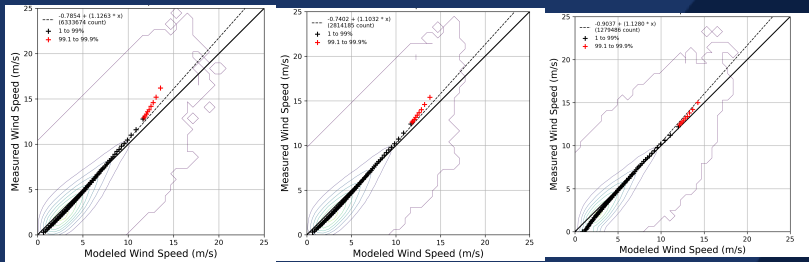
- **Hindcast Period:** 1960-01-01 through 2024-12-31
- **Variables:** Met., Wave and Hydro.
- **Spatial Resolution:** 500m-6km (unstructured mesh)
- **Latitude Coverage:** 23.14° to 30.5° N
- **Longitude Coverage:** 47° to 56.4° E
- **Met. forcing:** ERA5 with stat. adj. and kinematic analyses
- **Tidal boundary:** TPXO9
- **Previous Hindcasts:**
  - *PERGOS (2005)* 1983-2009 (+ earlier storms)
  - *PERGOS-2 (2018) with DHI* 1979-2018 (+ earlier storms)

## 2 Bathymetry



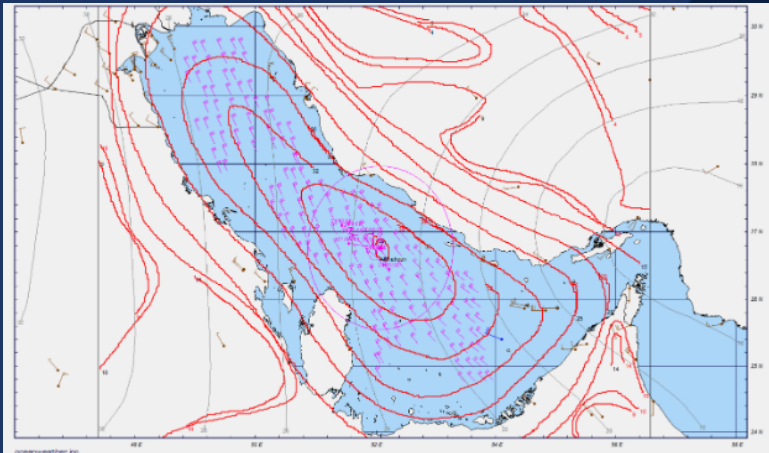
**Figure 1:** Examples of coastal bathymetry errors (center, prominence  $\pm 0.5$ ) in GEBCO and the results of the applied correction methodology (right), with depth in meters provided as positive up.

### 3 Wind field statistical adjustments



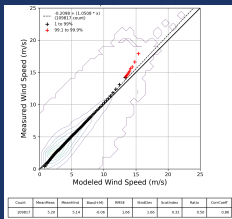
**Figure 2:** Wind speed (WS) 10m height effective neutral comparisons between model fields and satellite ASCAT(-B,-C), OCEANSAT2, and RAPIDSCAT instruments.

## 4 Kinematic analysis of storm population

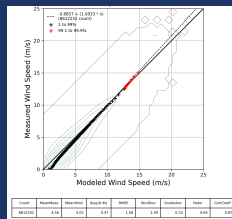


**Figure 3:** Expert-in-the-loop data assimilation storm reanalysis with the Interactive Objective Kinematic Analysis (IOKA) methodology in the Wind WorkStation (WWS) software for population of 189 storm events.

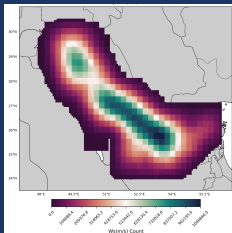
## 5 Wind Results



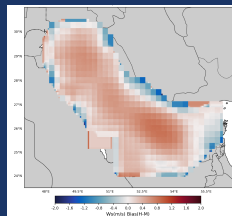
(a) Model WS vs. in-situ



(b) Model WS vs. scatterometer

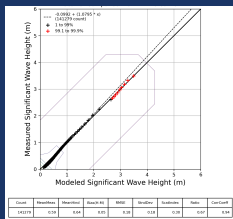


(c) Scat. counts within 55km

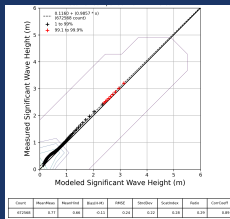


(d) Scatterometer WS bias

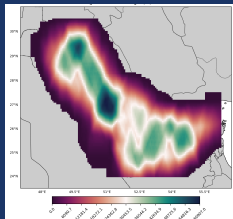
## 6 Sig. Wave Height Results



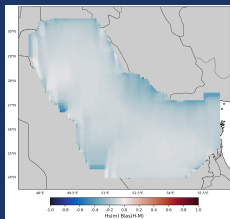
(a) Model HS vs. in-situ



(b) Model HS vs. altimeter

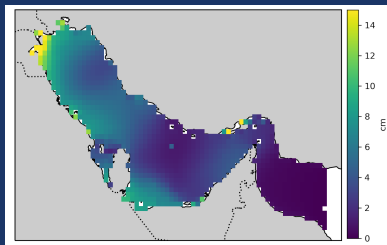


(c) Alt. counts within 55km

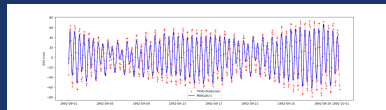


(d) Altimeter HS bias

## 7 Water Level Results



**(a)** Phase-weighted Tidal Amplitude root mean square error (RMSE) in cm with PERGOS-3 compared against the TPXO9 dataset of satellite derived tidal harmonics.



**(b)** Time series water level comparison between modeled (blue) and TPXO prediction (red) in the central Gulf for September 1992.