



Fleet Numerical Meteorology and Oceanography Center

Current Sub-seasonal to Seasonal Capabilities

presented at Workshop on Metrics, Post-Processing, and Products for S2S
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Team FNMOOC

- Diverse team of highly-educated, technically proficient and warfighting-experienced Sailors, Civilians and Contractors.
 - Center located in Monterey, CA
 - 18 Officers
 - METOC, IP, SWO, Intel
 - 25% MS Degree
 - 90% Warfare qualified
 - 150 Civilian & 30 Contractors:
 - Predominantly Physical Science and Computer Science
 - 9% PhD, 30% MS Degree, 35% BS Degree
 - 35 modelers and forecasters at Stennis Space Center, MS





Our Mission: Physical Battlespace Awareness

Observations

Models

Forecasting

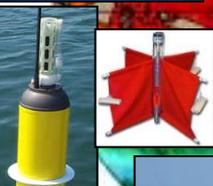
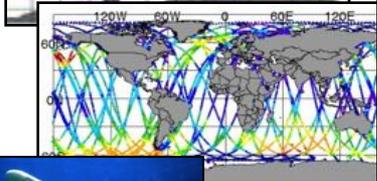
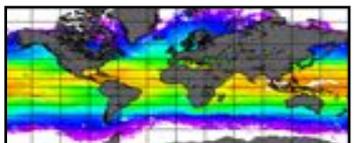
Reach Back

Atmos/Ocean Modeling

- 3D Full Physics / Assimilation
- Automated Forecasts to 7-10 days
- Nesting / Boundary / Bathymetry
- NEP-Oc Web production
- Monitoring daily / Supercomputers

Oceanographers

- Configure models
- Interpret forecasts
- Evaluate uncertainty
- Tailor ocean analysis

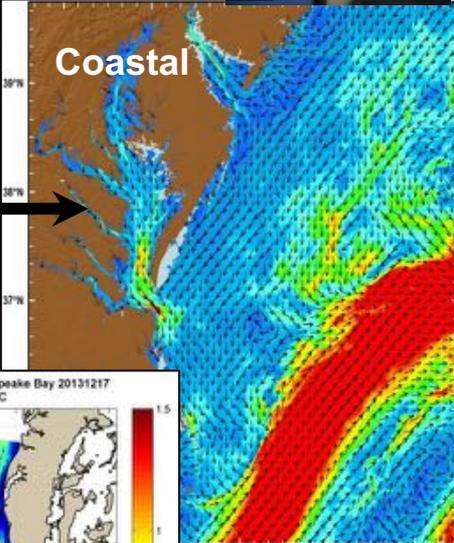
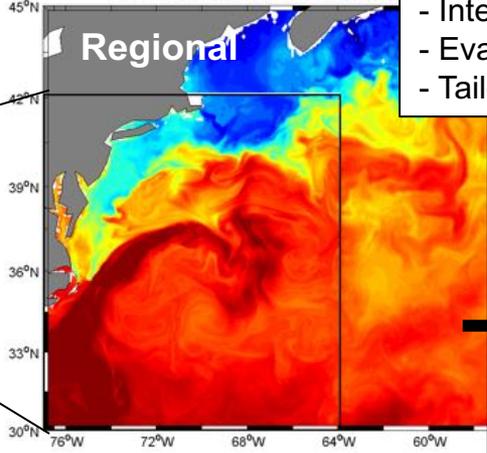


Global

Temperature at 0m for 21 May 2011

Regional

Coastal



Surface Current Speed (kts) and Direction for Chesapeake Bay 20131217
Model time: 17-Dec-2013 00:00UTC

Chesapeake Bay

- Weather
- Currents
- Temperature / Salinity
- Sea Surface Elevation
- Sound Speed
- Waves
- Storm Surge

NAVGEN / COAMPS

Fleet Numerical...

Atmospheric & Oceanographic Prediction Enabling Fleet Safety and Decision Superiority...



Current S2S Capability = Climatology Division

Static Climate Products

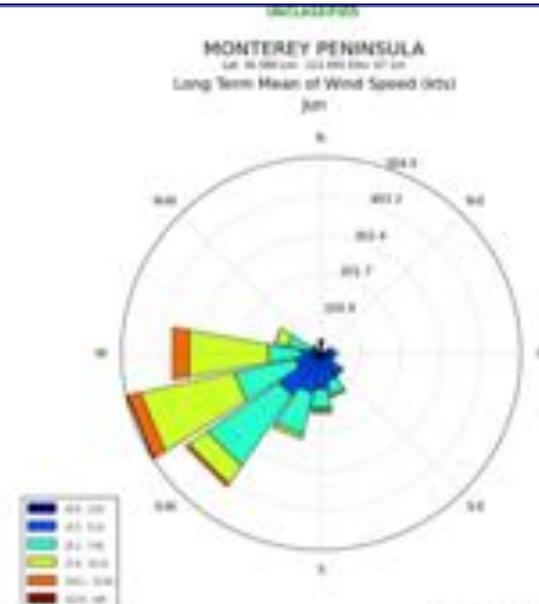
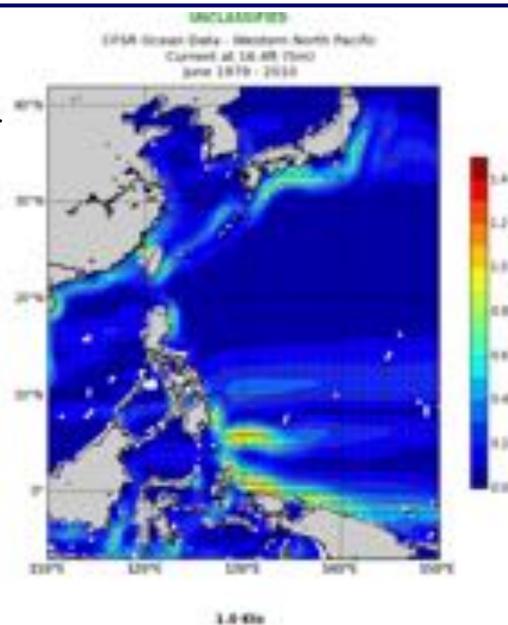
- Pre-made climate analysis information for regions of interest to the Navy and DoD
- Forecaster handbooks, port guides
- Currently over 2800 static products

On Demand & Dynamic Climate Products

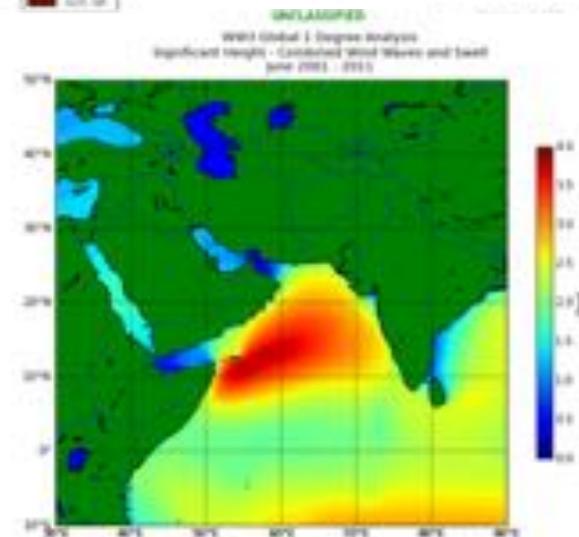
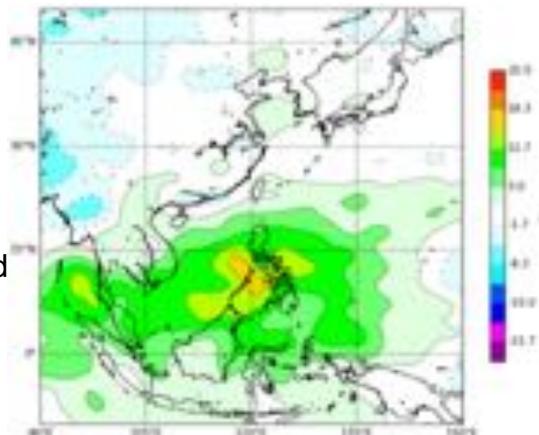
- Advanced Climate Analysis and Forecasting (ACAF) system (web app)
- Based on statistical analysis of reanalysis datasets and observations

Tailored Climate Products

- FNMO's Warfighting Support Team receives on average 8-10 climate-related inquiries a week resulting in a tailored product.



Cloud coverage anomalies during La Niña winters

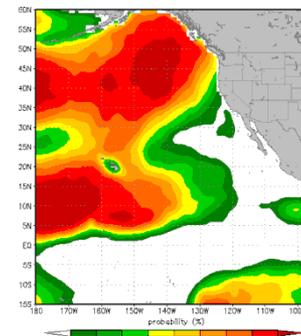
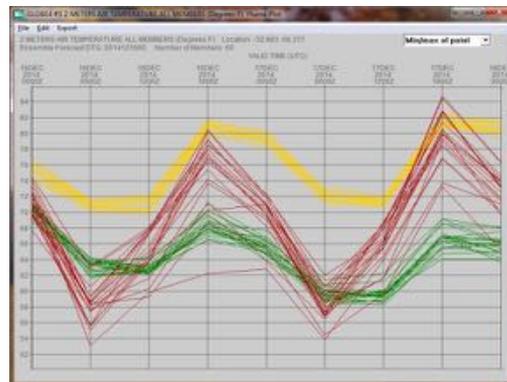
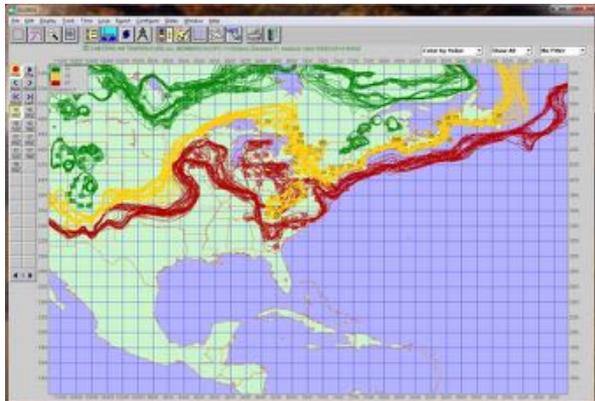




FNMOC Global Ensembles – “not” S2S

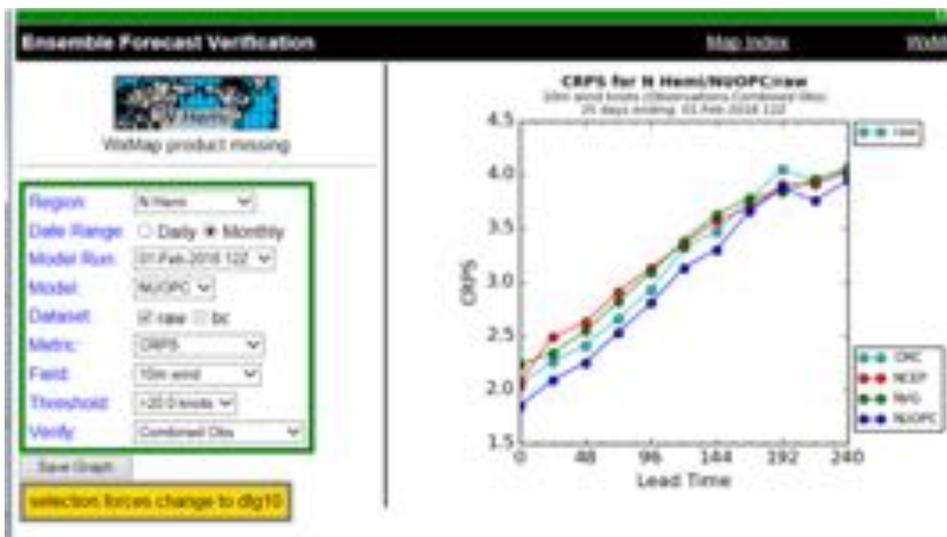
Products

- Means, potential error, thresholds
- On-demand “spaghetti”, plumes



VT: Thu 12Z 07 APR 16
 FNMOC EFS (U) Probability of Significant Wave Height > 5 ft
 Run: 2016033000Z Tour: 204
 Members Available: NRG 20 GFS 20 CMC 0
 Approved for public access. Distribution is unlimited.

Robust, on-demand verification

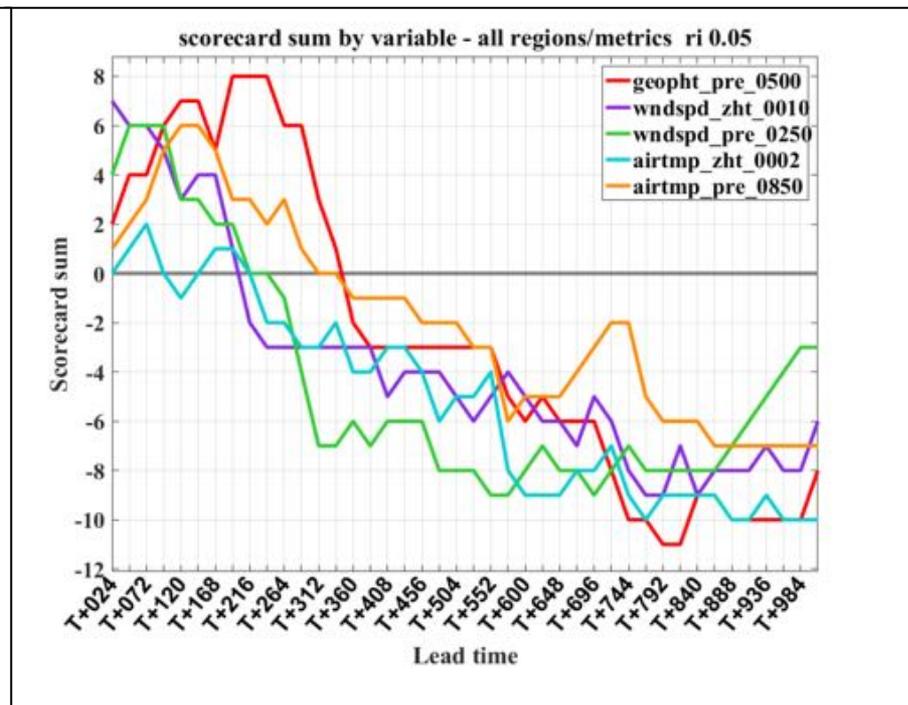
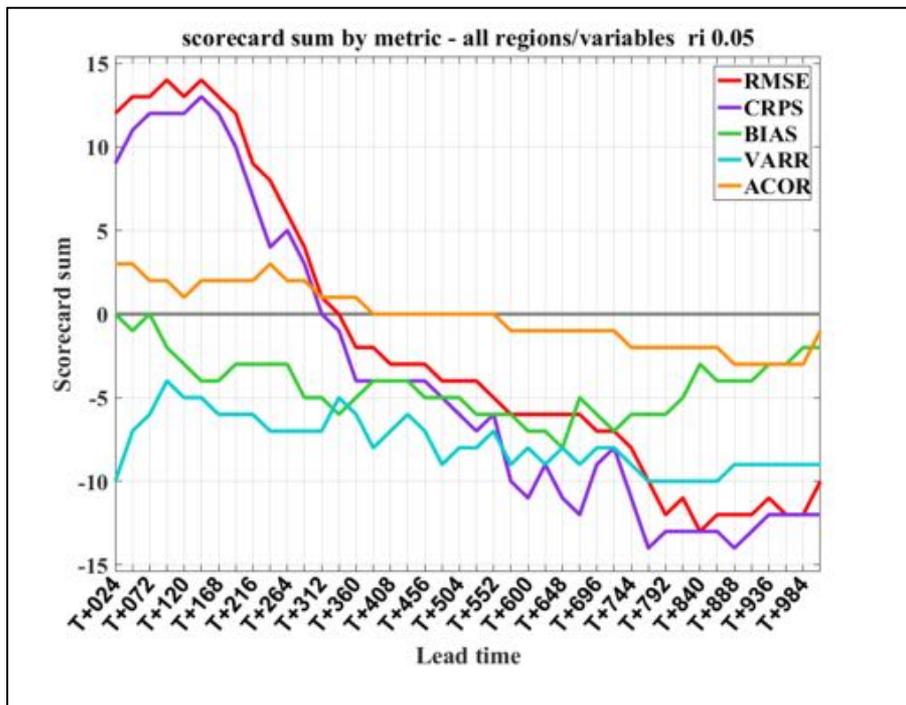


	Atmosphere	Ocean Waves
Model	NAVGEN v1.4.1	WW3 v
Initial Uncertainty	2-layer, 9-band ET with analysis error adjustments	10-m winds from NAVGEN ensemble
Model Uncertainty/ Stochastic	SKEB with moisture convergence mask	none
Daily Frequency	00, 12 UTC	00, 12 UTC
Resolution	T359L60 (37km)	0.5 deg
Control	Yes	No
Ensemble Members	80 for DA, 20 for long forecast	20 for long forecast
Forecast Length	16 days	16 days
Post-Process	Time lagged bias correction with ensemble mean	State dependent bias correction



Towards S2S- Extended Range Scorecard Methodology

1. Calculate the paired difference between the ESPC and ECMWF ERA-Interim for a range of metrics and parameters.
2. Test the statistical significance of the average paired difference.
 Score +1: Statistical significance exceeds 95% threshold AND relative improvement $\geq +5\%$
 - 1: Statistical significance exceeds 95% threshold AND relative improvement $\leq -5\%$



McLay et al. 2016: "Validation Test Report NAVGEM 42d Intra-Seasonal Ensemble Forecast System (EFS)", unpublished NRL report



Towards S2S – FNMOC Reanalysis & Reforecast Project

Current time lagged bias corrections produce “mixed results”

- Duration: 1/01/1999 to present, and continue with real-time runs. Expect to start reanalysis and retrospective runs in late 2018.
- Both reanalysis and reforecast will be run at the same resolution of T359L60 (37 km). Reforecast output will be saved on 1/2° grids.
- Reanalysis will be done with the currently operational NAVGEM for **consistency**, including AMSU data from NCEP starting 1/01/1999.
- Preliminary test of reforecast with the reanalysis data has indicated improved accuracy over the old analysis.



Towards S2S – FNMOC Reanalysis & Reforecast Project

Continuous reforecast system will enable faster model upgrades

- Ensemble perturbations will be cycled every 6h with the reanalysis, mimicking the real-time operation. **Complete one-month reforecast available in 30 days.**
- Ensemble reforecast will be run every 3 days, each with a 16-day forecast period for 11 members (control + 10 perturbed members).
- Ensemble reforecasts will be used to augment our current bias correction technique with bias statistics from the past history.
- Probability distributions from the reforecast history will be used to adjust the ensemble spread and probability products on an individual variable basis (most likely winds and seas first).