Ecological Forecasting
Ecological Forecasting
(Efforts in Europe: e.g., U.K. Met Office)

Forecasting Ocean Assimilation Model recently transitioned to Nucleus for European Modeling of the Ocean as a core ocean modeling component
A testbed region (GLBa0.24) was made and set up for implementation of on-line coupling of NPZD-type ecosystem models.
Ocean Data Assimilation
(Navy Coupled Ocean Data Assimilation: NCODA)

Stage 1: Preliminary data sensibility error checks
Ocean Obs

SST:
NOAA (GAC, LAC),
METOP (GAC, LAC),
GOES, MSG, AATSR,
AMSR-E, Ship/Buoy
Profile Temp/Salt:
XBT, CTD, Argo Float,
Fixed/Drifting Buoy
Altimeter SSH:
Jason-1, Jason-2,
ENVISAT
Sea Ice:
SSMI/I, SSMIS
Glider:
Slocum, Sea-Glider,
Spray CTD

Stage 2: External data error checks
Ocean Data QC

Innovations

Stage 3: Internal data error checks
3DVAR

Incorporates
Forecast Fields + Prediction Errors
First Guess

Stage 4: Adjoint sensitivities

Adaptive Sampling Data Impacts

Analysis Components (QC + 3DVAR)

HYCOM

Forecast Component

STAR JPSS Annual Meeting, 2016
NCODA Exercises
(GOMI0.04; 3DVAR w/ SSH, SST)

STAR JPSS Annual Meeting, 2016
Neural Network Application
Neural Network Applications
(status)

• Neural Network (NN) technique applied to ocean color applications — gap-filling, consistent ocean color, etc.

• NN: robust, flexible, accurate, and computationally cheap

• In-house expertise from Dr. Vladimir Krasnopolsky

• Exploits statistical linkages between ocean biological parameter (e.g., chlorophyll-a) and upper ocean variables (e.g., SST, SSH, Argo Temperature & Salinity profiles, etc)
Neural Network Applications

(status continued)

• Basic premise: (a) inputs — SST, SSH, etc., — are stable, and (b) relationship between chlorophyll-a and inputs holds over time

• NN trained on NASA/VIIRS (2012-2014), applied to 2005-2014 to reconstruct chlorophyll-a

• Results: stable over time, accurate (Krasnopolsky, et al., Computational Intelligence and NeuroScience., 2015)
Neural Network Applications (results)

- NN trained on daily VIIRS yields promising results
- Good fidelity in western equatorial Pacific
- Significant errors in eastern equatorial Pacific, possibly due to upwelling
- May need more input diagnostic variables from ocean models (upwelling velocities, horizontal advection, etc.)
- NN trained on monthly SeaWiFS, expected (Spring 2017)
- NN trained on SeaWiFS will produce consistent chlorophyll-$a$
On-going or ToDo List

• Science quality VIIRS products and thermal structure effects

• On-line coupling of NPZD-type ecosystem model

• Added complexities (e.g., 9-component including carbon and dissolved oxygen sub-modules)

• Ocean color (SeaWiFS/VIIRS) data assimilation (2DVAR) into BGC-coupled RTOFS-Global

• NCODA implementation for physical/biogeochemical variables (3DVAR)