Introduction to West Coast Ecological Forecasting

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Very important topic that is receiving a lot of attention in several international organizations:

**PICES** – North Pacific Marine Science Organization (Working Group on “Climate and ecosystem predictability” joint with **CLIVAR**)

**ICES** – International Council for the Exploration of the Sea
NOAA MAPP Marine Prediction Task Force

A Research Initiative to Advance the Seasonal Prediction of Living Marine Resources and Coastal High Water Levels

Leads: Antonietta Capotondi, Mark Merrifield, and Mike Jacox

Program Manager: Dan Barrie
Goal: Coordinate the activities of researchers supported through the MAPP-National Marine Fisheries Service (NMFS) Fiscal Year 2017 grant competition

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Use the experience from the 8 projects participating in the MPTF to assess the major data limitations to ecosystem (or physical ecosystem drivers) forecasting.

Projects focus on different regions along the U.S. coasts

They use both statistical and dynamical forecasting approaches
Statistical Forecasting

Approaches

• Multiple Linear Regressions to relate large-scale climate variables to ecosystem variables or ecosystem drivers

• Self-organizing maps to relate synoptic meteorological fields to ocean variables, i.e. SSH

• Linear Inverse Modeling (SST, SSH)

Observational Needs

Long data records to establish robust statistical relationships between predictors and predictands.

SSH appears to be a very important variables in several applications (also for ocean reanalyses). Importance to continue the altimeter programs
Dynamical Forecasting

High-resolution regional models (CCS, Pacific Northwest, Bering Sea) largely benefit from local observations to aid in the development, validation of the model.

However, regional models use output from global models for their lateral boundary conditions and surface forcing.

Thus, global ocean reanalysis and realistic global models are very important also for regional applications.

In particular, global surface fields from satellite (SST, SSH, Chlorophyll) are extremely important to constrain reanalysis, initialize forecast system and in model development and validation.
There are initial efforts for biogeochemical data assimilation, and biogeochemical forecasting. Data limitation is an issue.

- Global climatology of biogeochemical variables for model initialization is missing
- Spin-up for biogeochemistry is longer than for the physics
- Observations are also very sparse for model validation

There is a large diversity of ENSO impacts on the CCS. Important factors include:
- Importance of long-term monitoring
- Properties have different spatial patterns at the surface and at depth
- Importance of sampling over the water columns
- Largest anomalies are in some cases located in narrow bands near the coast

Turi et al. 2018
Biogeochemical Modeling and Forecasting Needs

- Satellite measurements of chlorophyll
- Biogeochemical Argo floats
- Coastal observations of key biogeochemical quantities (O₂, PH, CO₂ partial pressure)