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

NOAA MAPP Marine Prediction Task Force

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

Coastal High Water Levels

2 Application areas

3 Common Objectives

Living Marine Resources

Predictability Sources	Prototype Prediction tools	Exploratory Products

OceanObs'19 Paper: "Observational needs Supporting Marine Ecosystems Modeling and Forecasting: Insights from U.S. Coastal Applications"

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.

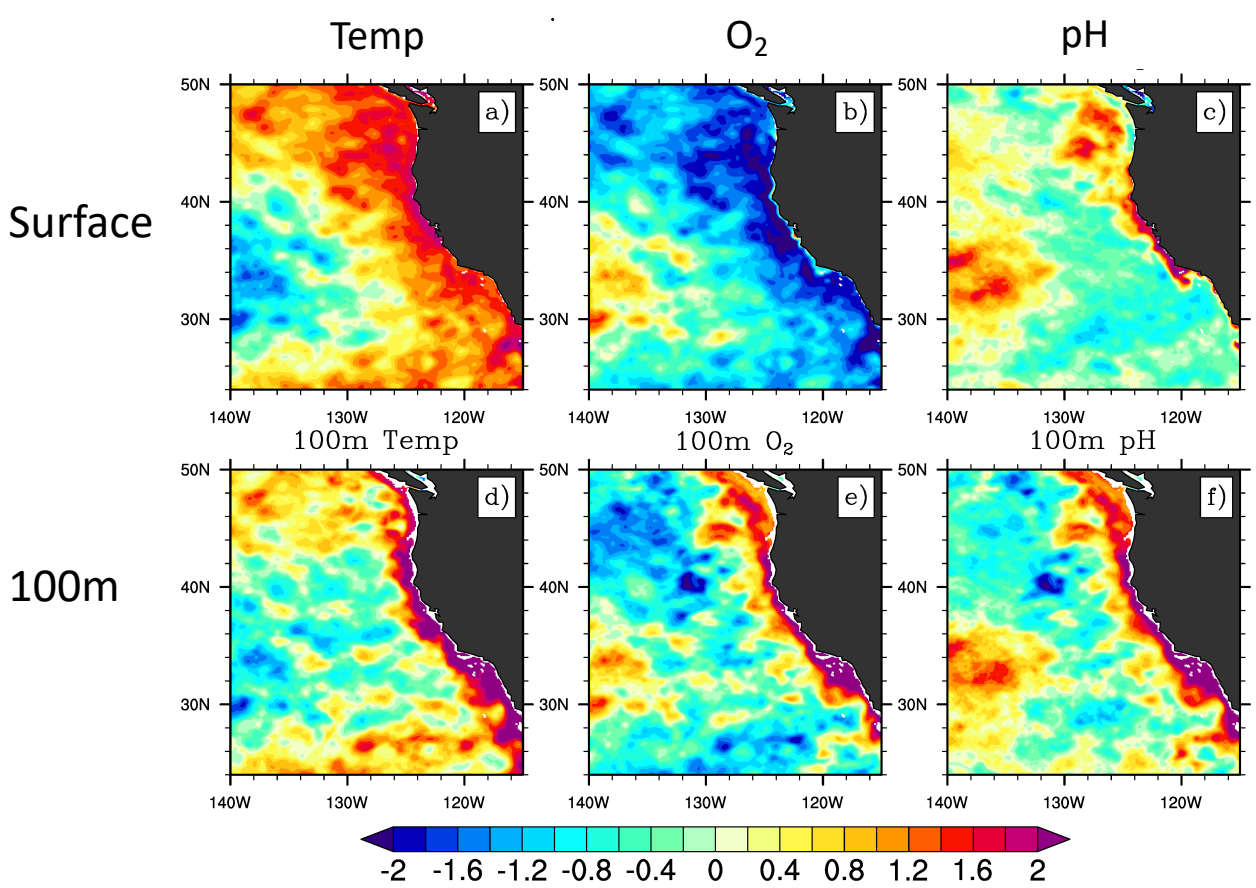
Thus, global ocean reanalysis and realistic global models are very important also for regional applications.

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.

Biogeochemical Modeling and Forecasting

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 -> 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 -> Importance of high-resolution measurements

Turi et al. 2018

Biogeochemical Modeling and Forecasting Needs

- Satellite measurements of chlorophyll
- Biogeochemical Argo floats
- Coastal observations of key biogeochemical quantities (O_2, PH, CO_2 partial pressure)