



Microsoft Research

Faculty Summit

2014 15TH ANNUAL

- Parker MacCready: *Univ. of Washington*
- Rob Fatland: *Microsoft Research*
- Wenming Ye: *Microsoft Research*
- Nels Oscar: *Microsoft Research*

Ocean Modeling:
*Using the Cloud to Connect
Science & the Public*



LiveOcean: *Daily Forecast Model of Regional Ocean Circulation and Chemistry*

Funded by Washington State

Earlier model development funded by NSF, NOAA, DOE

Focused on Ocean Acidification

When CO₂ from the atmosphere dissolves into seawater it makes it more acidic.

Harder for larval oysters to grow shells => no natural set of oysters in Willapa Bay in 8 of last 10 years!

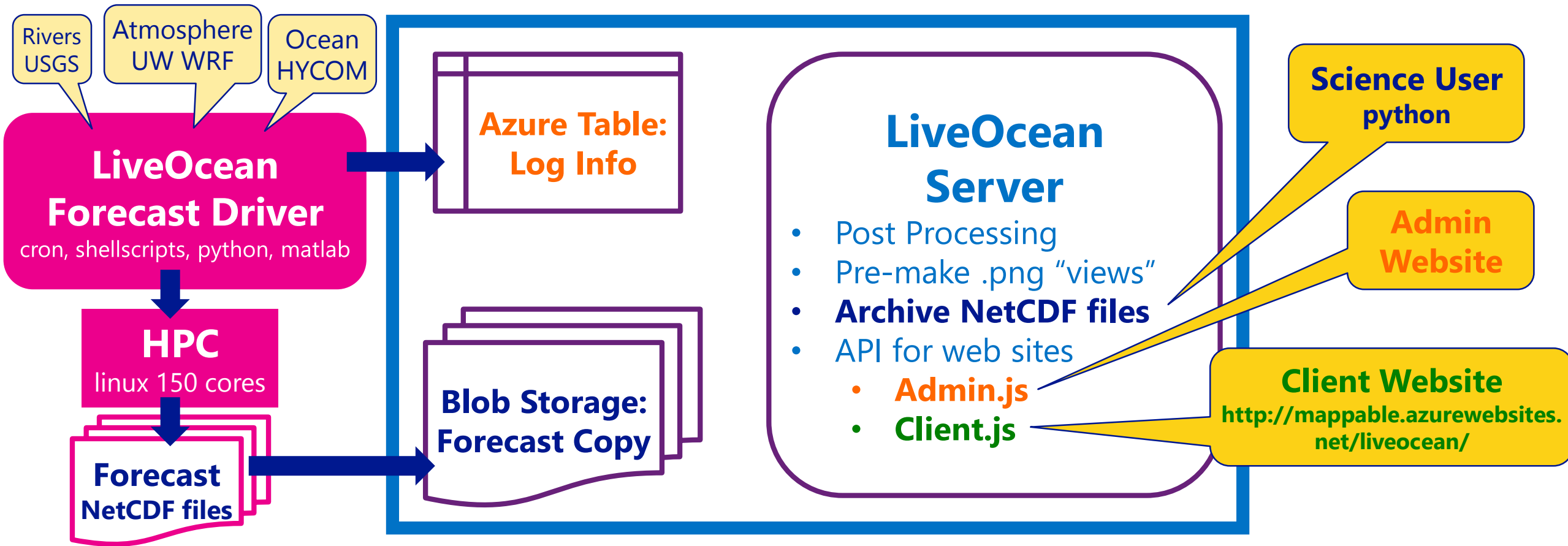
Who will use it? Oyster Growers

Did you know 7 out of every 10 oysters consumed in US are grown in Willapa Bay?

By changing hatchery operation in response to forecasts they may be able to continue operation.

LiveOcean: System Architecture

Use **Azure** for post-processing and web-delivery



Realistic Regional Ocean Modeling

Predicts 3-D Ocean currents and water properties (salinity, temperature, biogeochemistry) by numerical integration of Partial Differential Equations

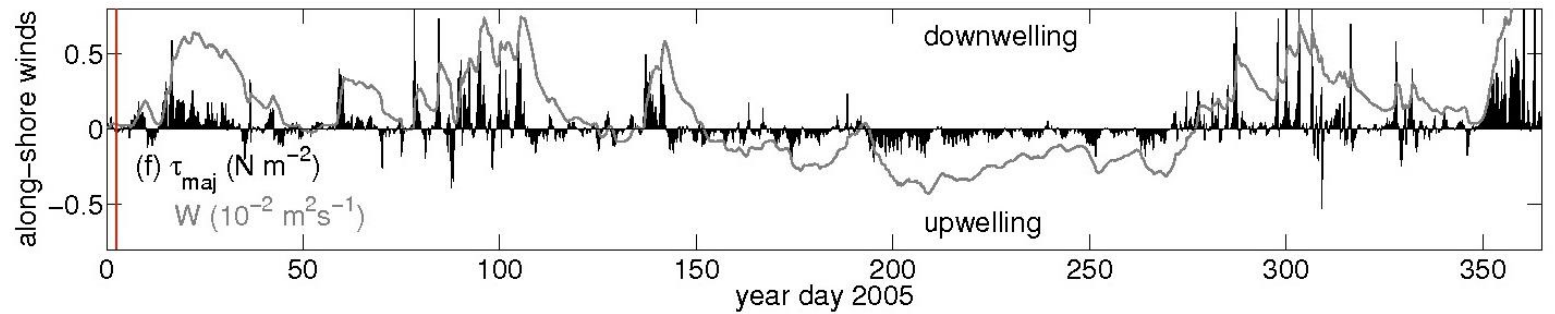
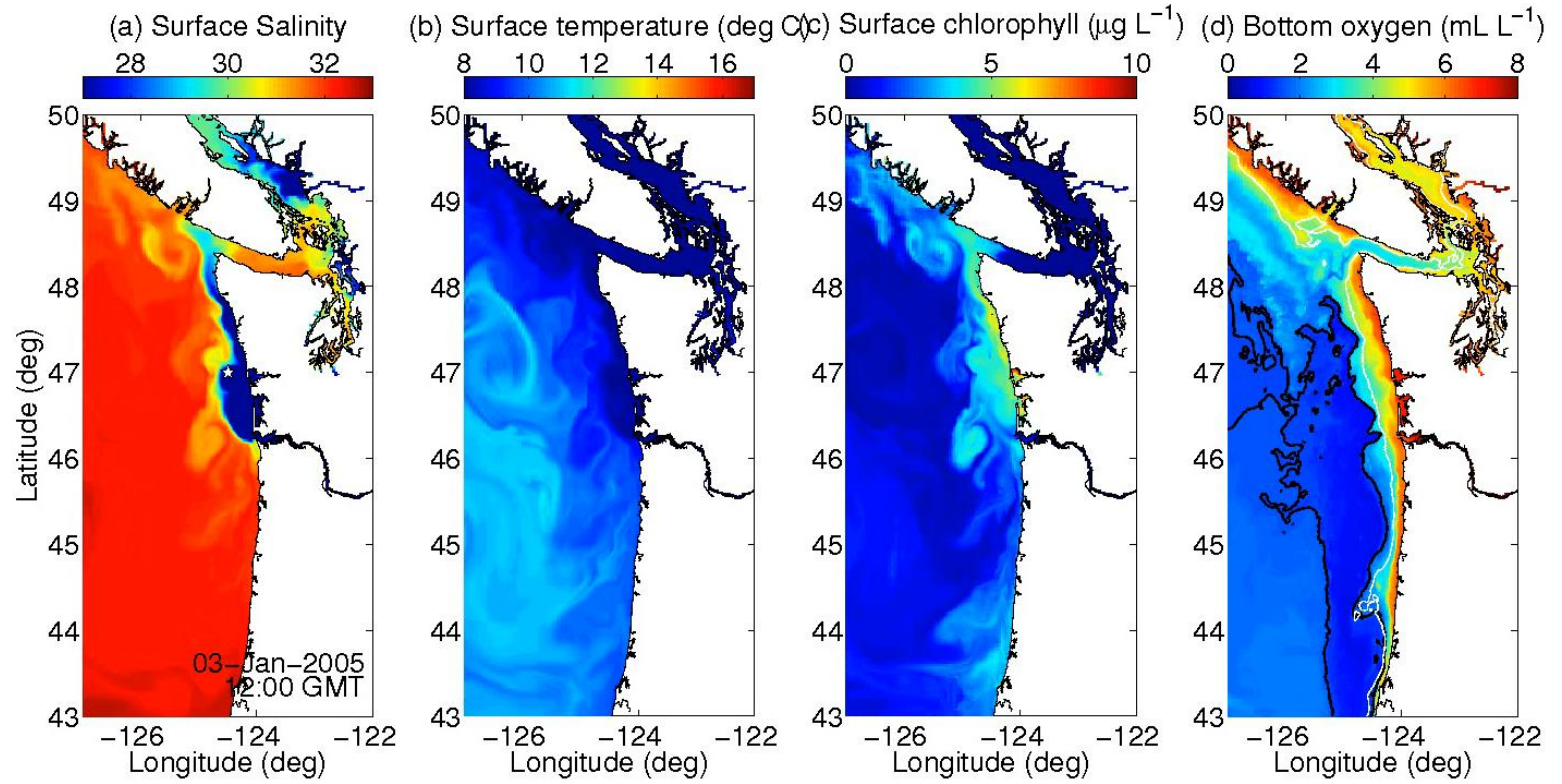
Relies on external data sources:

- *Bathymetry*
- *Wind and heating*
- *Open Ocean BC's*
- *Tides*
- *Rivers*

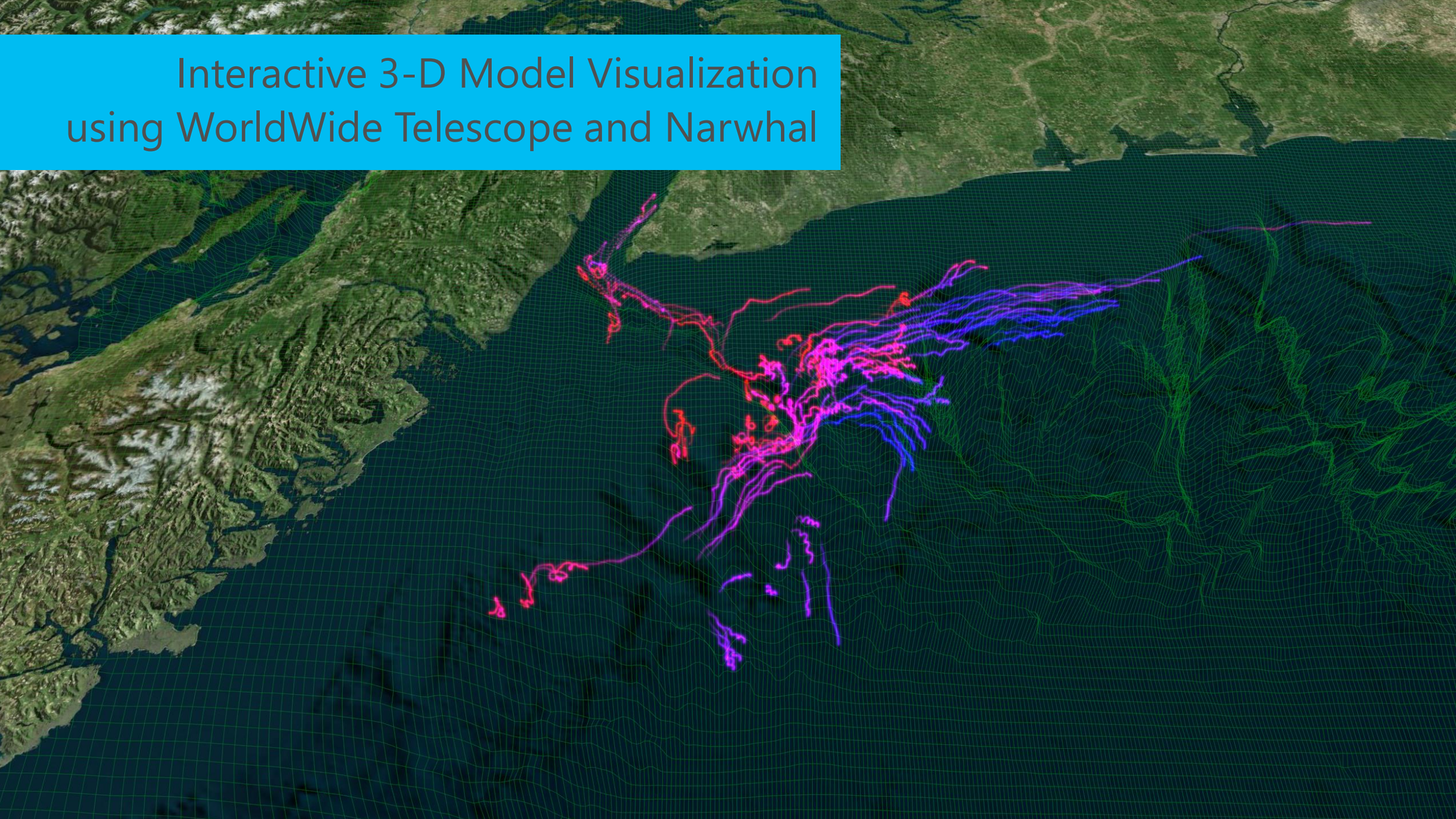
Model Movie



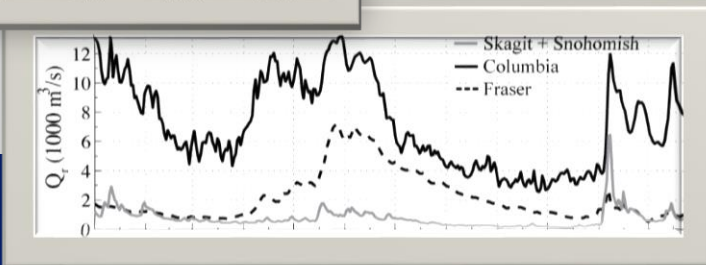
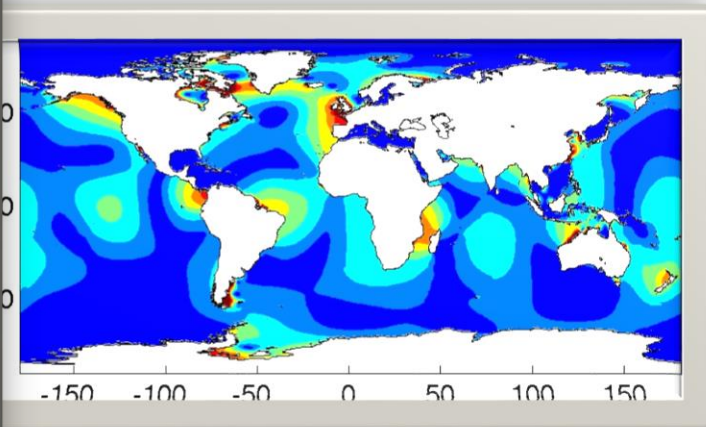
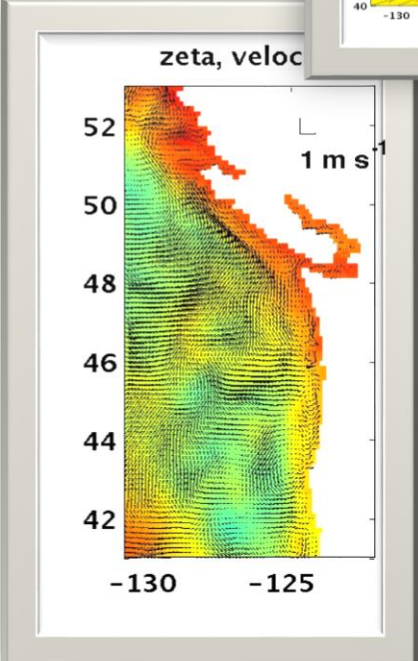
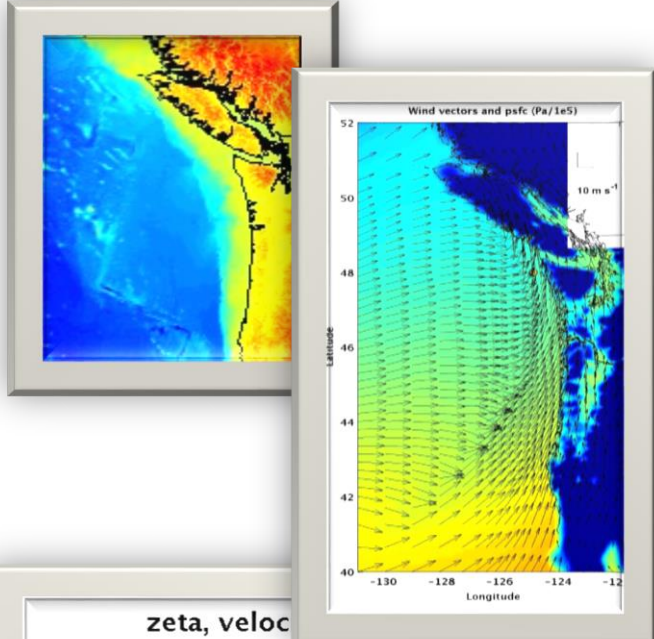
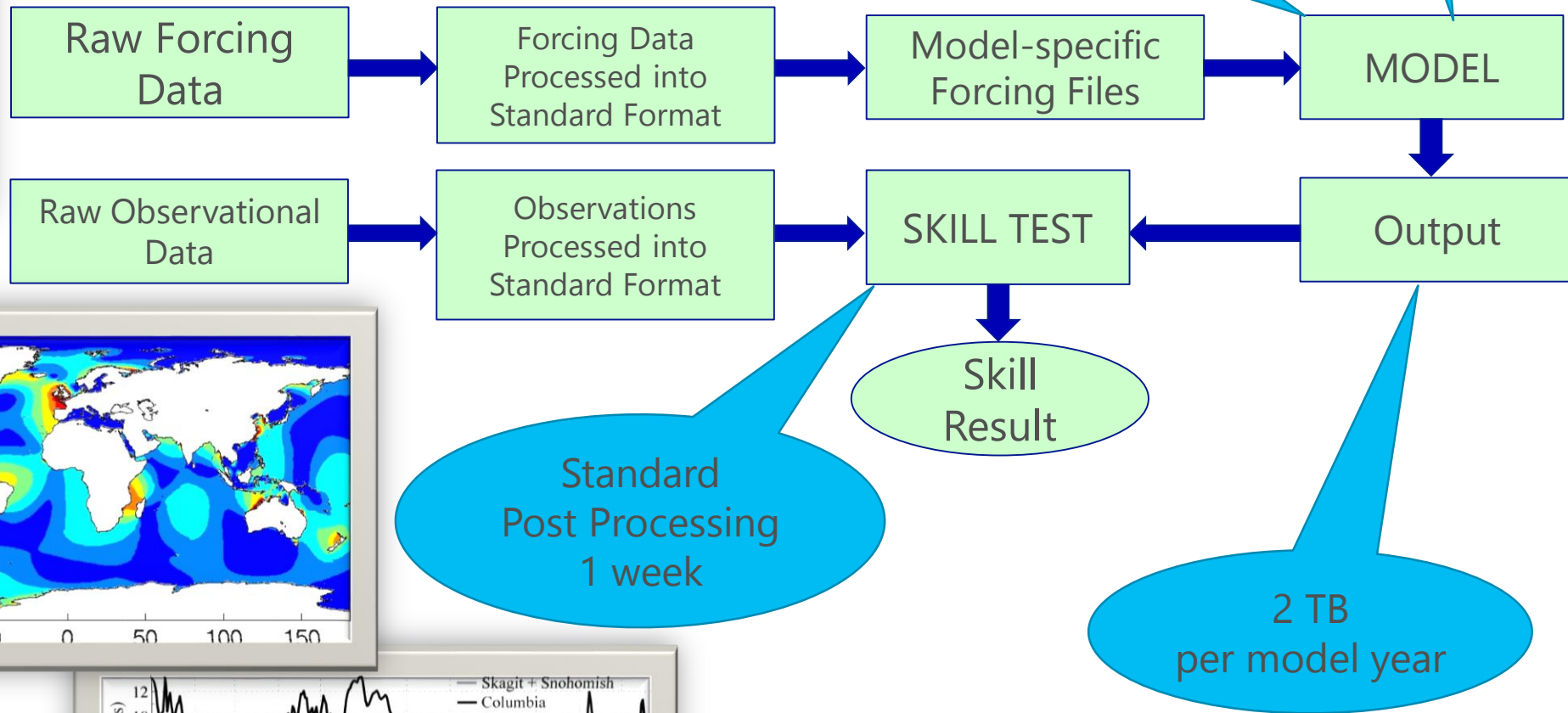
UW Coastal Modeling Group



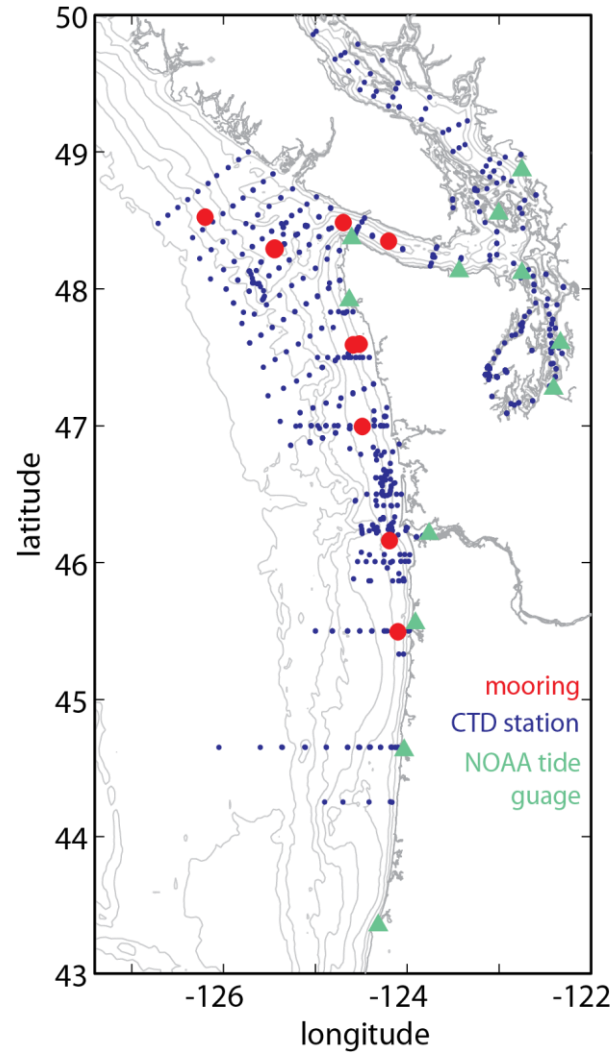
Interactive 3-D Model Visualization using WorldWide Telescope and Narwhal



Modeling Workflow



Model Validation



Comparisons are done to an extensive suite of in-situ observations

- sea surface height
12 NOAA tide gauges
- salinity and temperature
over 2000 CTD casts from ECOHAB, RISE, DOE, NANOOS, Hood Canal, IOS, King County, and NOAA
- velocity and moored S,T
7 coastal ADCP / CTD moorings from the ECOHAB and RISE projects, 2 moorings from IOS

Validation: Dissolved Oxygen & Temperature

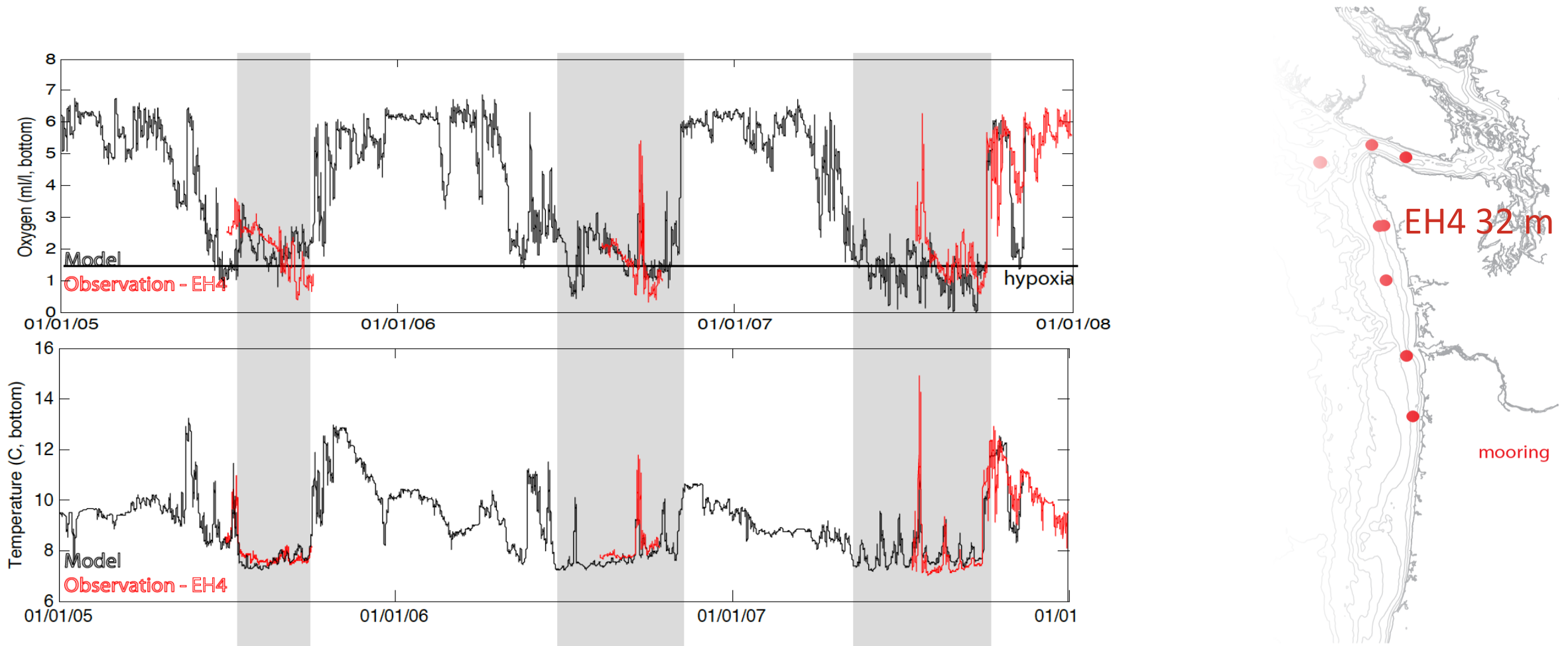
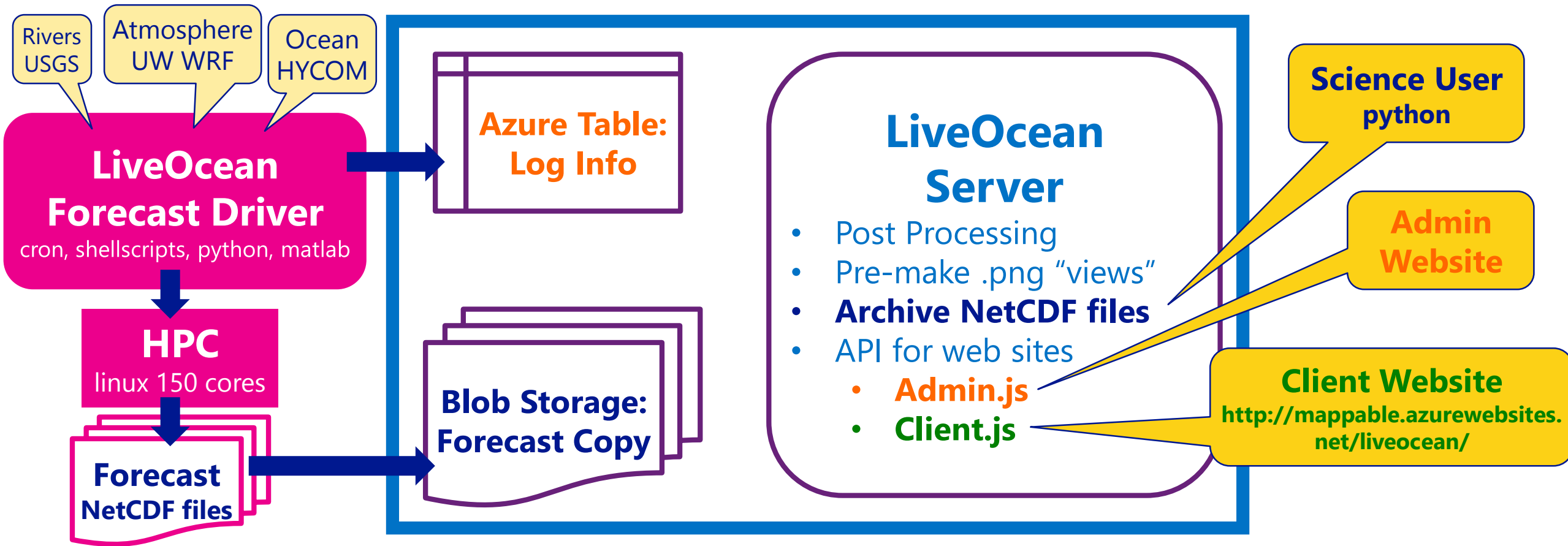


Figure from SA Siedlecki, UW/JISAO; Observations from Connolly et al., 2010

LiveOcean: System Architecture

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Conclusions

What are advantages of using the cloud?

Reliable and scalable

Simplifies: Collaboration with others who work on content delivery (e.g. Client Website)

Enables: Nesting On-Demand

Enables: Particle Tracking On-Demand

Enables: Comparison with Real-Time Observational Data (OOI, IOOS)

Enables: Comparison with Data from Other Models

What are the drawbacks?

Have to learn how to talk to Azure (but python azure module helps!)

Azure currently not good for HPC beyond ~16 cores



Save the planet and return
your name badge before you
leave (on Tuesday)

