

2014 DOE PI MEETING

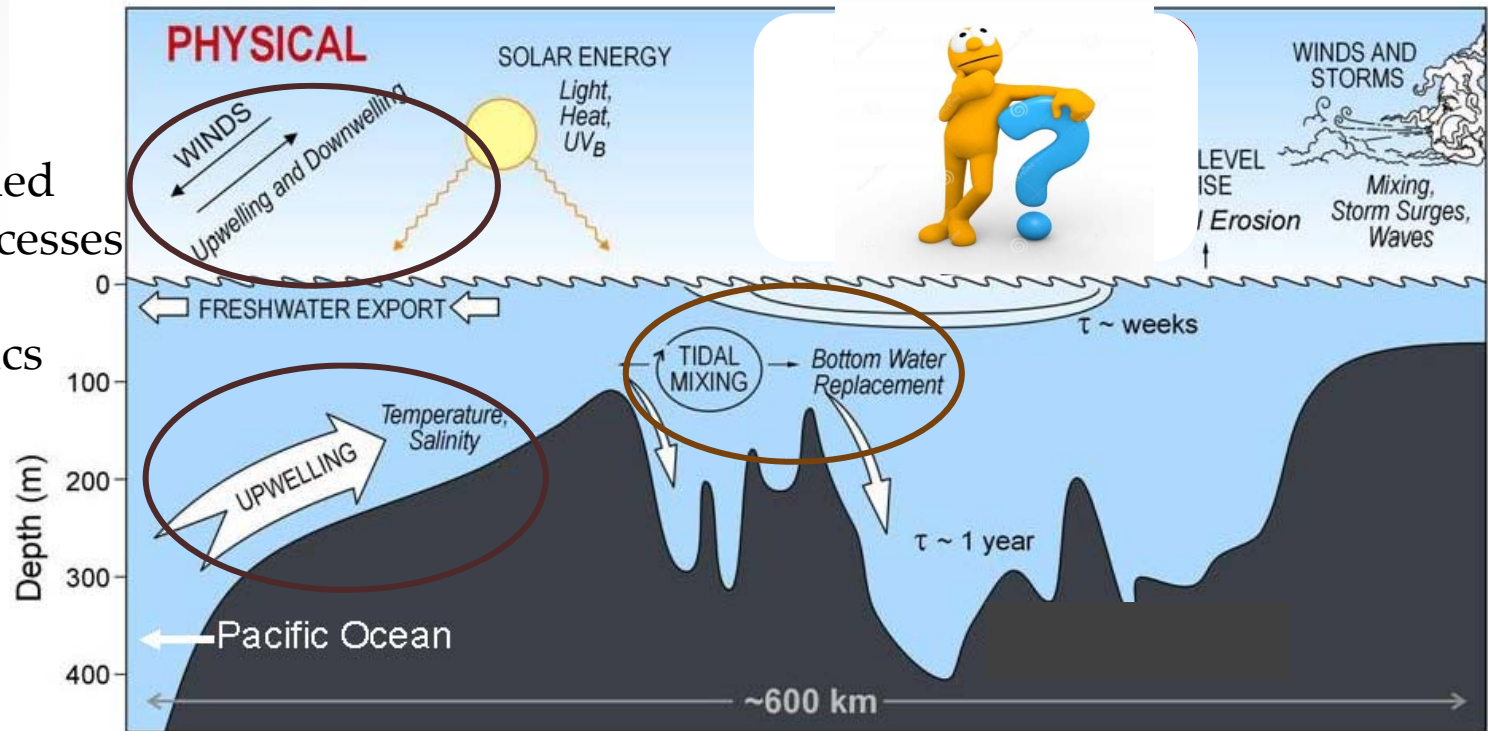
Implementation of Estuary-Shelf Freshwater Exchange Parameterizations in the Community Earth System Model

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- Why?
- Estuary-Shelf Freshwater Exchange Parameterizations
 - Improved “augmented precipitation” scheme
 - Estuary and shelf box models
- Conclusion and Future.....

Coastal zone: coupled
Air-land-ocean processes

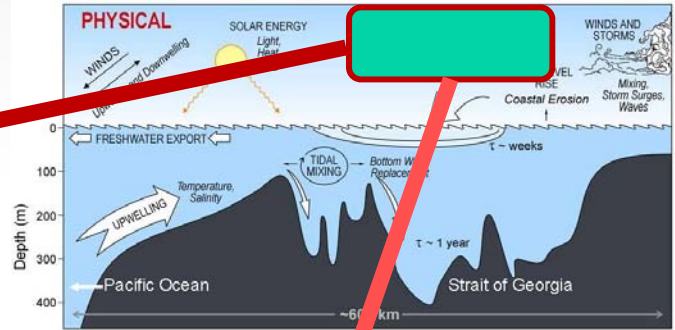
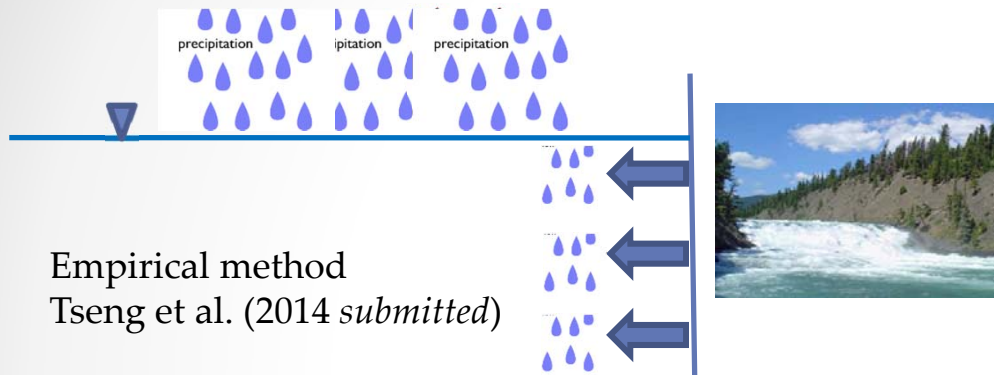
Multi-scale dynamics



Johannessen & Macdonald (2009)

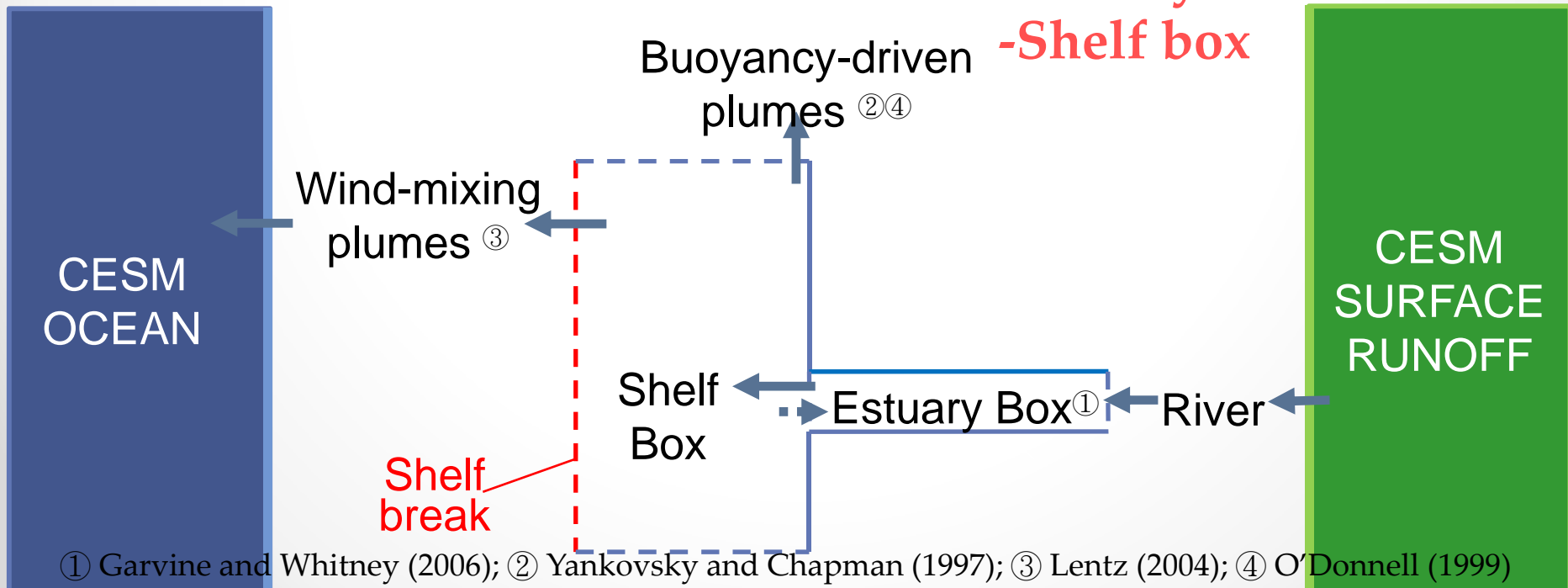
Virtual salt flux: is it correct to consider the global water budget?
Where are the impacts of costal ocean?
Can we better represent the processes in the ESM (e.g., CESM)?

Improved "augmented precipitation" approach



Box Model Approach

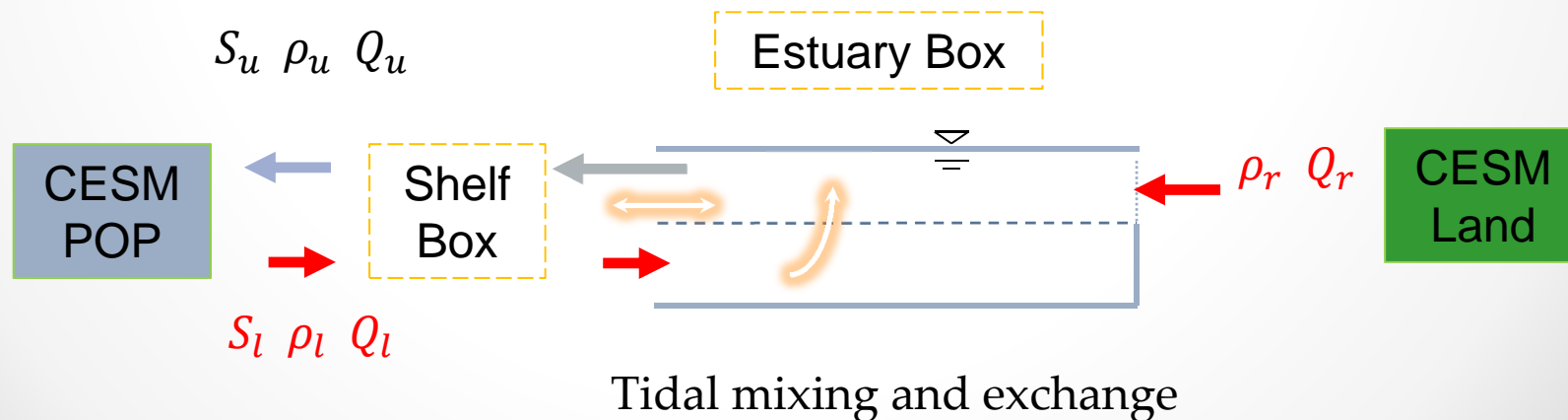
- Estuary box
- Shelf box



Two-layer Estuary Box Model

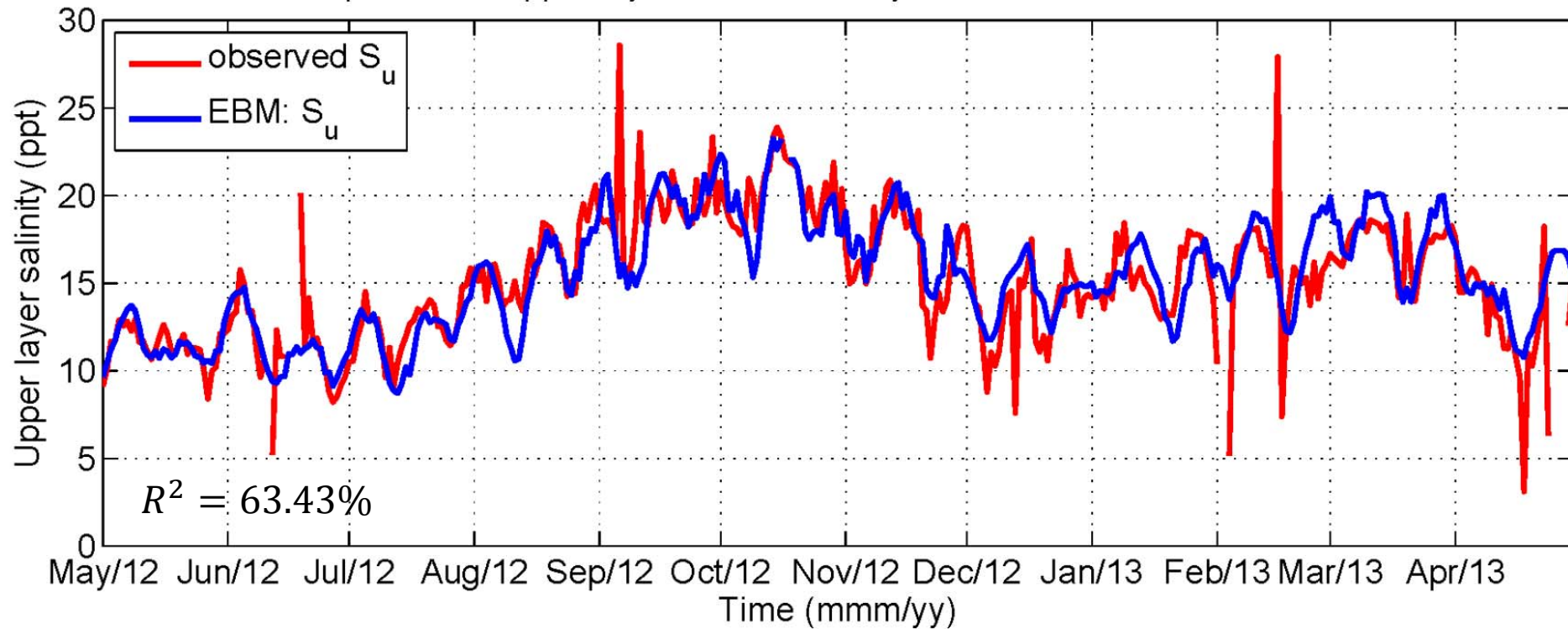
➤ Methodology

- Steady-state Governing Equations:
 - Water mass flux conservation
 - Salt mass flux conservation
 - Potential energy flux (PEF) conservation



Off-line Estuary Box Model-validation with observation

Comparison of upper layer outflow salinity between EBM and observations

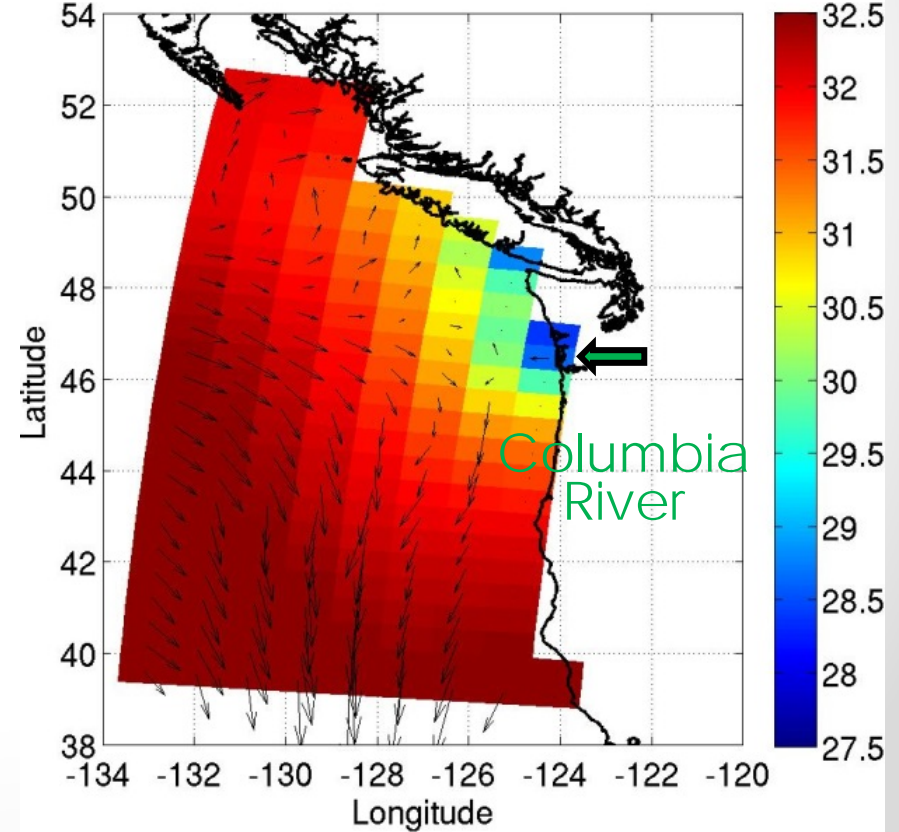
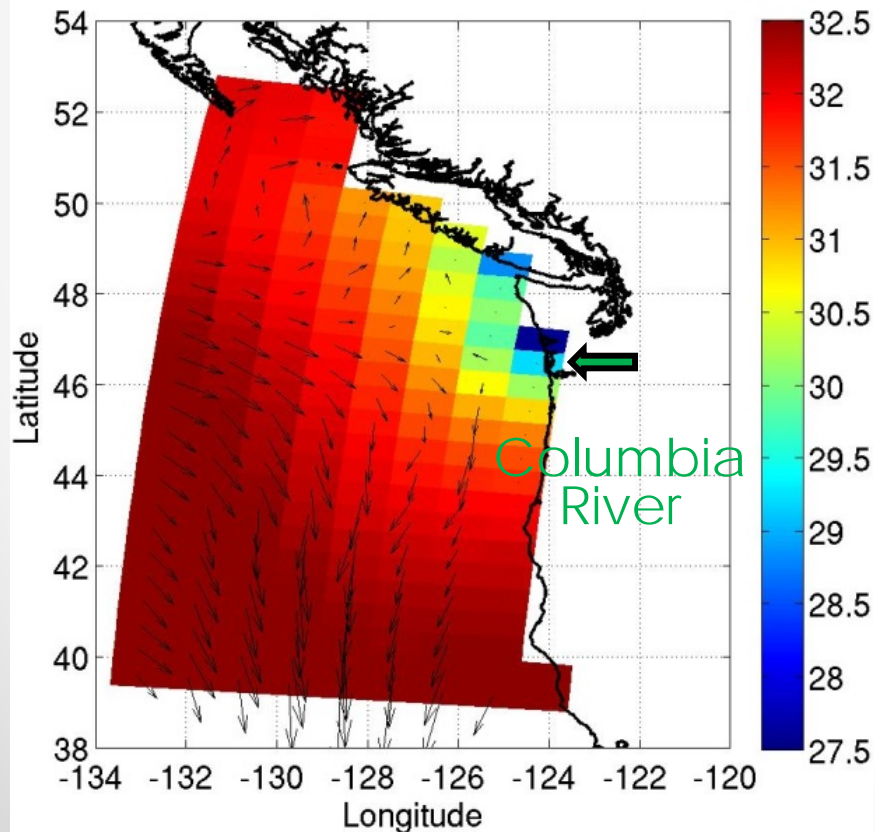


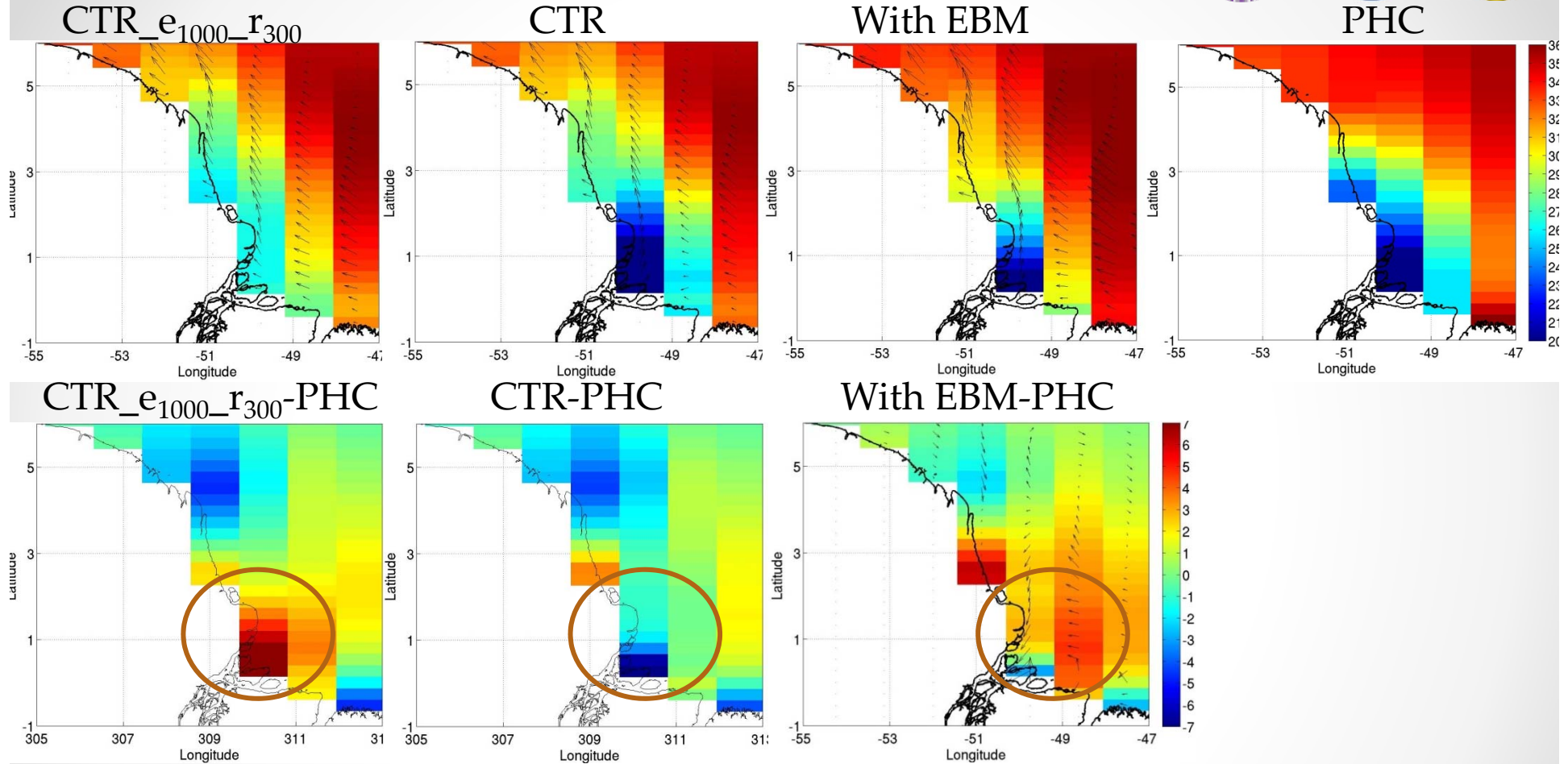
Interactive Estuary Box Model (coupled with POP)

➤ Apply Box Model in the CESM

(<http://www.cgd.ucar.edu/staff/ytseng/research/Salinity/main.html#ESP>)

CESM surface ocean salinity and velocity vector (annual mean)
no Estuary Box Model output **with Estuary Box Model output**

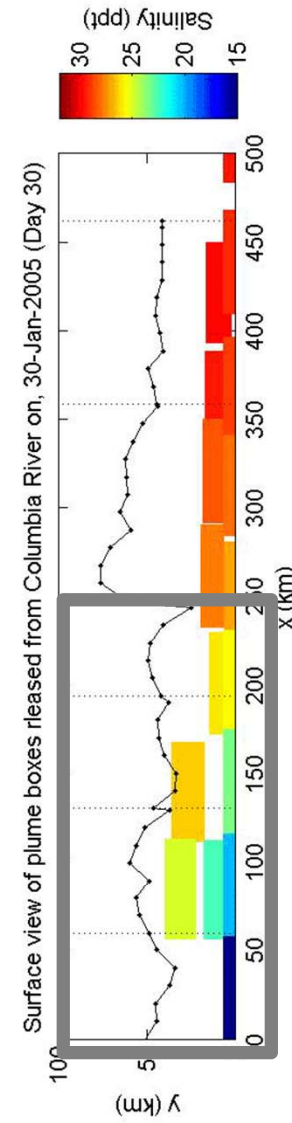
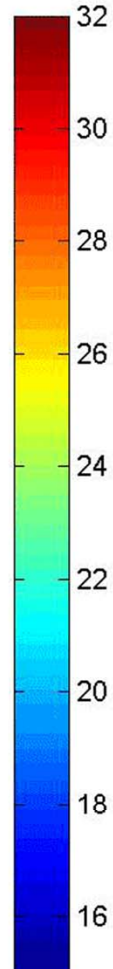
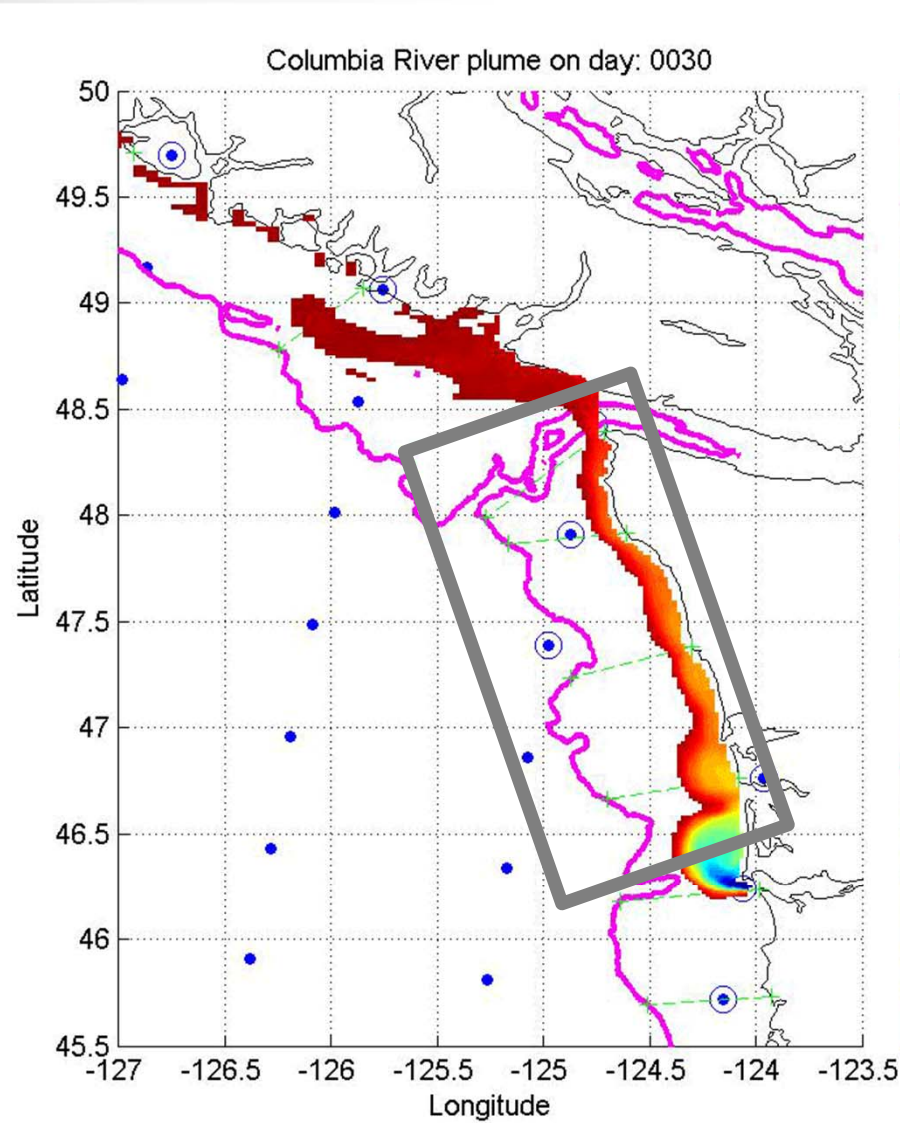




Summary of the estuary box model

- The estuary Box Model agrees well with observation in the Columbia River estuary.
- Surface salinity distribution at river mouth is obviously improved with estuary Box Model, but we need to introduce the shelf Box Model for more realistic salinity distributions on the shelf ocean.

Off-line Shelf Box Model-validation with ROMS



Conclusion and future.....

- The estuary box model is implemented and tested for Amazon and Columbia (offline and online coupled with POP)
- Parameters for different rivers are being estimated and examined (Congo and Mississippi rivers are done!)
- Top 20 rivers will be included and analyzed/compared
- The model framework of shelf box model is completed. It will be included and tested soon after the offline validation is completed (2014 summer)
- Validation/generalization ready for CESM2 (2014 winter)