A Regional HYCOM Model for the US West Coast

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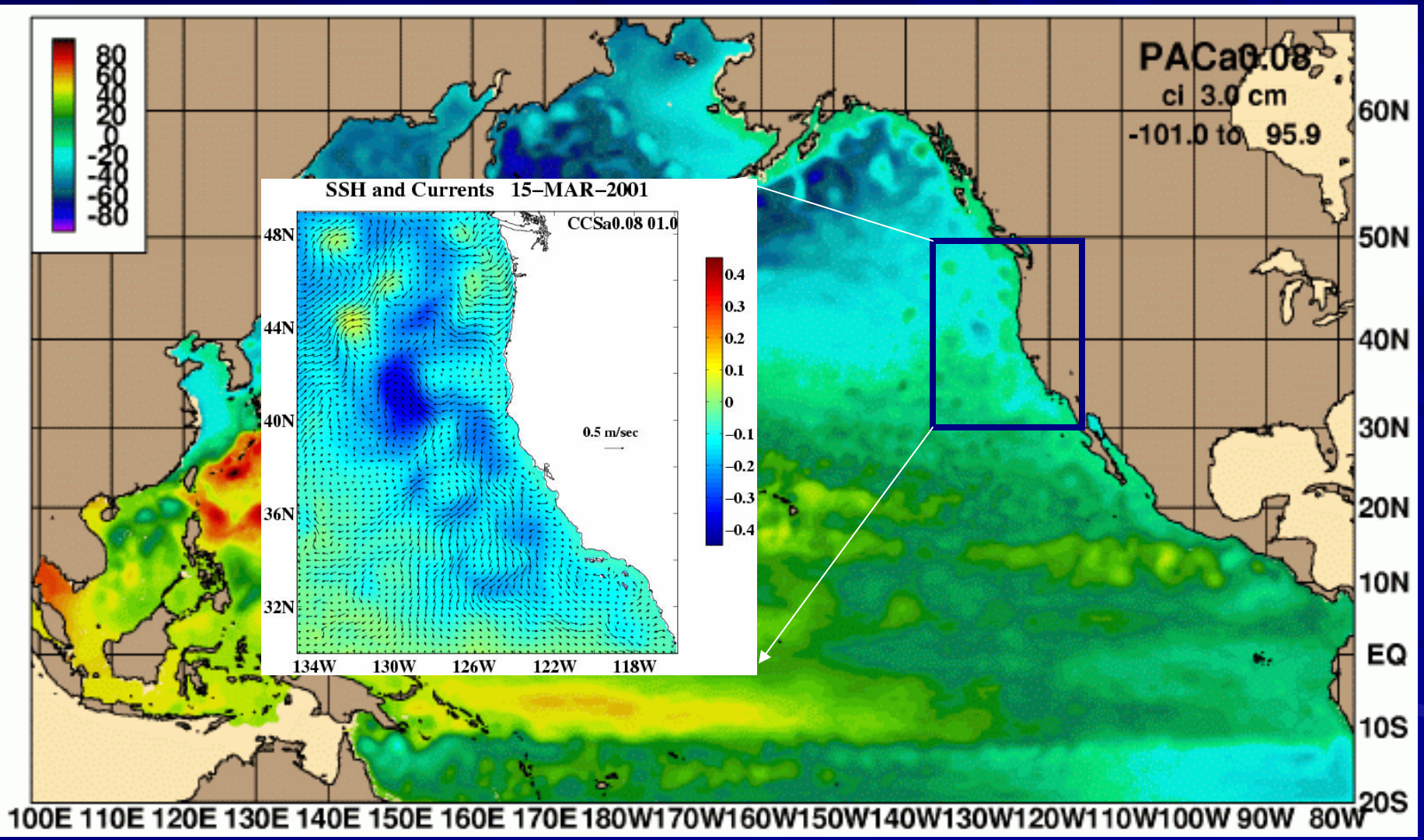
Acknowledgments: Joe Metzger, Alan Wallcraft, Harley Hurlburt, Pat Hogan
Stephanie Anderson(Cayula), Igor Shulman

US West Coast HYCOM

- Funded by
  - NRL 6.2 Coastal Ocean Nesting Studies (CoNESTS) Project ---w. Pat Hogan
    - Evaluate HYCOM as a coastal Model
    - Implement Regional HYCOM for US west coast.
  - NOPP PARADIGM Project: Partners for the Advancement of Interdisciplinary Global Models ---with Eric Chassignet
    - Incorporate Biological Model into HYCOM

1/12° Pacific HYCOM Basin-scale Circulation with nested US West Coast HYCOM

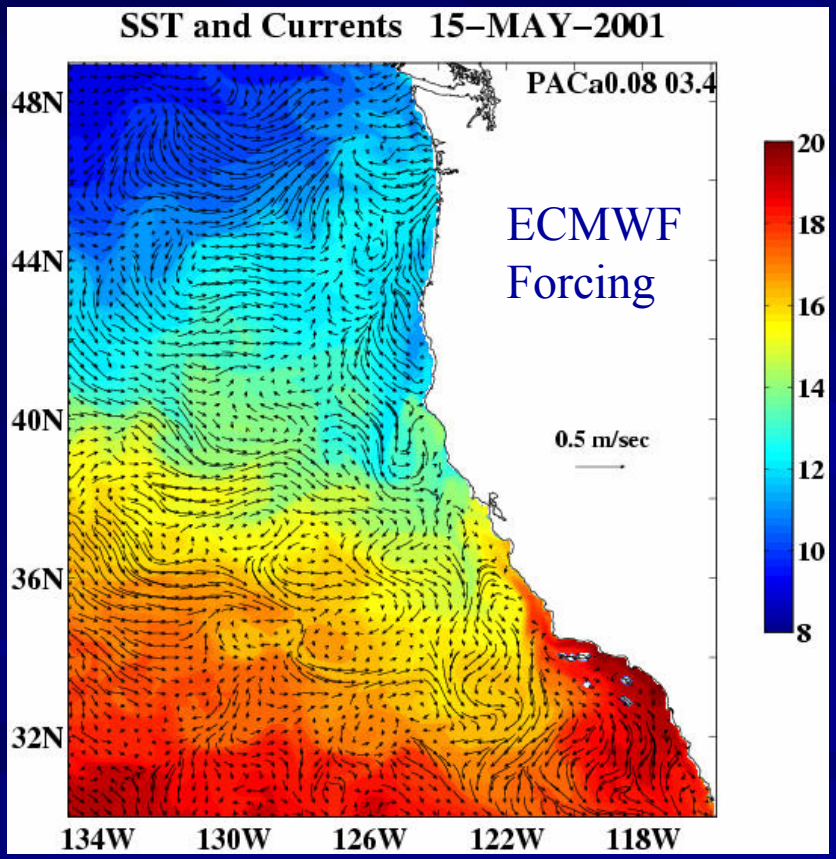


Forced with high frequency ECMWF winds and thermal forcing

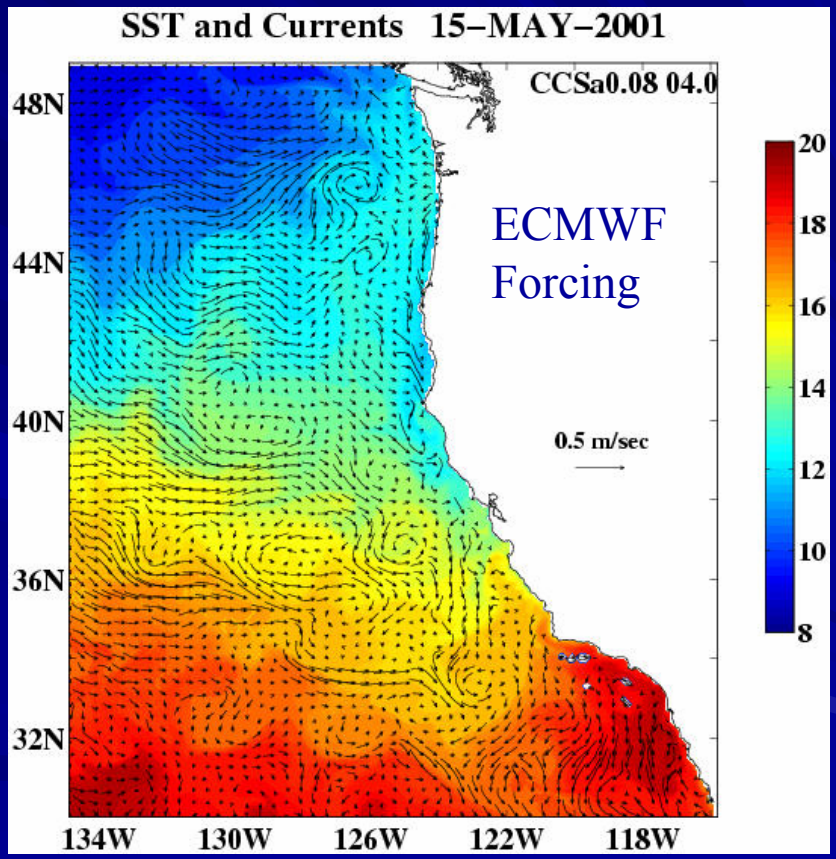
SSH Snapshot – 21 March

1/12° Pacific HYCOM Basin-scale Circulation with nested US West Coast HYCOM

Pacific Basin HYCOM



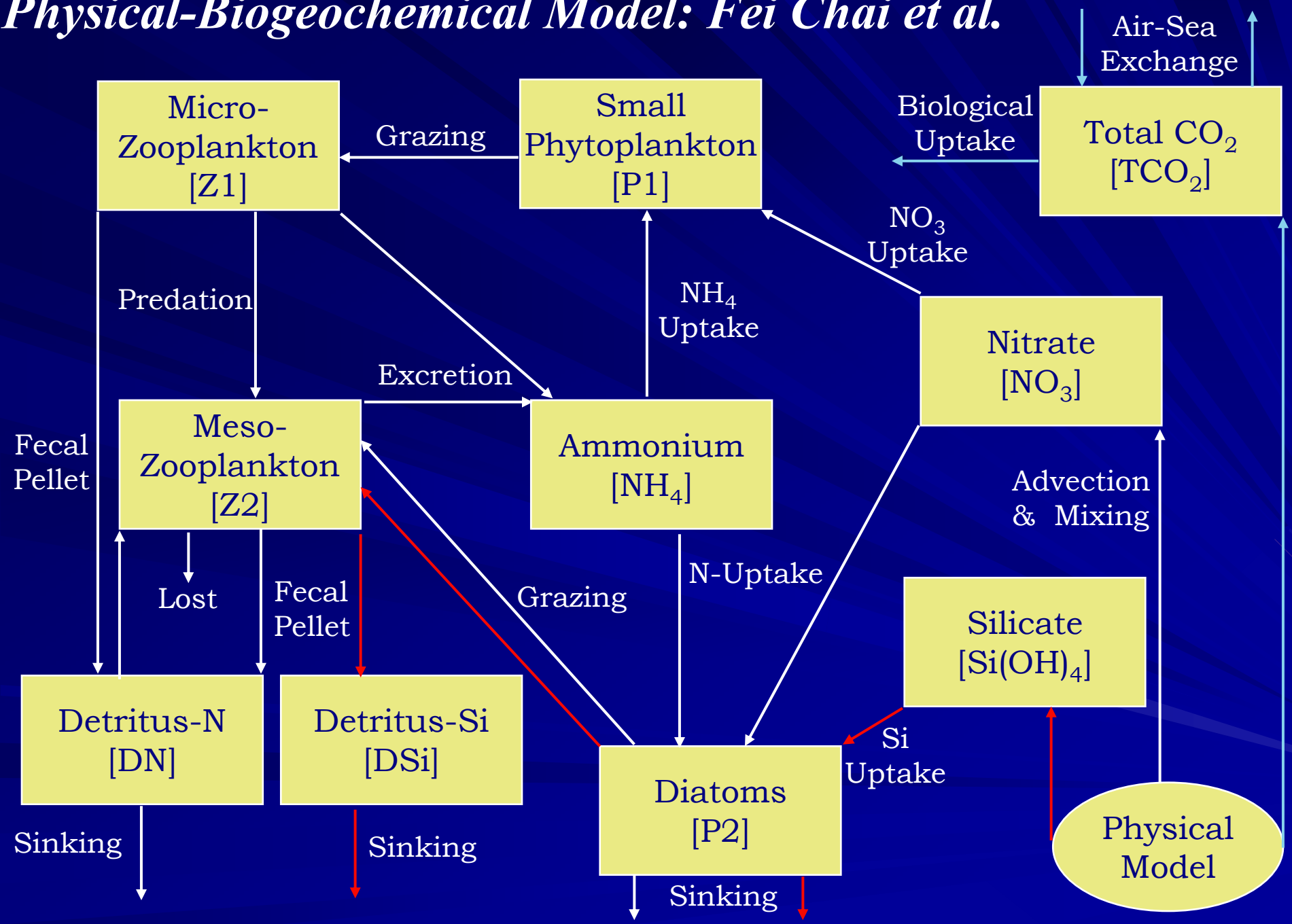
Nested US West Coast HYCOM



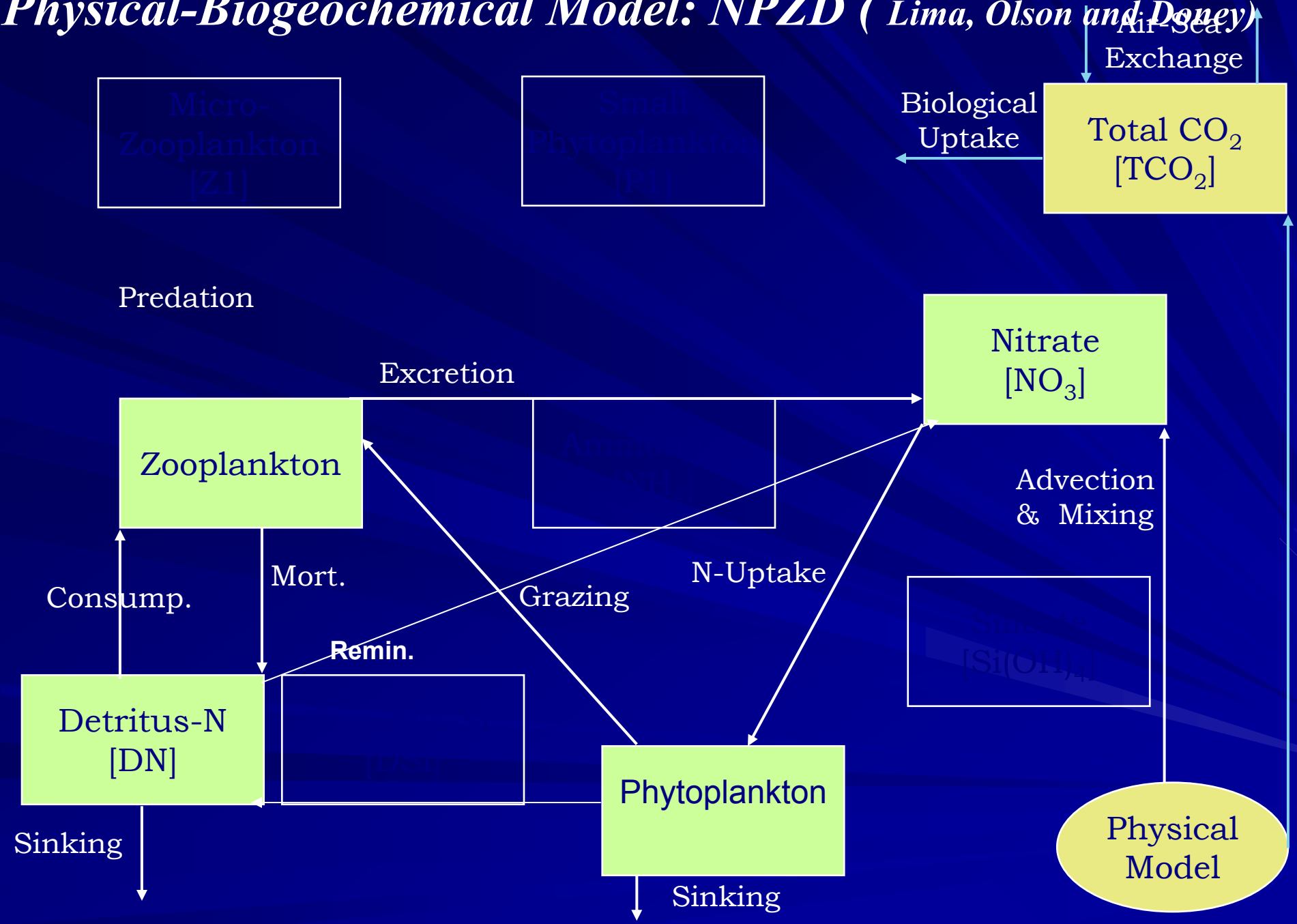
Nested HYCOM uses same resolution and forcing as Pacific HYCOM to test bc.

Simulation begins on January 1, 2001; no data assimilation is included.

Physical-Biogeochemical Model: Fei Chai et al.

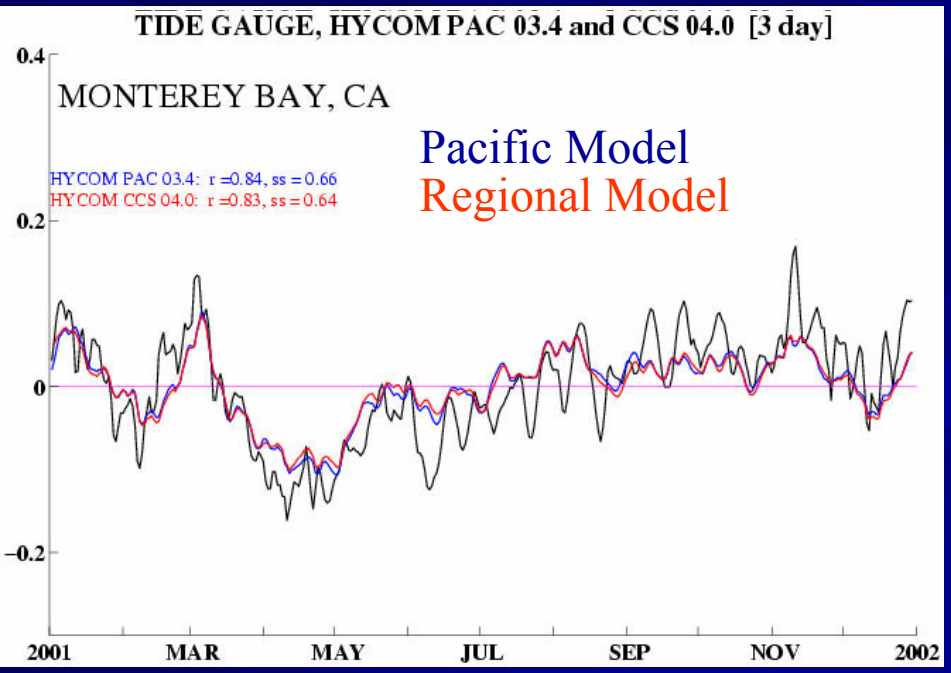


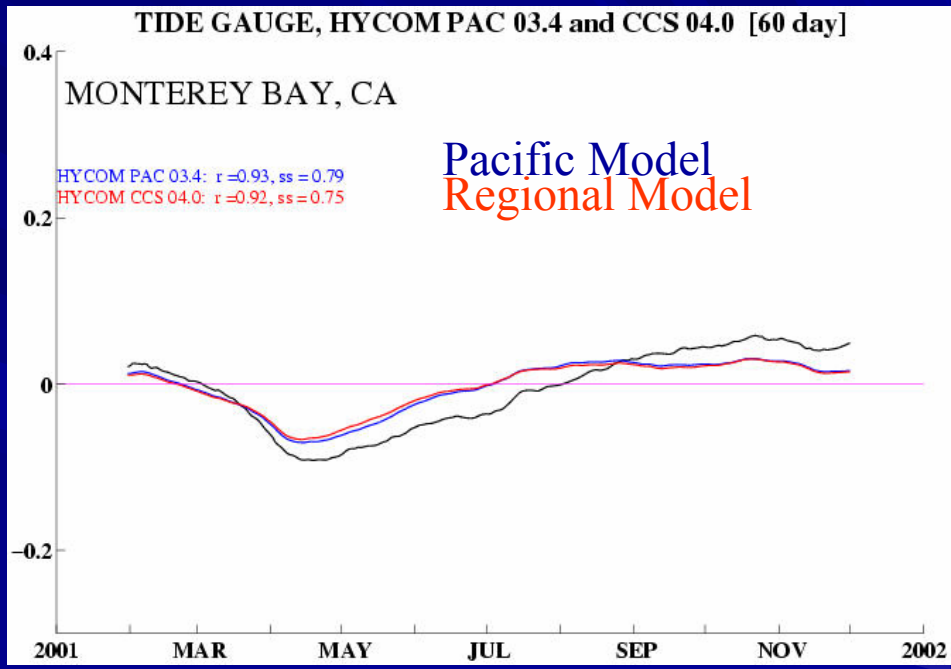
Physical-Biogeochemical Model: NPZD (Lima, Olson and Doney)



Evaluation of Nested HYCOM

Model SSH comparisons with observations from tide gauges (atm. pressure corrected)

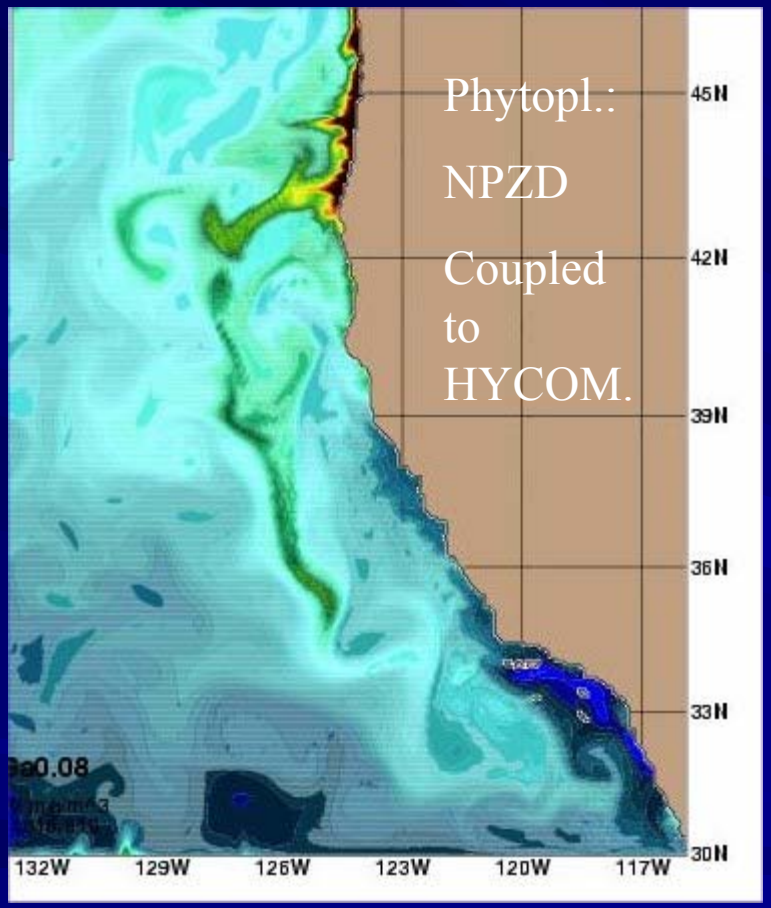




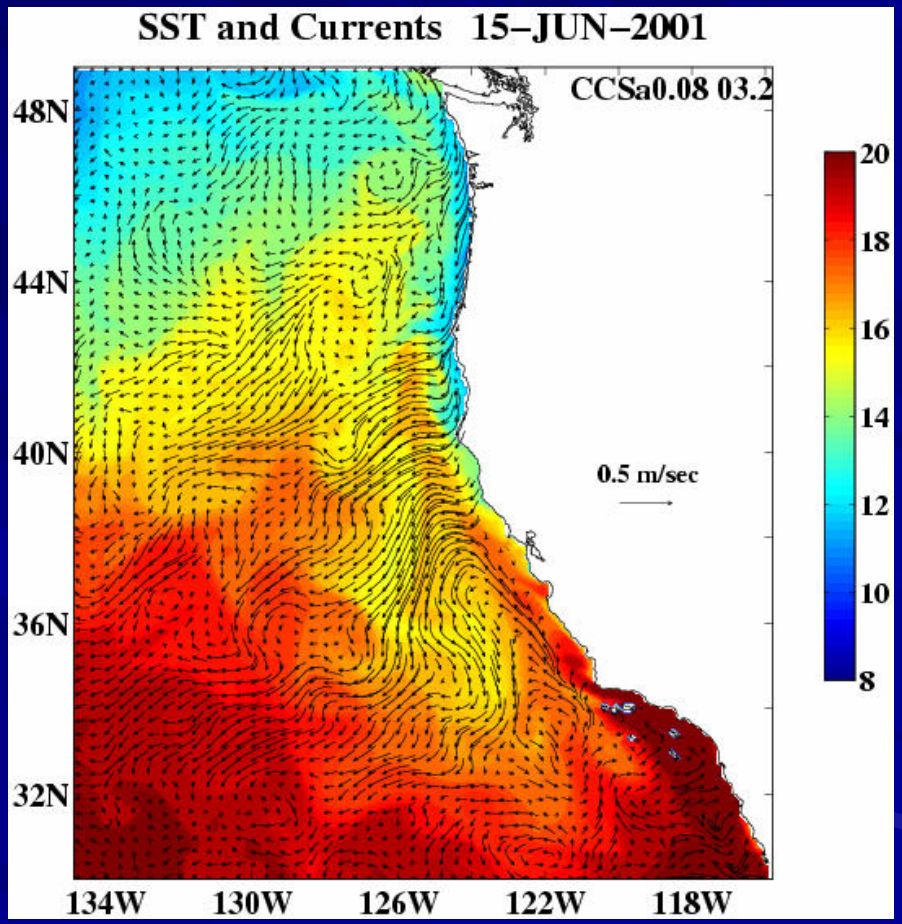
ECMWF Forcing

Ecosystem Model Response

Model Phytoplankton

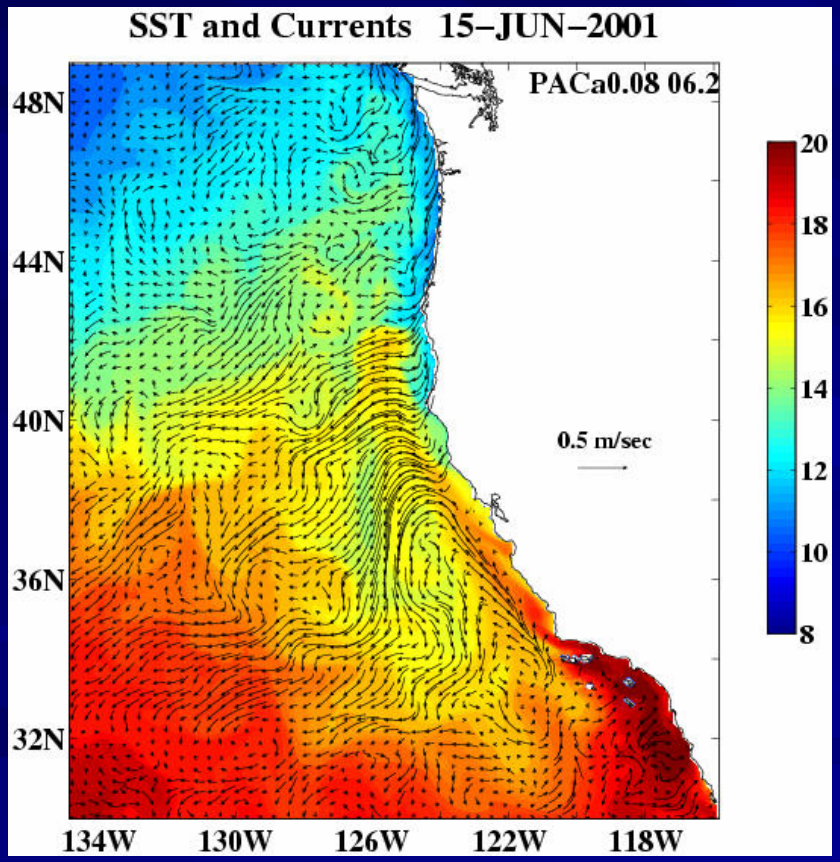


NOGAPS Forced Experiment



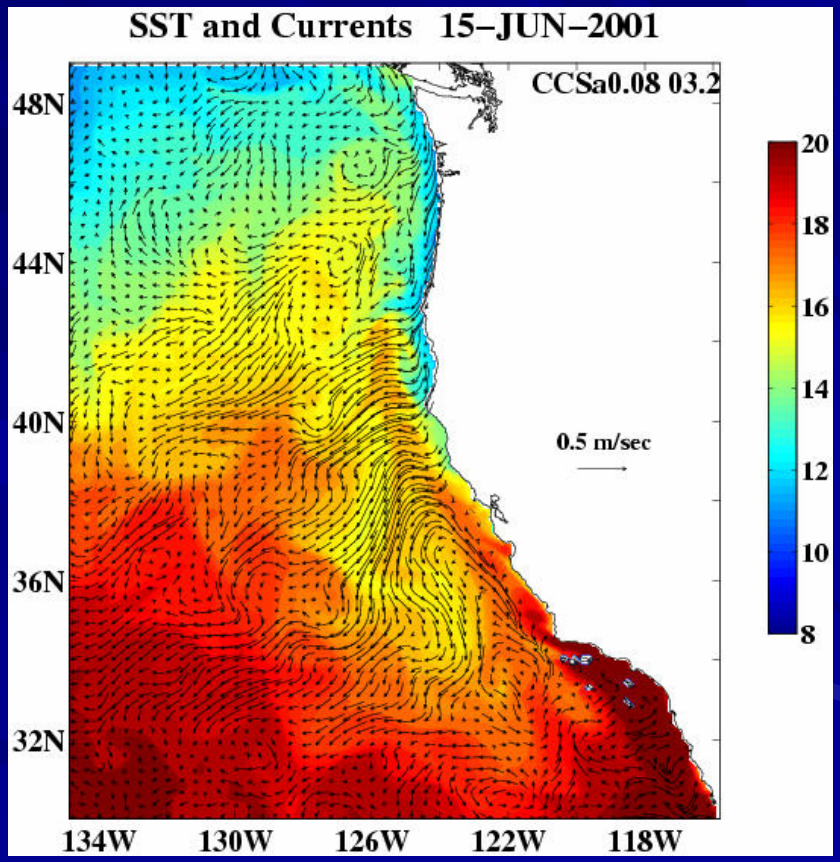
Pacific HYCOM/ Regional HYCOM

Pacific Model



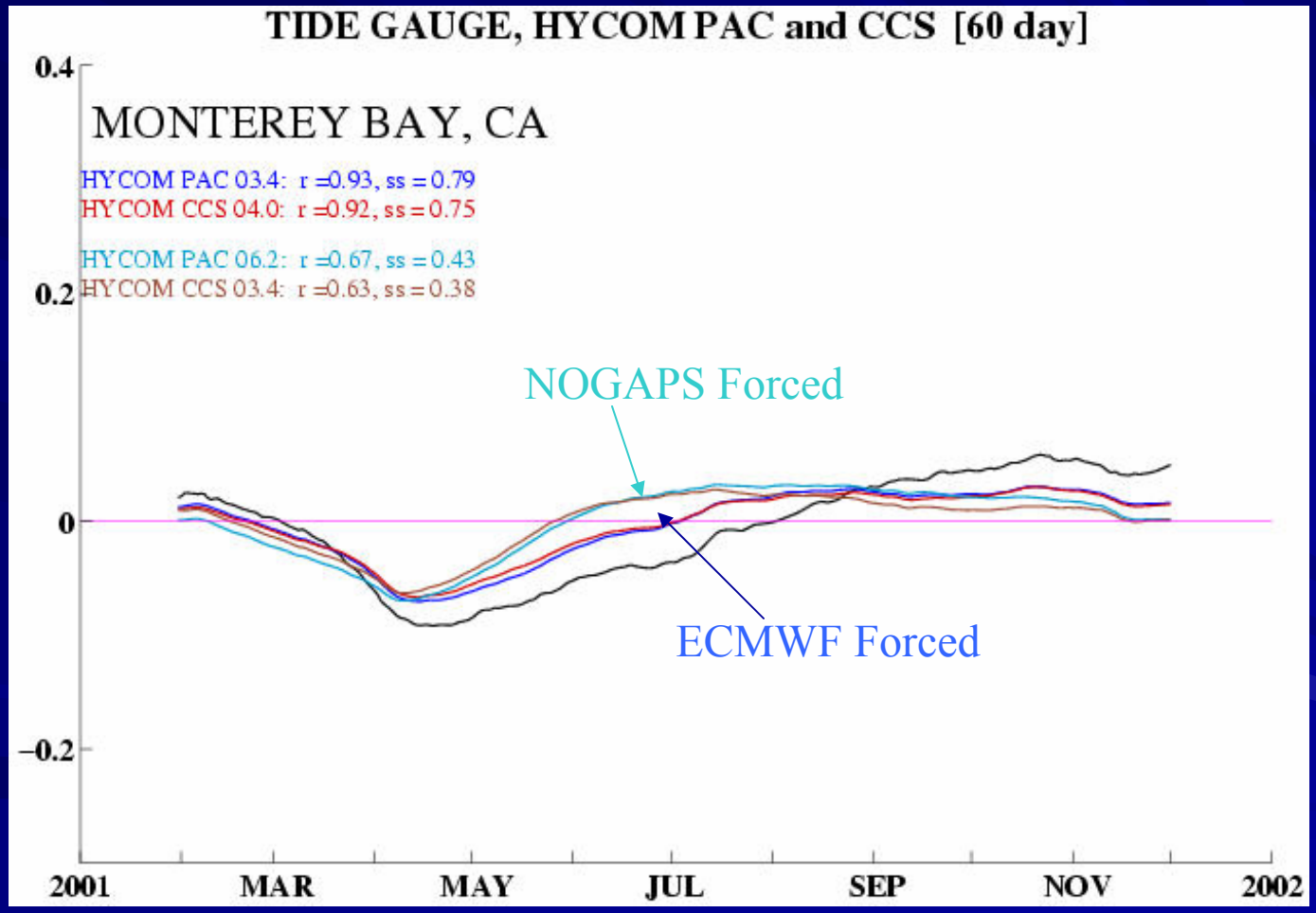
NOGAPS Forcing

Regional Model



NOGAPS Forcing

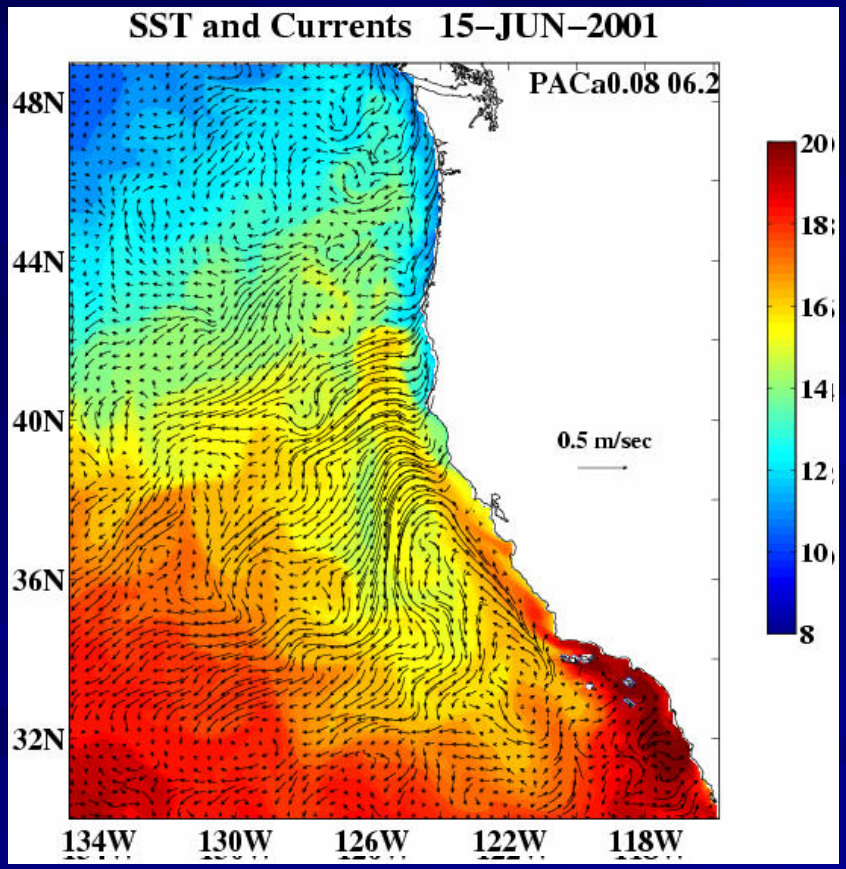
ECMWF vs. NOGAPS?



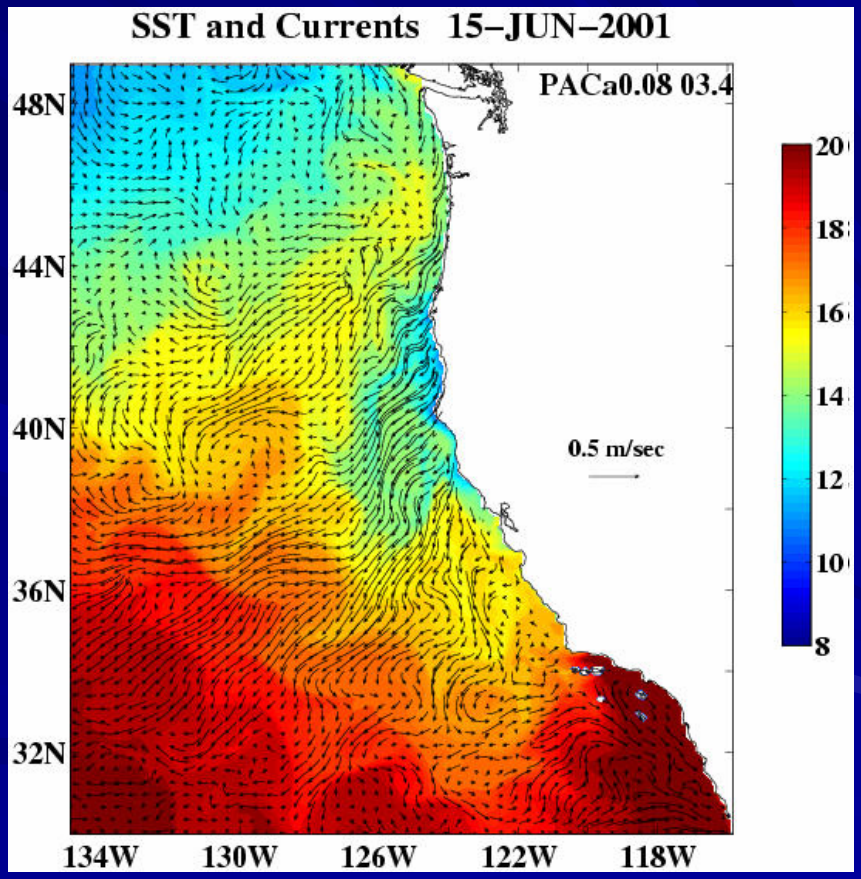
Pacific and Regional Simulations

Pacific HYCOM: ECMWF vs. NOGAPS

NOGAPS Forcing

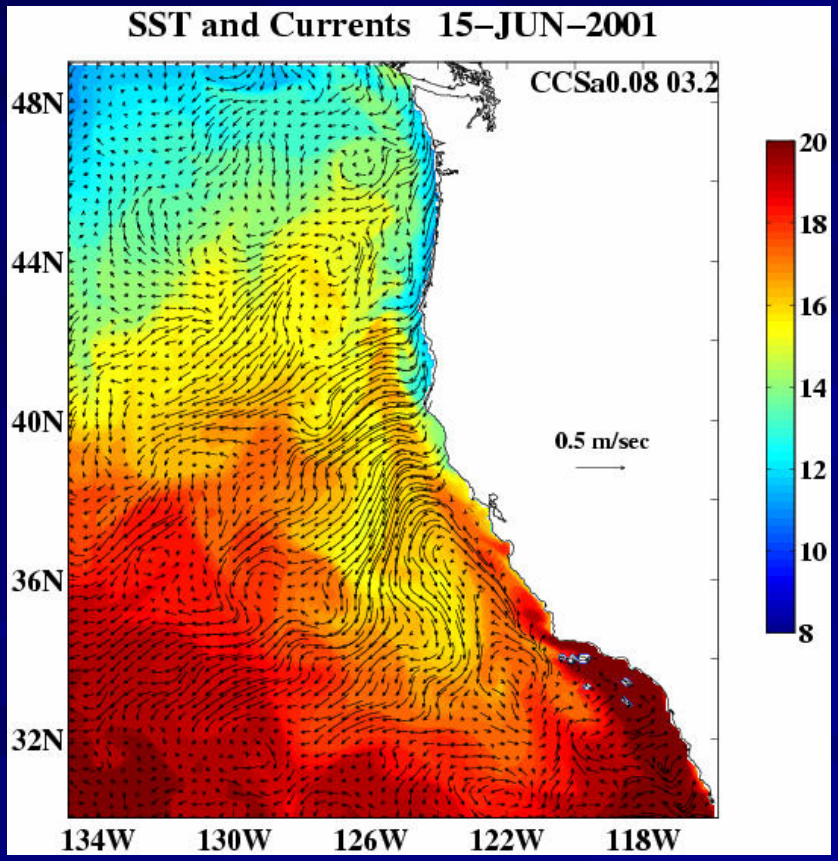


ECMWF Forcing

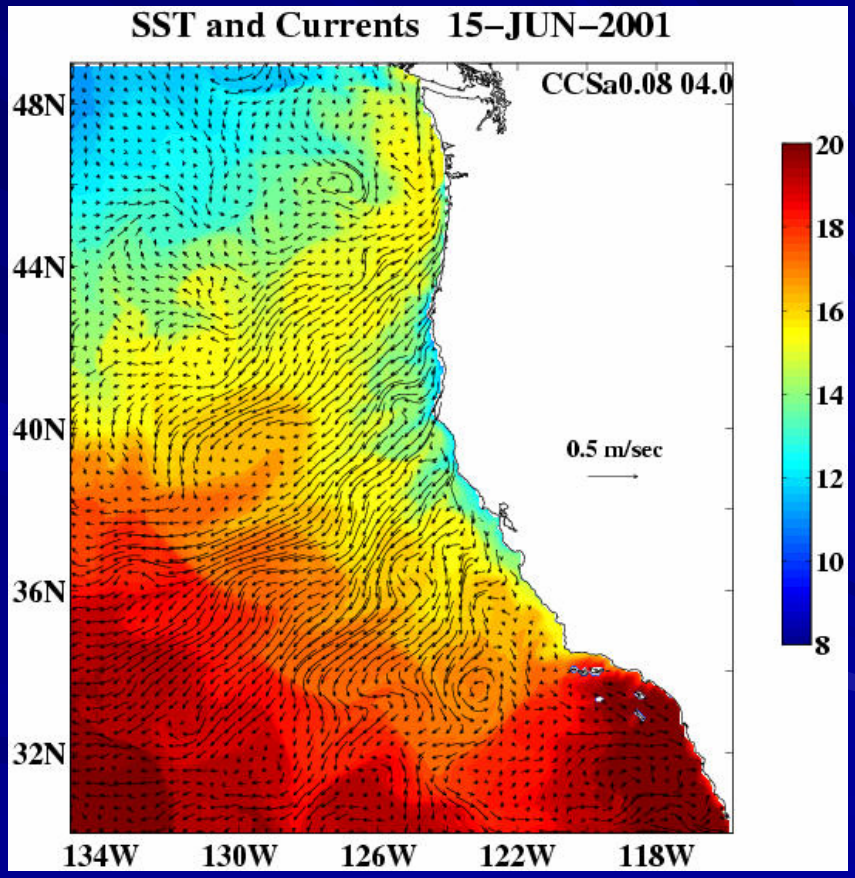


Regional HYCOM: ECMWF vs. NOGAPS

NOGAPS Forcing



ECMWF Forcing



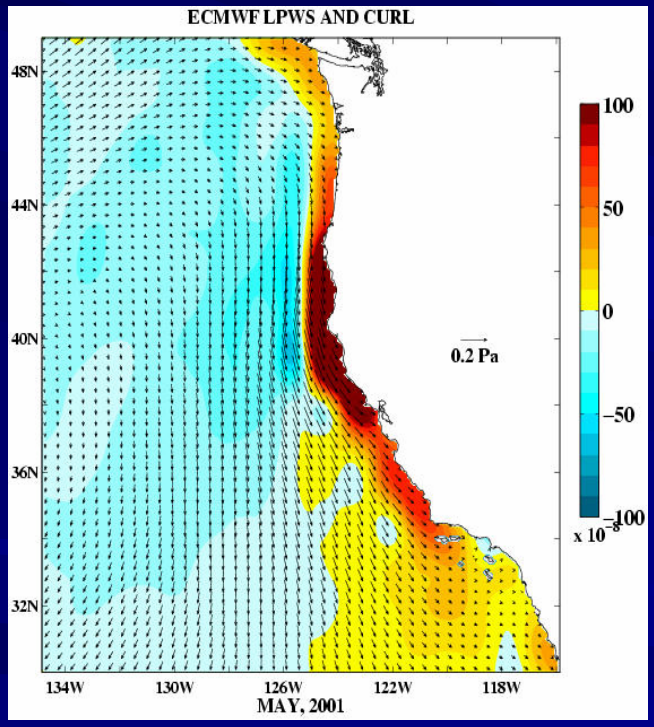
Differences in Forcing for Pacific Experiments

- ECMWF case uses stresses formed from 10m winds
- NOGAPS case uses direct model stresses offset by ECMWF mean
  - Hybrid wind set
  - NOGAPS mean replaced by ECMWF mean(as determined above)

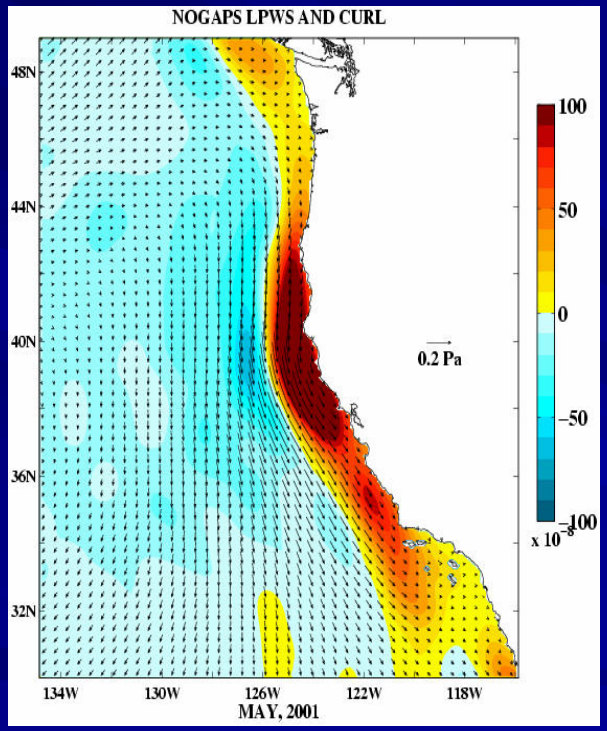
Hypothesis: Responses explained by differences in wind stress curl patterns

Wind Stress Curl Distributions May 2001

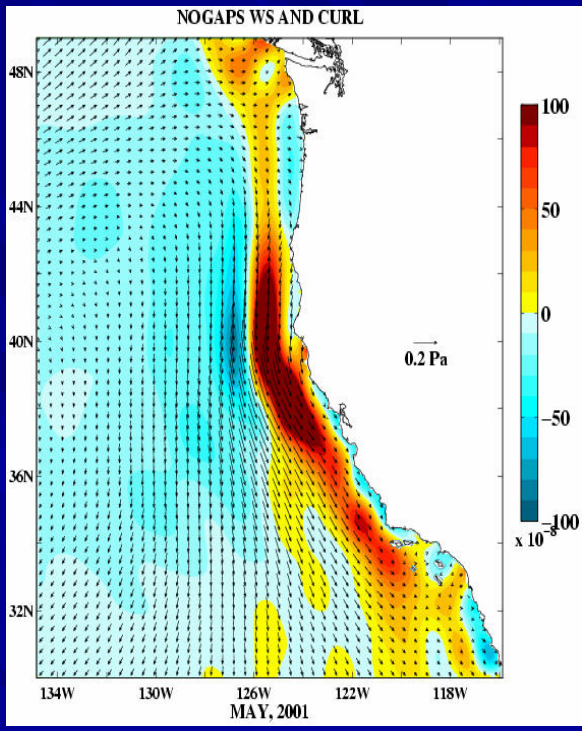
ECMWF 10m winds



NOGAPS 10m winds



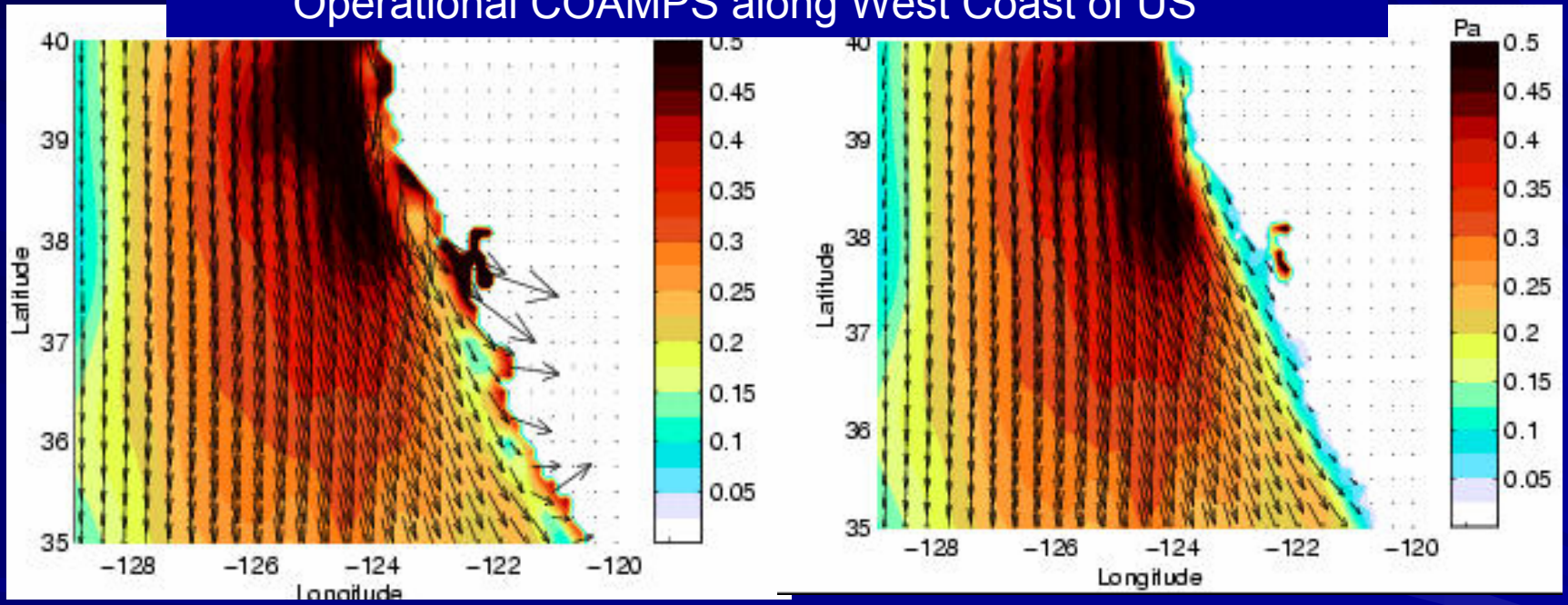
NOGAPS Direct stresses



Dynamics of Coupled Models: COAMPS

Flux Coupler: Accounts for Large Land-Sea Gradients by interpolating fields from the native atmospheric grid using the atmospheric model land mask. Otherwise, ocean points are corrupted

Operational COAMPS along West Coast of US

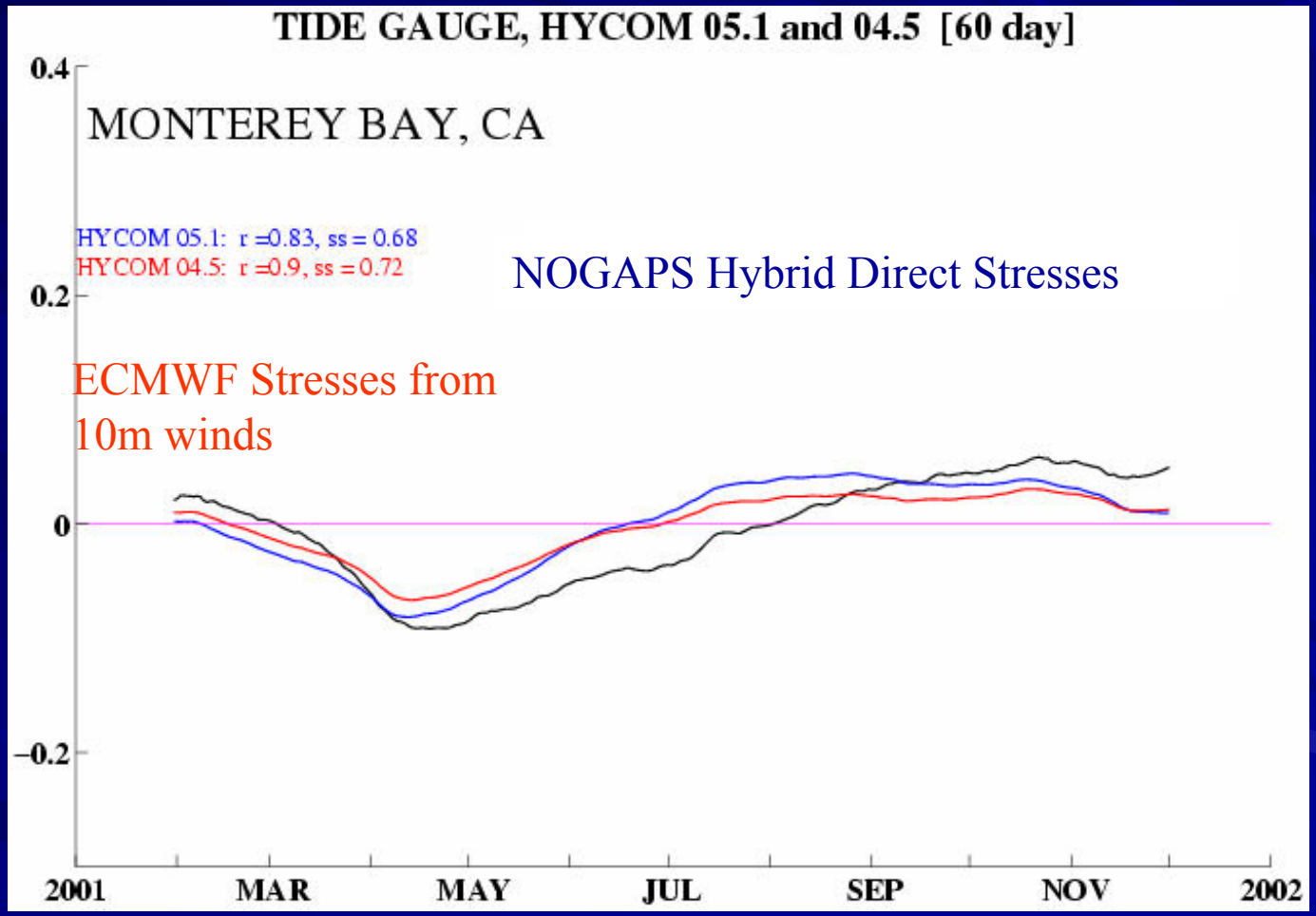


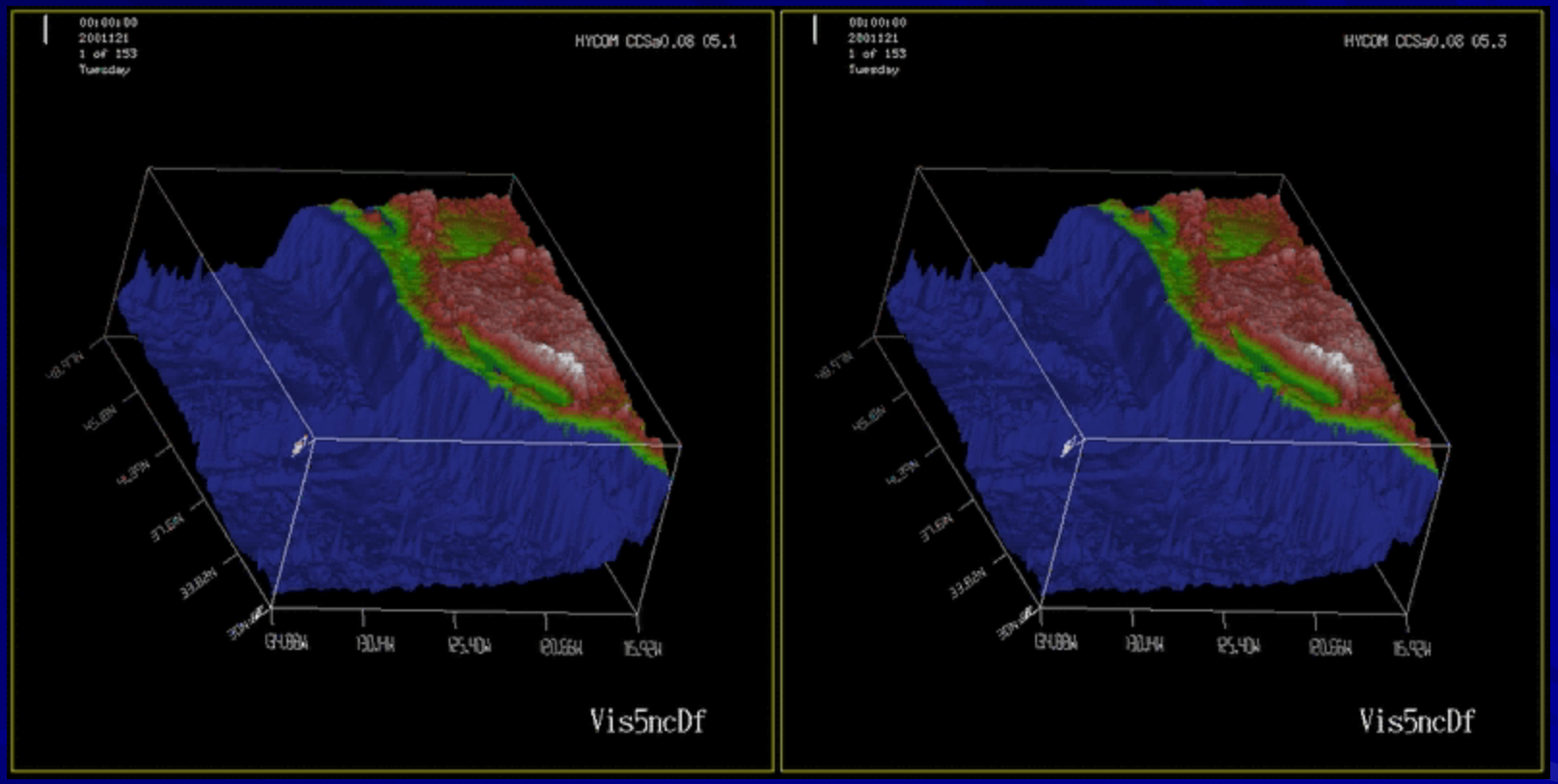
Standard Interpolation: No land mask information

Flux Coupler Applied using land mask information

Ocean model response may be corrupted unless atmospheric forcing has been carefully interpolated to ocean model grid using native atmospheric fields and model land mask.

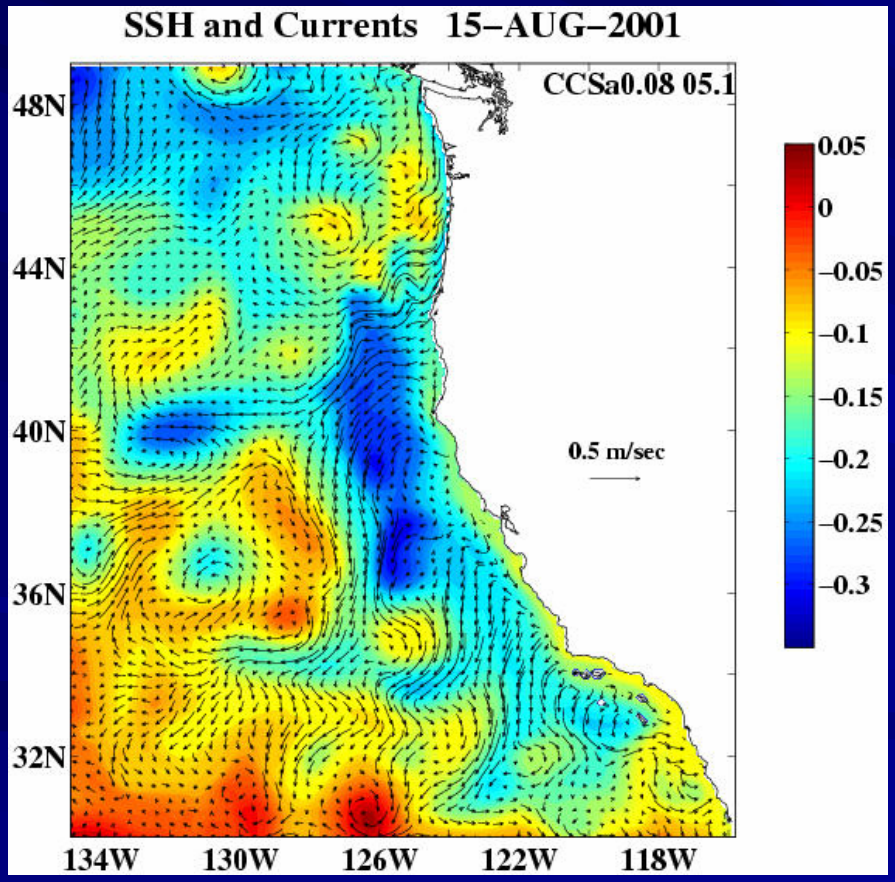
Sensitivity to Wind forcing



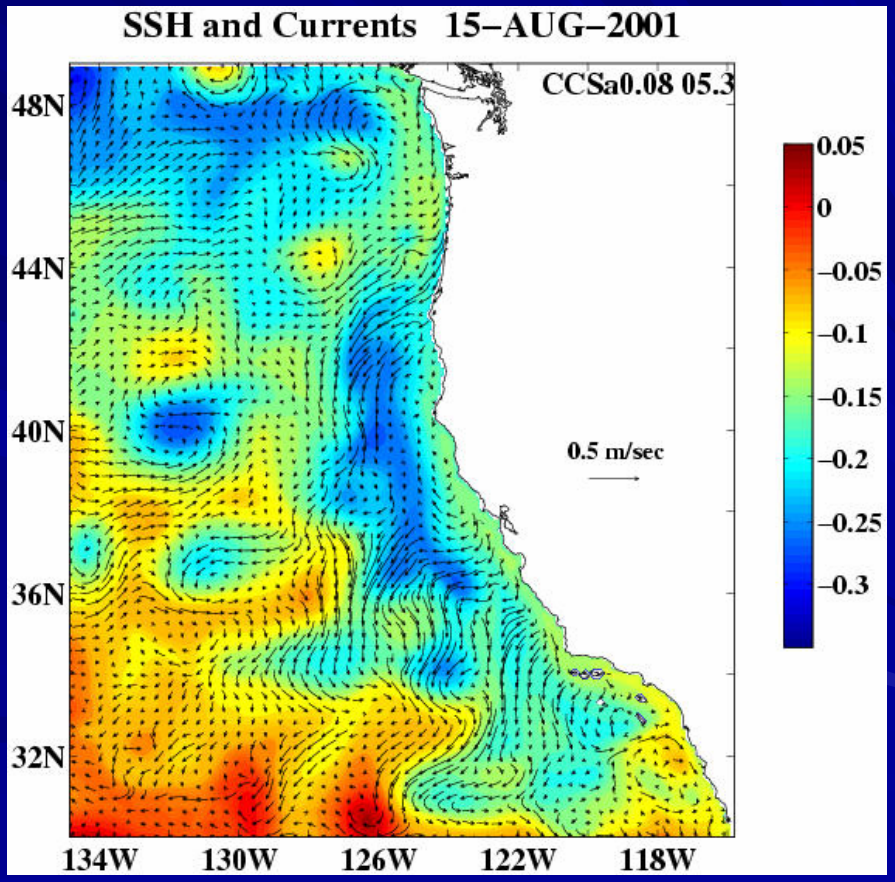

00:00:00
2001121
1 of 153
Tuesday
HYCOM CCSa0.08 05.1
Vis5ncDf
00:00:00
2001121
1 of 153
Tuesday
HYCOM CCSa0.08 05.3
Vis5ncDf

Sensitivity to Wind forcing

NOGAPS Hybrid Stresses

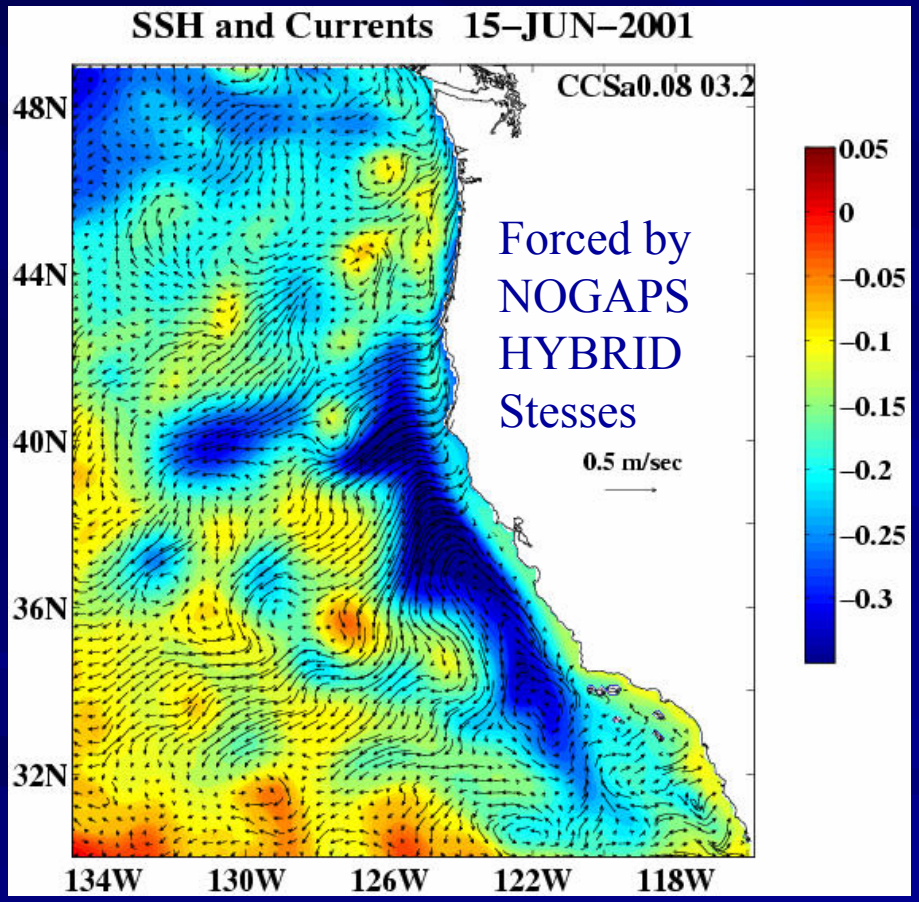


NOGAPS L&P Stresses

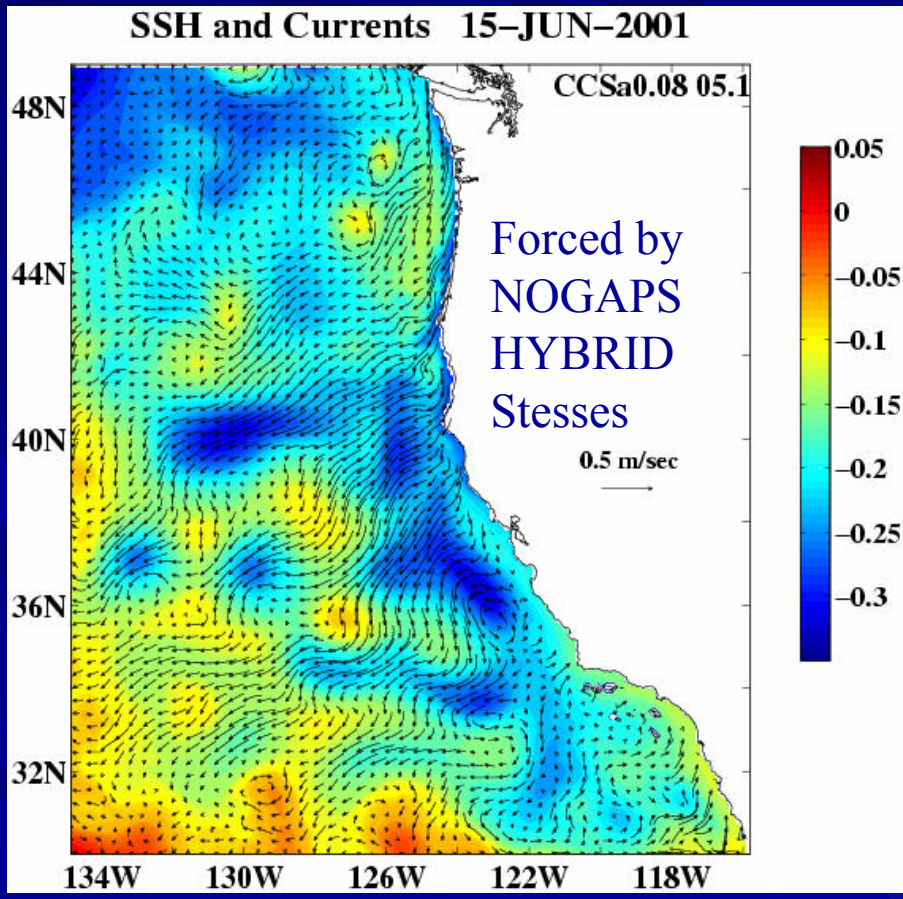


Sensitivity to Model Version

HYCOM Version . 2.1.09



HYCOM Version . 2.1.27+

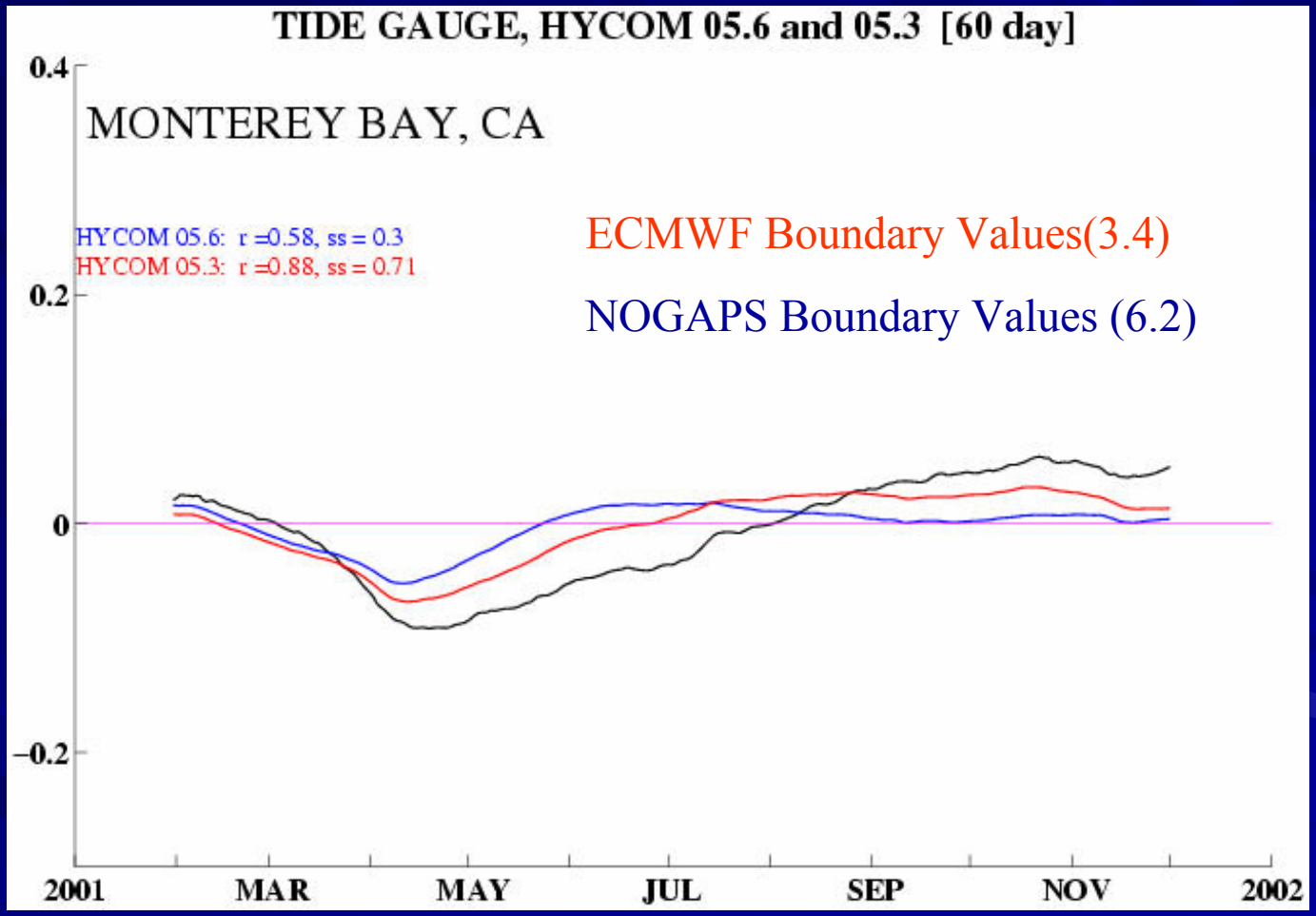


Both Experiments have same forcing, same Boundary values

Recommendations for Pacific Data Assimilative Runs

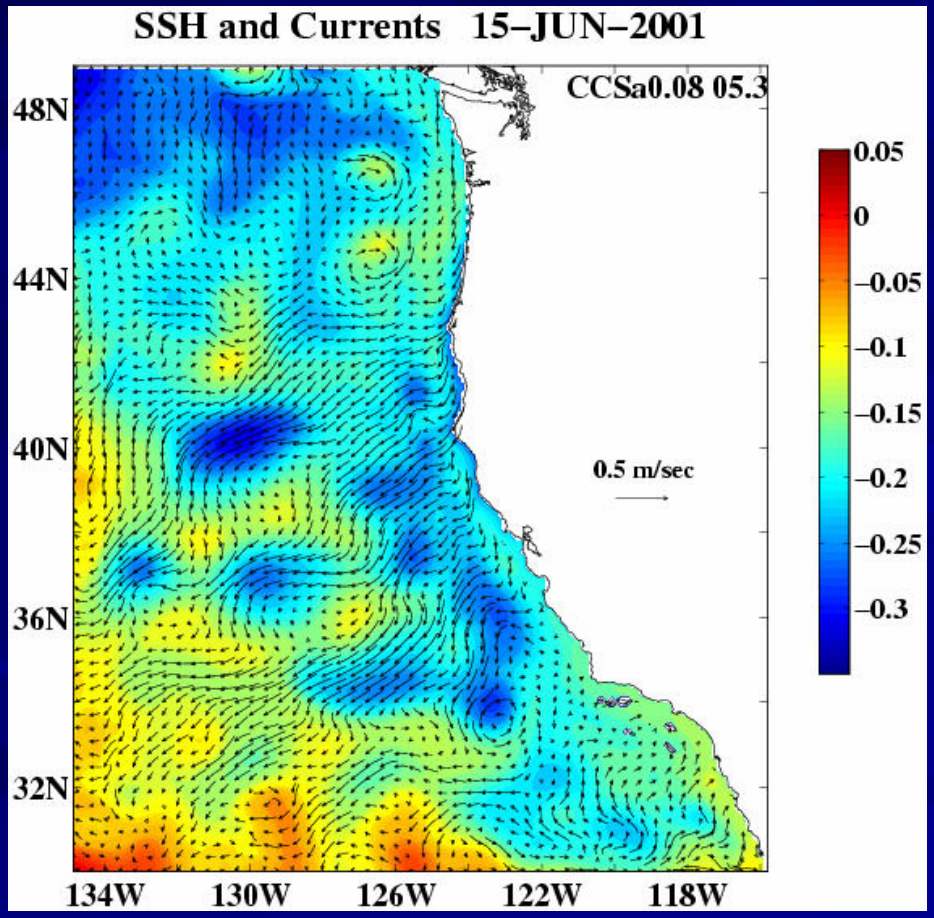
- Use latest version of Model Code
- Use stresses based on NOGAPS 10m winds instead of direct stresses
  - Unless NOGAPS stresses become available on native grid.

Sensitivity to Boundary Values

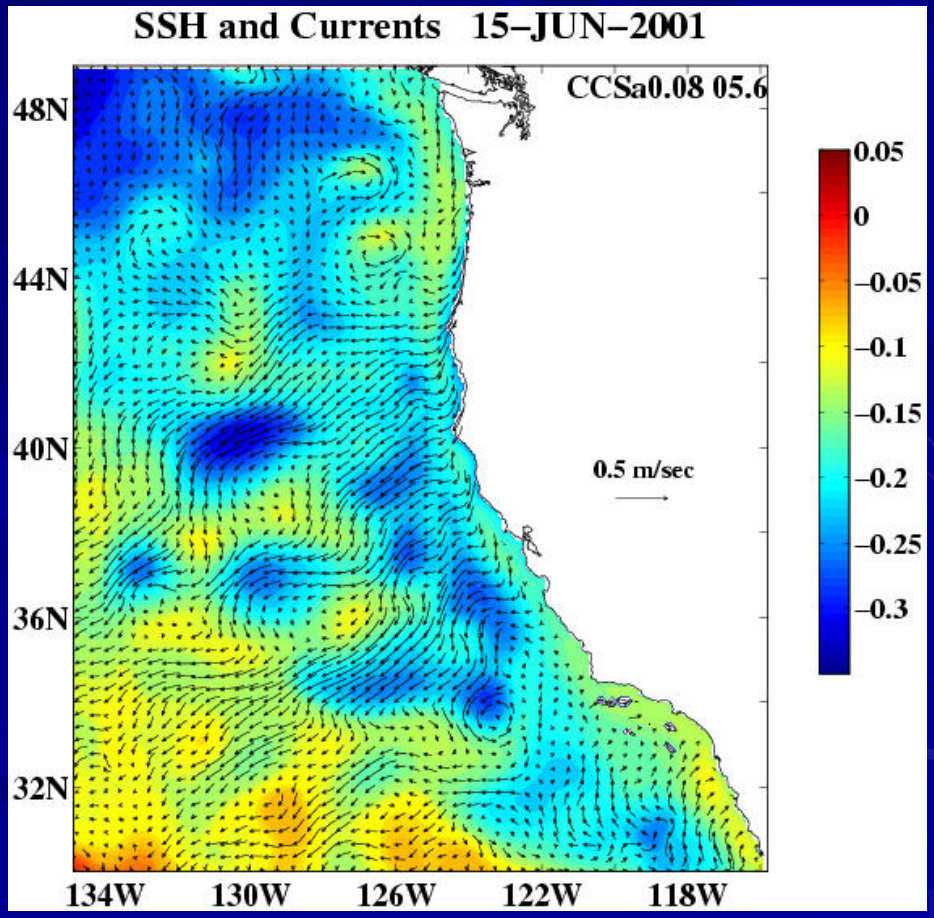


Sensitivity to Boundary Values

ECMWF (3.4) Boundary Values



NOGAPS (6.2) Boundary Values



Plans

- Pacific Basin HYCOM Simulation($1/12^0$)
  - Evaluate Real-time, assimilative Pacific HYCOM
    - US west Coast region
    - Compare with Observations/ NCOM
- Nested Eastern Pacific HYCOM
  - Force with High Resolution COAMPS (81/27/9/3 km)
  - 2-3 km resolution experiments
  - Evaluate HYCOM
    - As a coastal Model
    - Coupled Ecosystem model(s)
    - Impact of vertical coordinate on Ecosystem response
    - Impact of Model choice on Ecosystem response
      - HYCOM; NCOM; ROMS
  - Real-time HYCOM for the US west Coast
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    - Add data assimilation for physical component
    - Boundary conditions from Real-time Pacific HYCOM
    - Combine with Real-time MODIS Ocean Color

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The End