A comparison of remote versus local influence of El Nino on the coastal circulation of the Northeast Pacific

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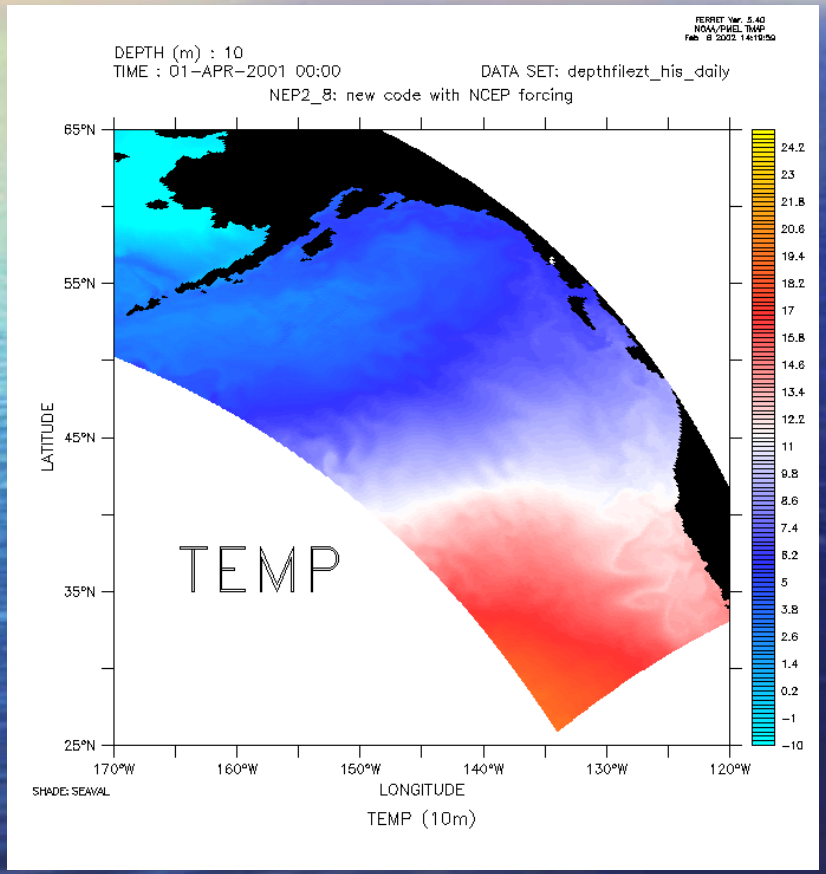
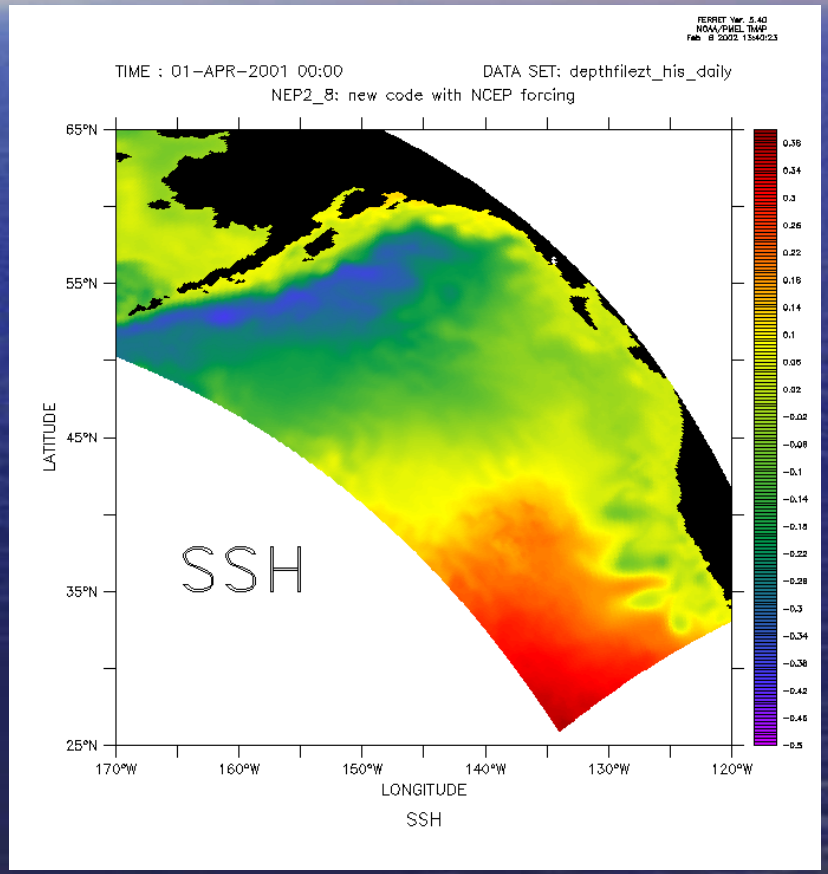
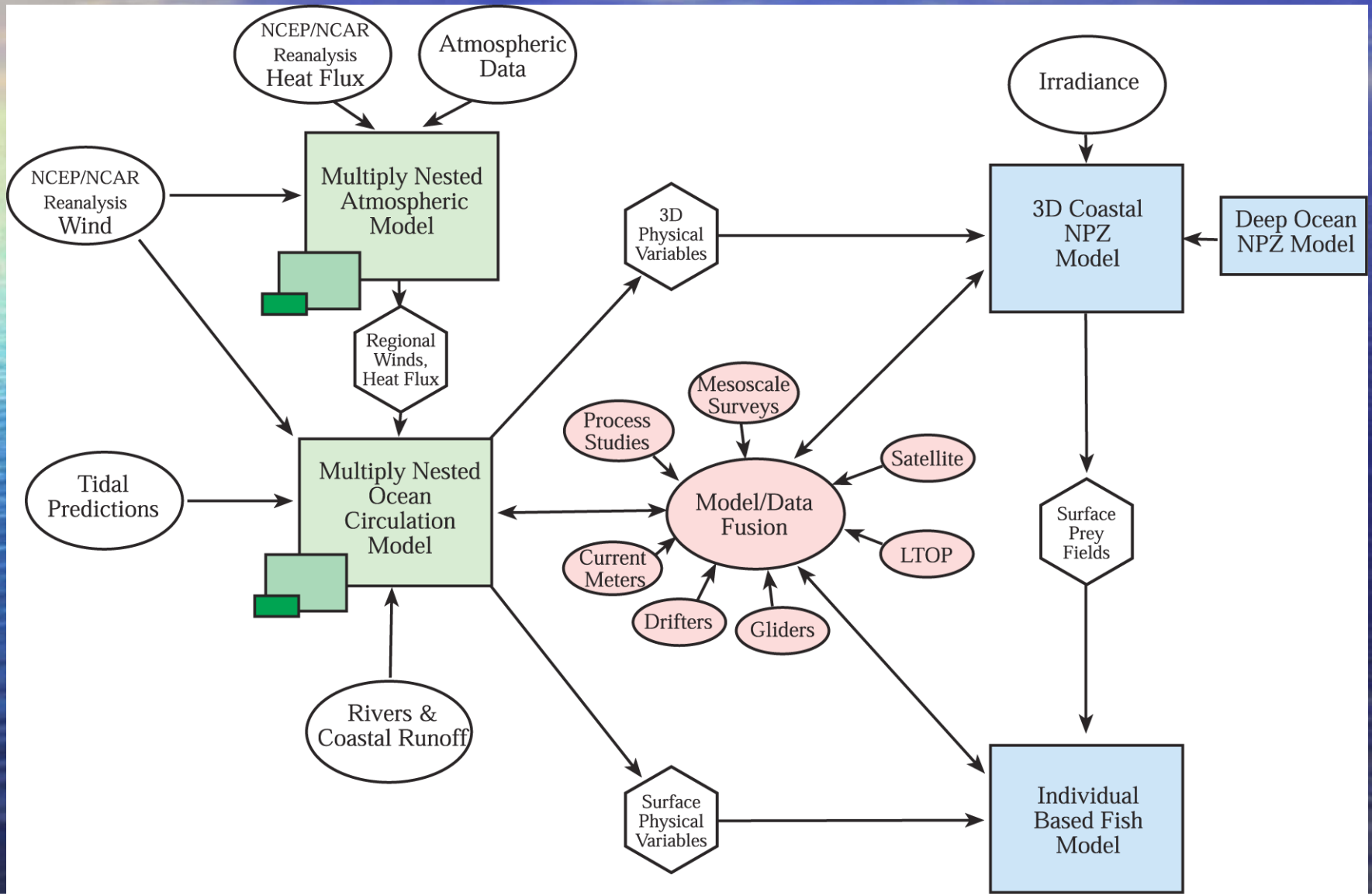
Northeast Pacific GLOBEC





Nested Biophysical Models for GLOBEC:

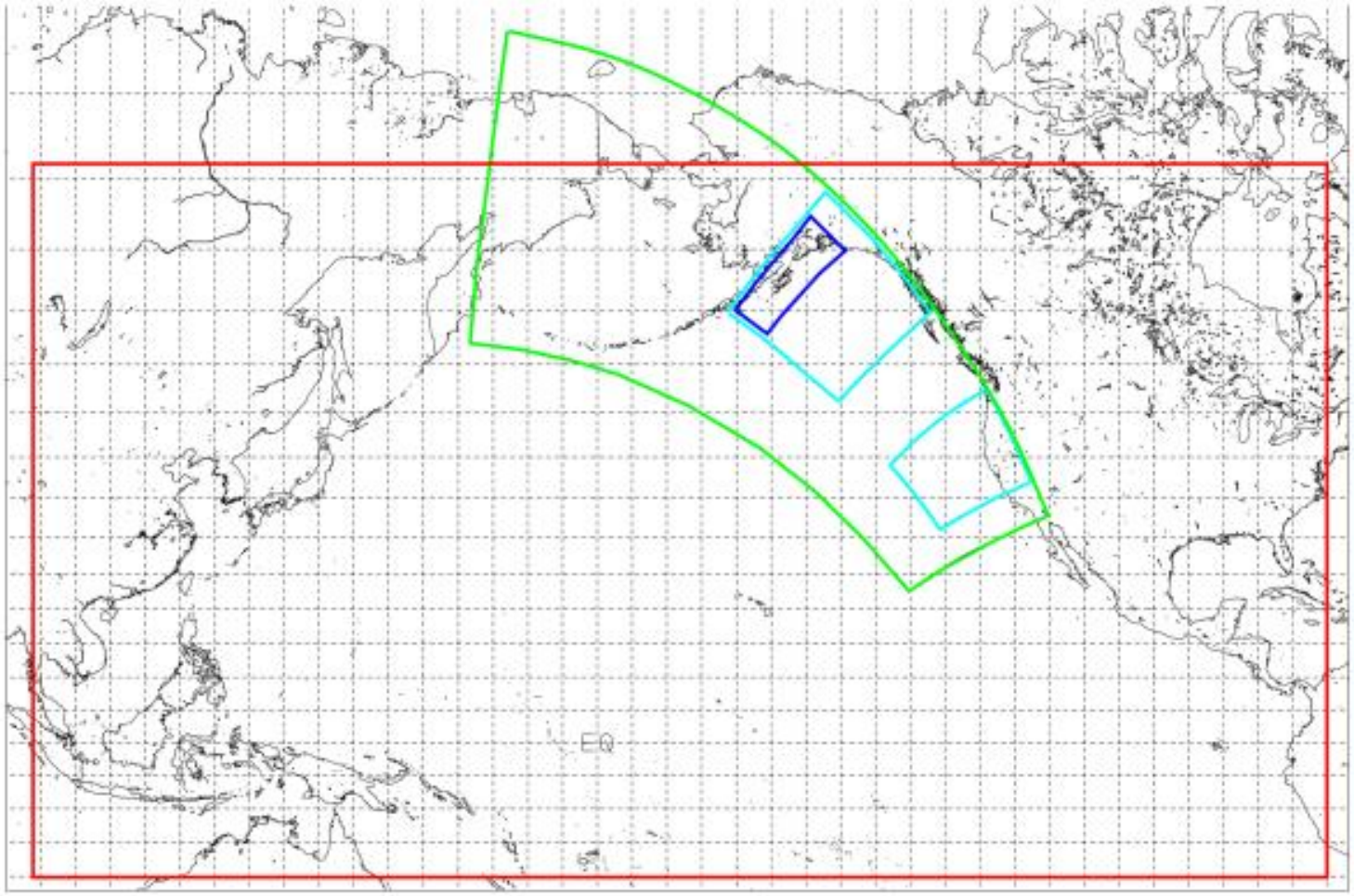
NCEP/MM5 -> ROMS/NPZ -> IBM



The Circulation Models

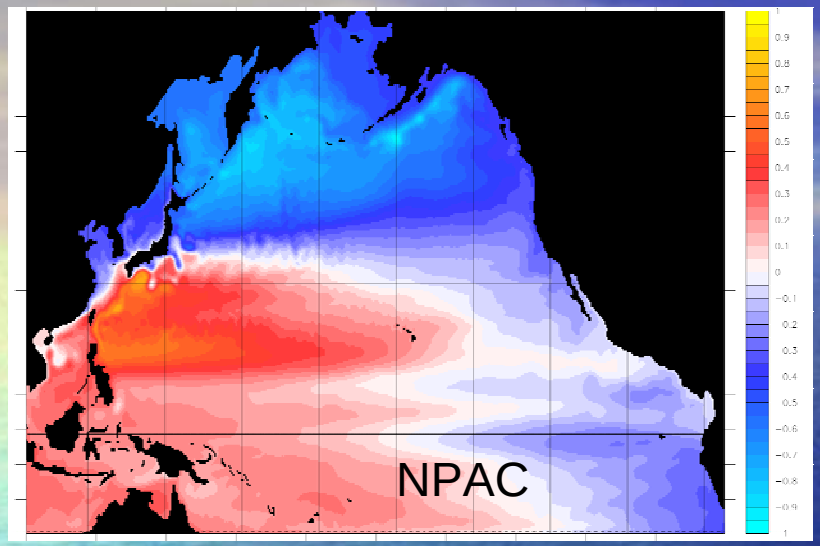
- Regional Ocean Modeling System (ROMS)
- Primitive Equations
- Terrain-following vertical coordinates (30 vertical levels)
- LMD mixed layer physics
- COADS/NCEP/MM5 wind and heat forcing
- Implemented on massively parallel (distributed memory) computers

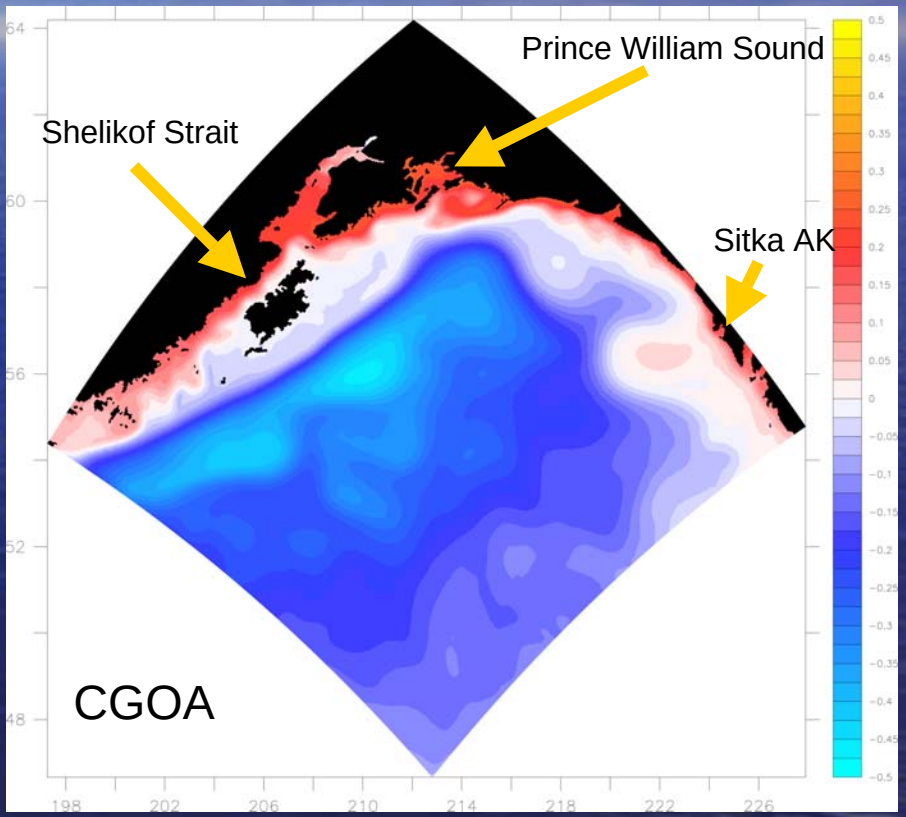
NESTED CIRCULATION MODEL DOMAINS

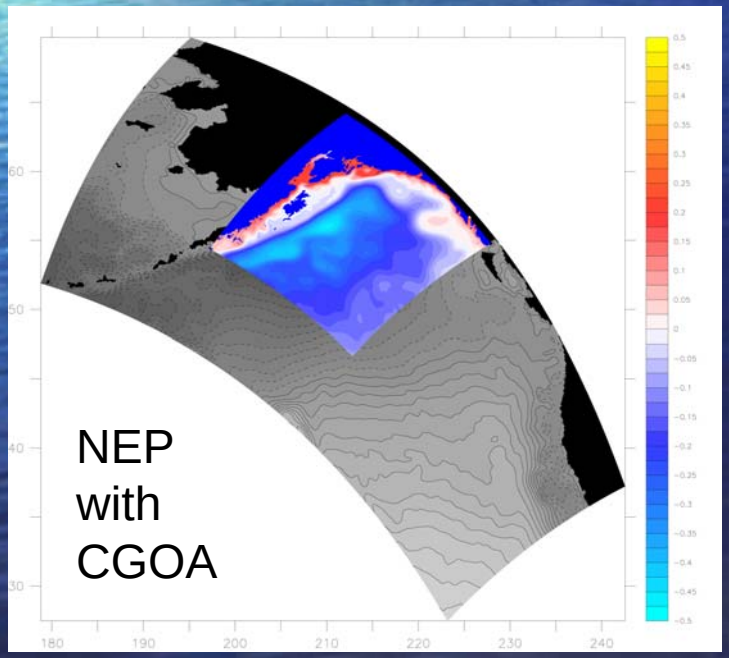


Delta x = 20 40 km Delta x = 10 km Delta x = 3 km Delta x = 1 km

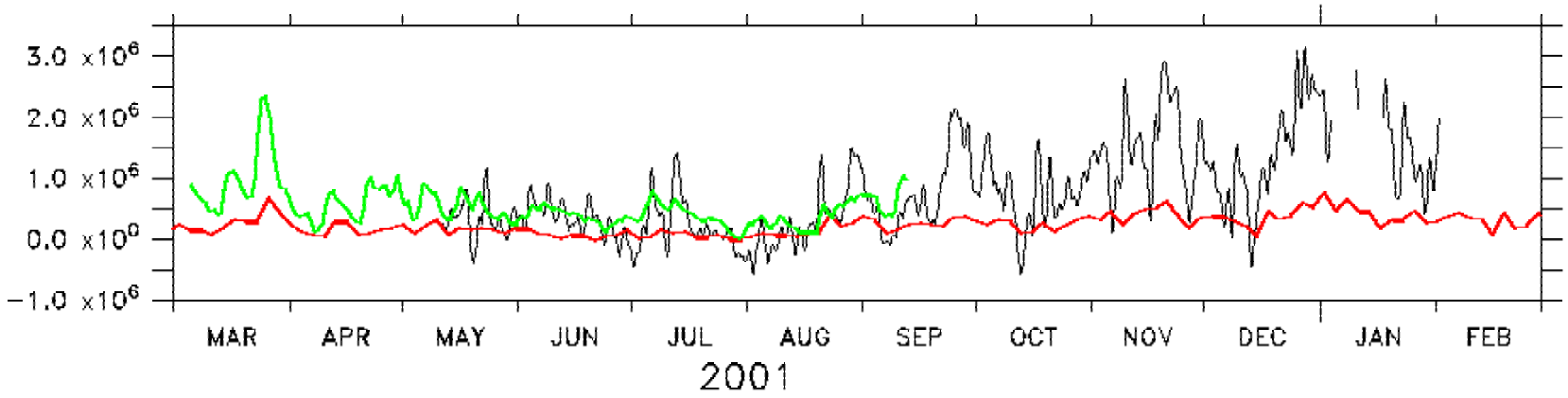
Nested model domains with SSH



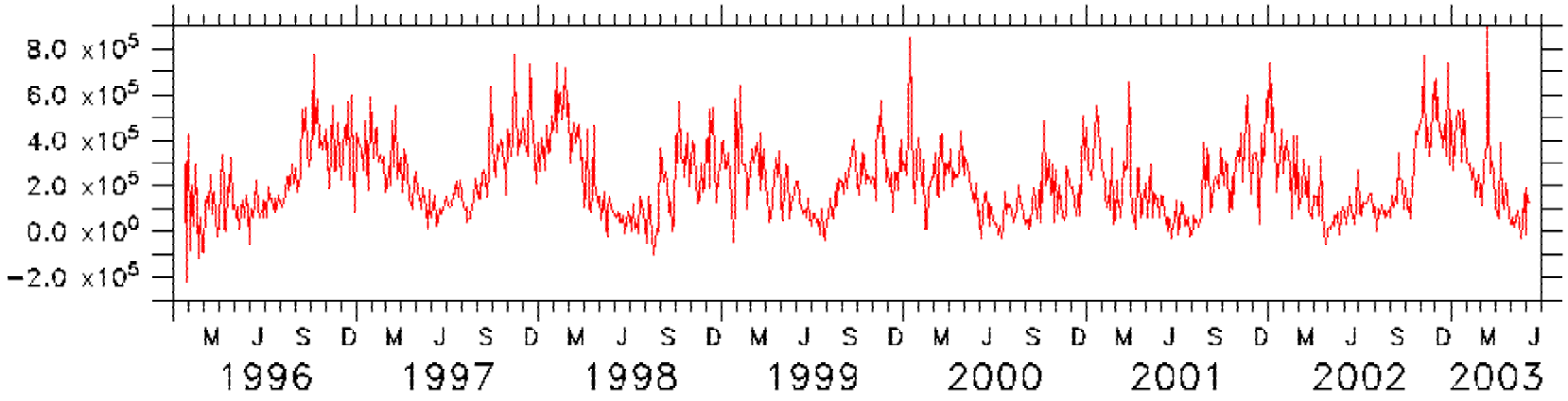




How well do NEP and CGOA models replicate flow thru Shelikof Strait?

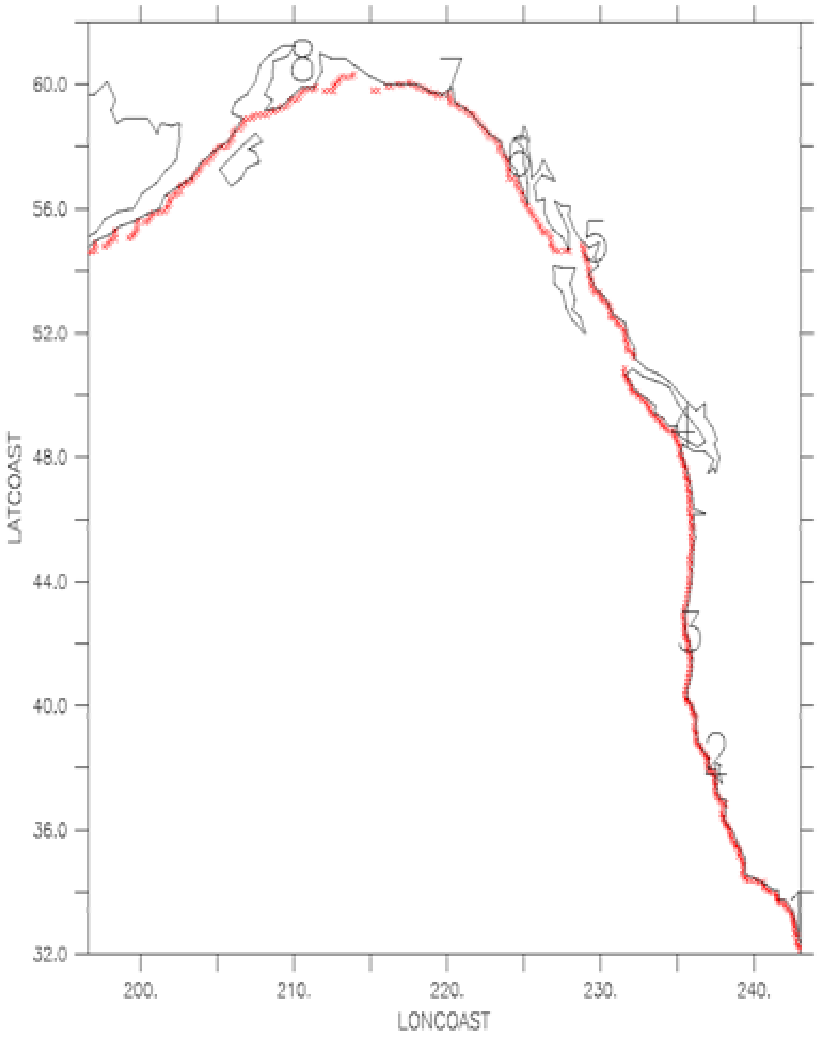


model−data comparison (sv) (NEP− red; CGOA− green; data− black)

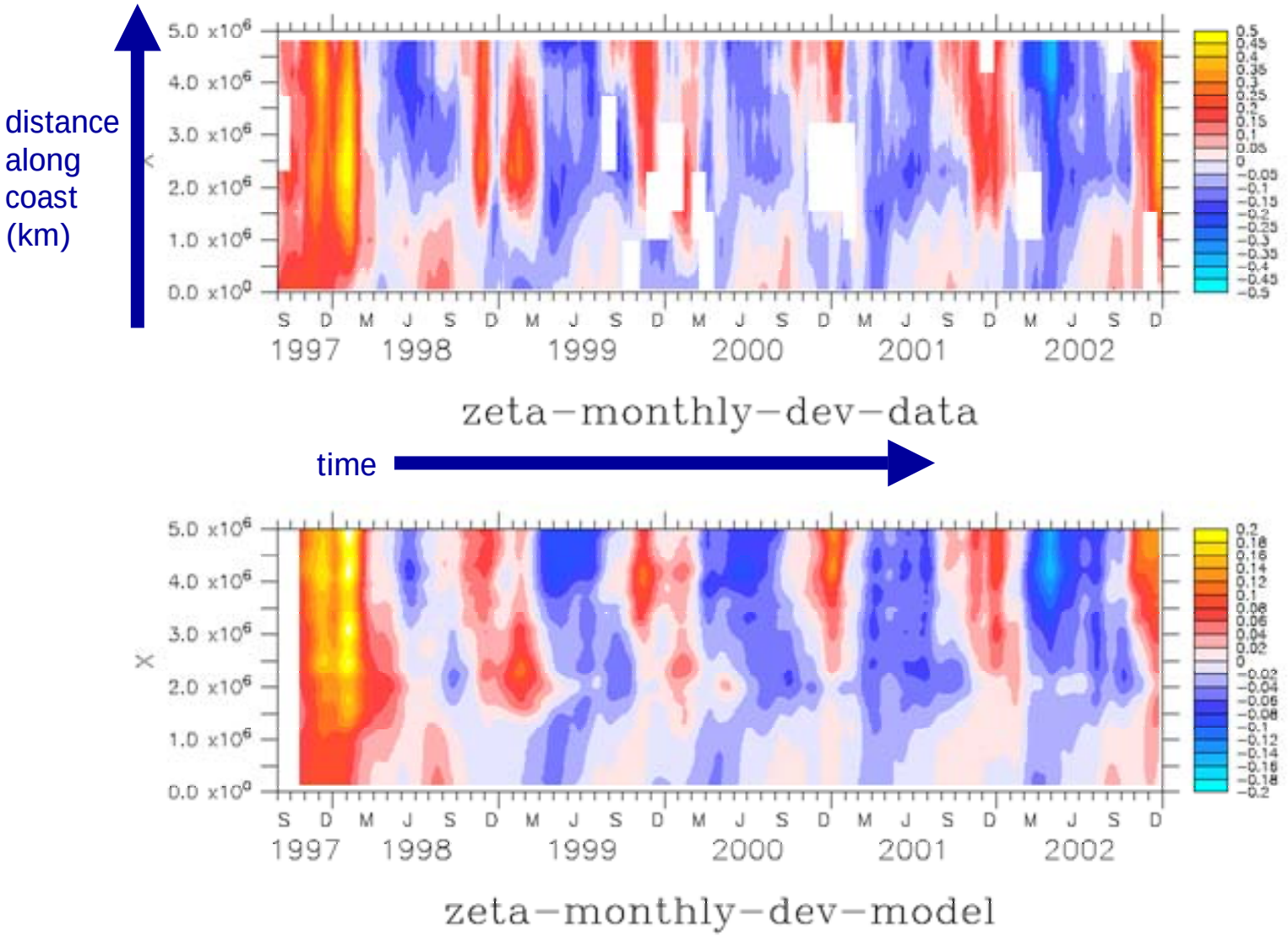


Flux through Shelikof Strait (sv) (NEP model)

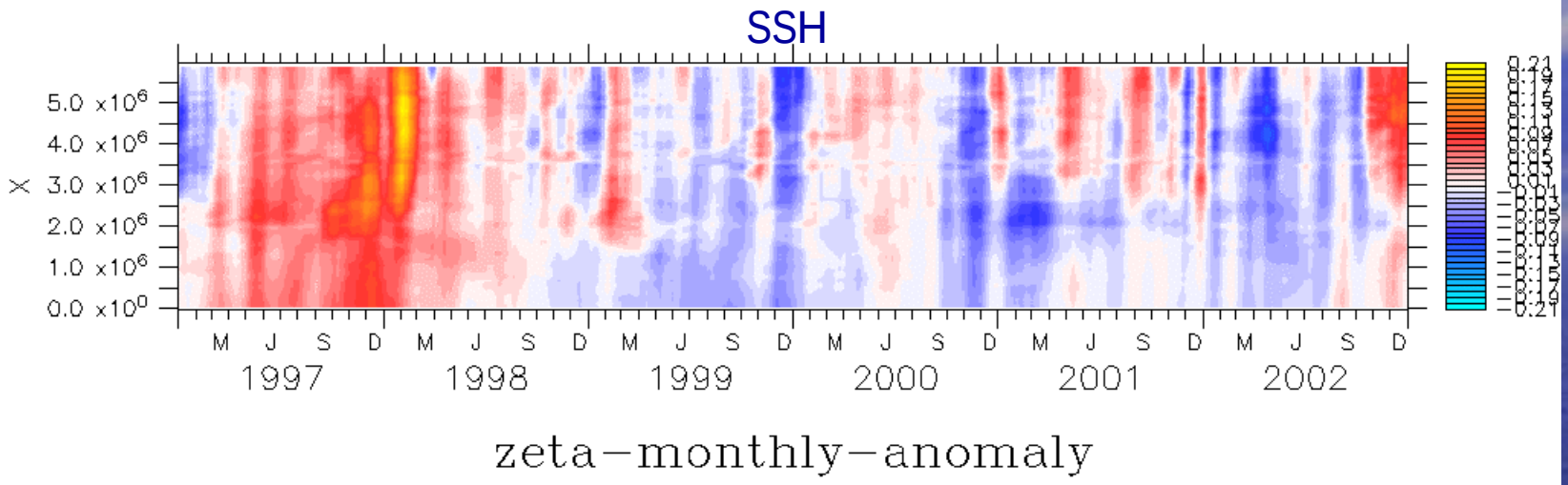
Focus on the *coastal* signals in NEP model

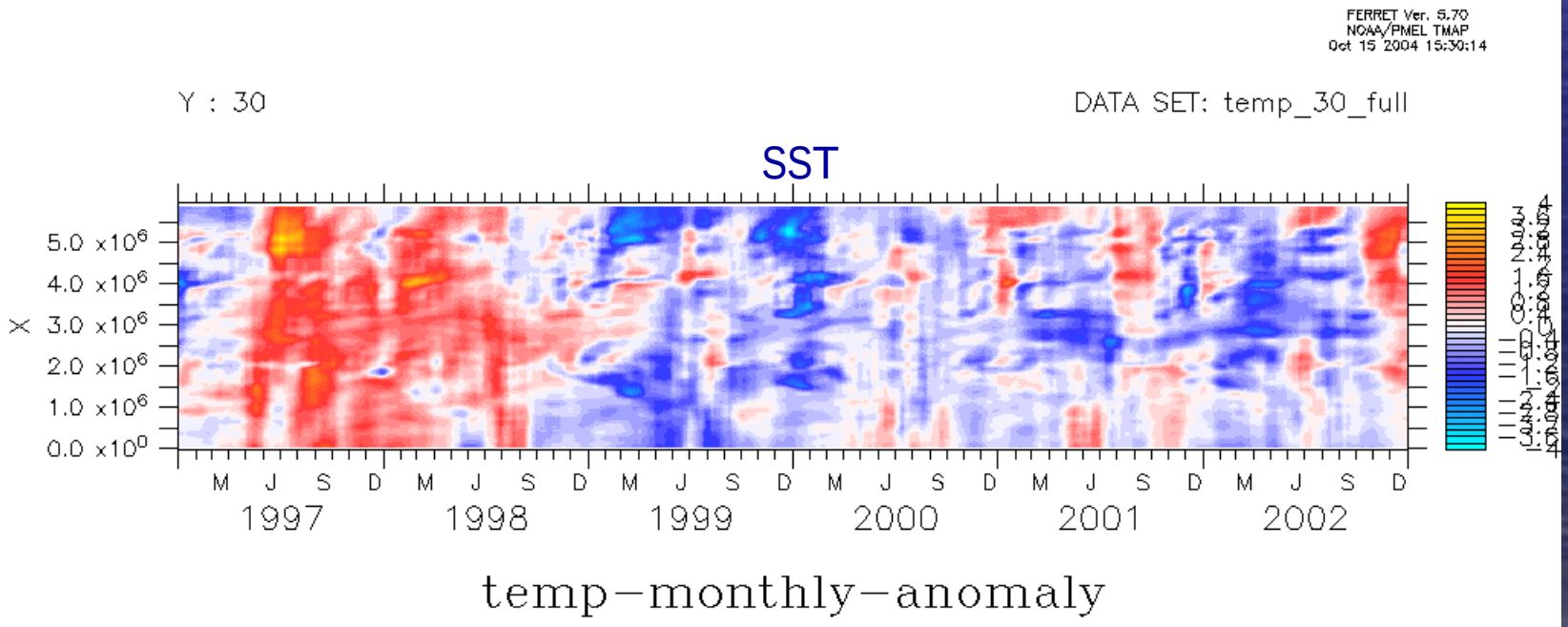


How well does NEP replicate observed coastal SSH (relative to long-term mean)?

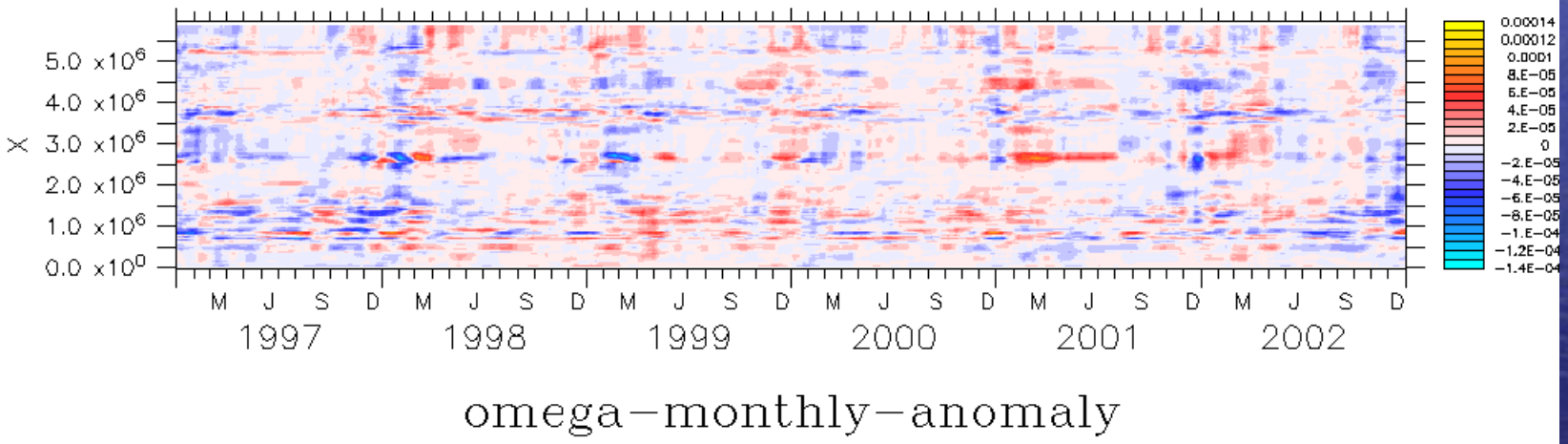


Monthly anomalies of SSH and SST

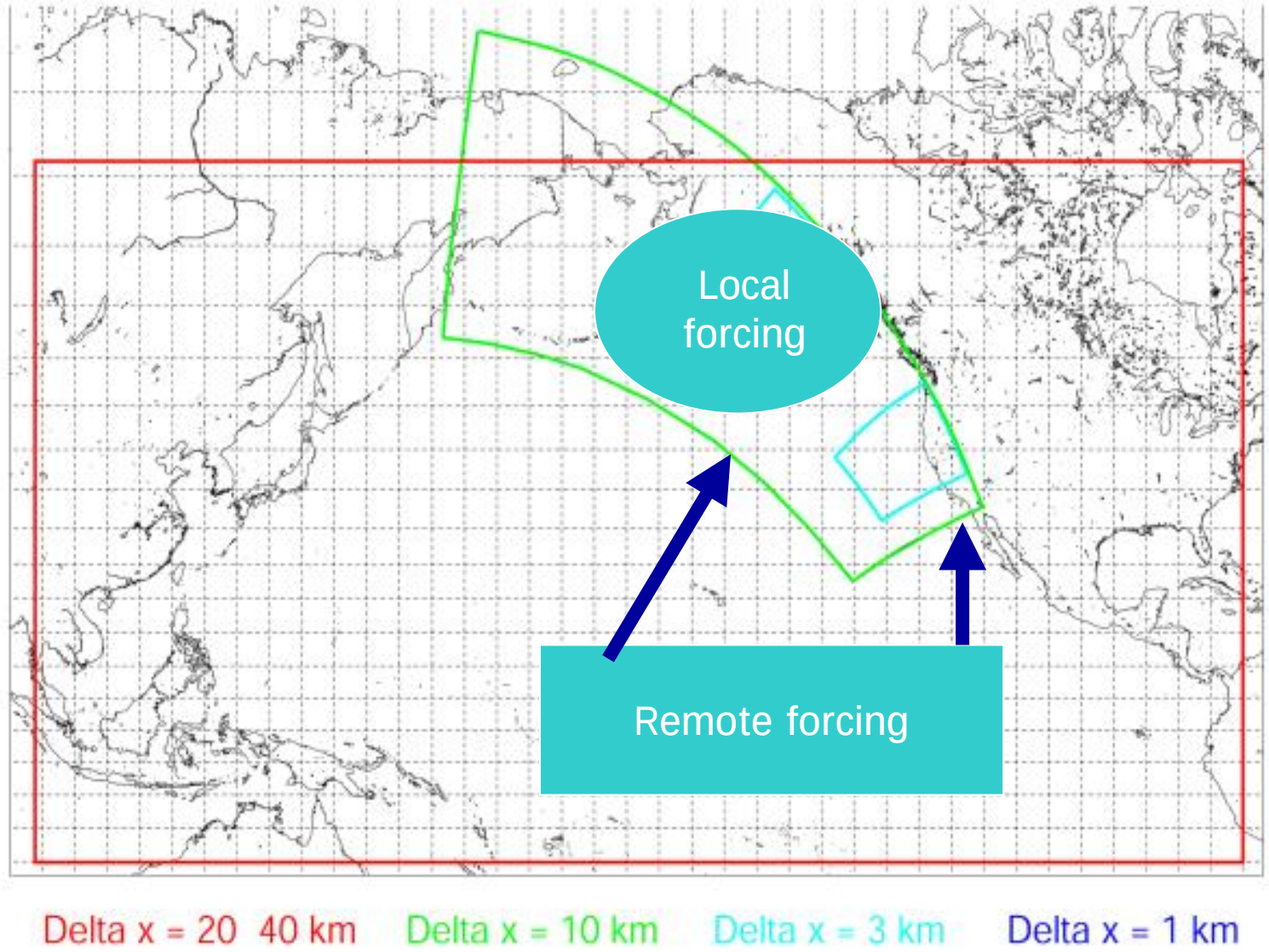




Monthly anomalies of vertical velocity



Local vs remote forcing



NEP El Nino Sensitivity experiments

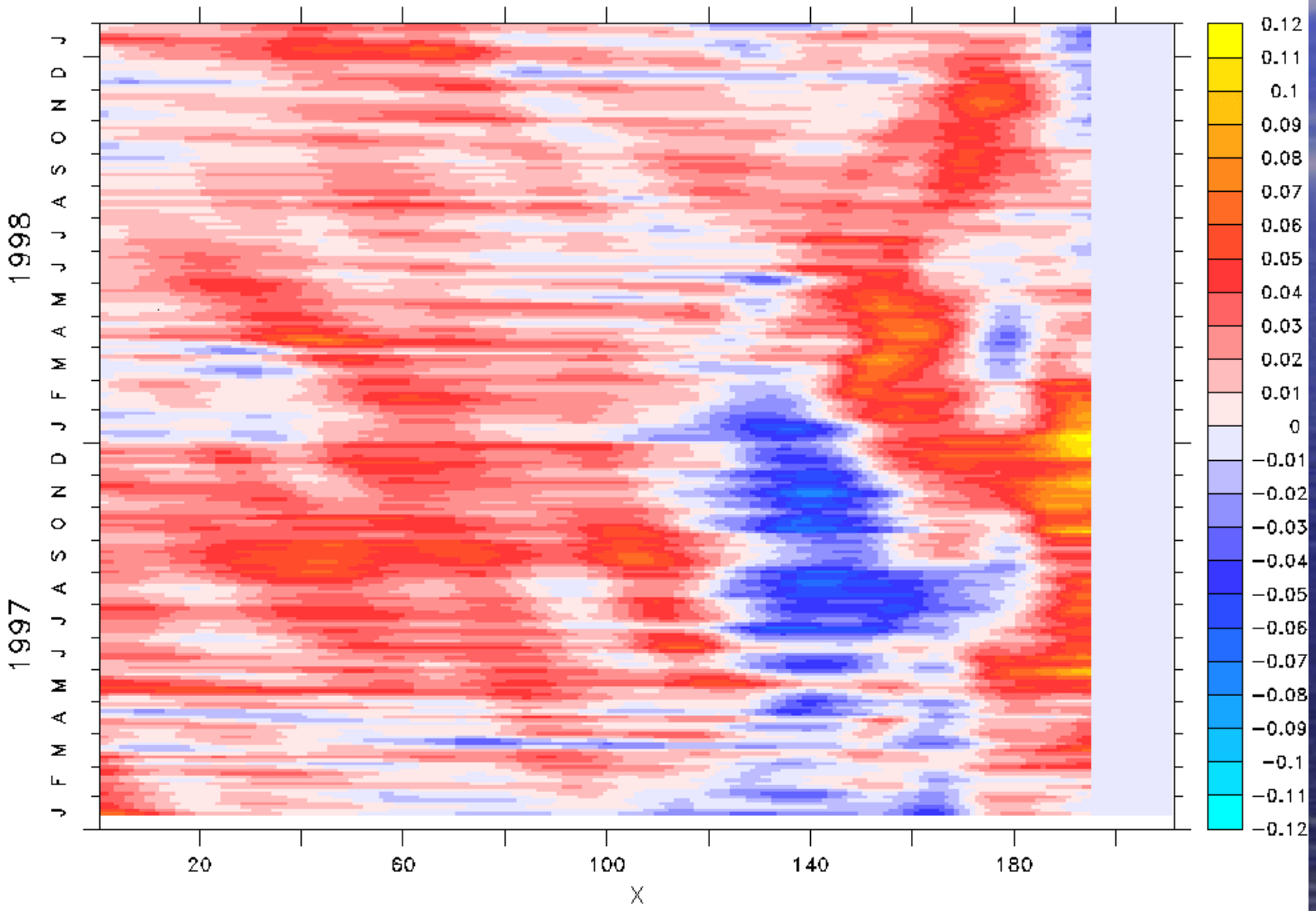
1. “Standard” (full hindcast) run
   - NCEP daily surface forcing (VW)
   - NPac 3-day averages as BC (VBC)
2. “Climatological” run
   - monthly climatology of NCEP surface forcing (CW)
   - monthly climatology of NPac BC (CBC)
3. "Variable surface" run
   - VW with CBC
4. "Variable boundary" run
   - VBC with CW

Define:

"Local forcing" = 3 - 2

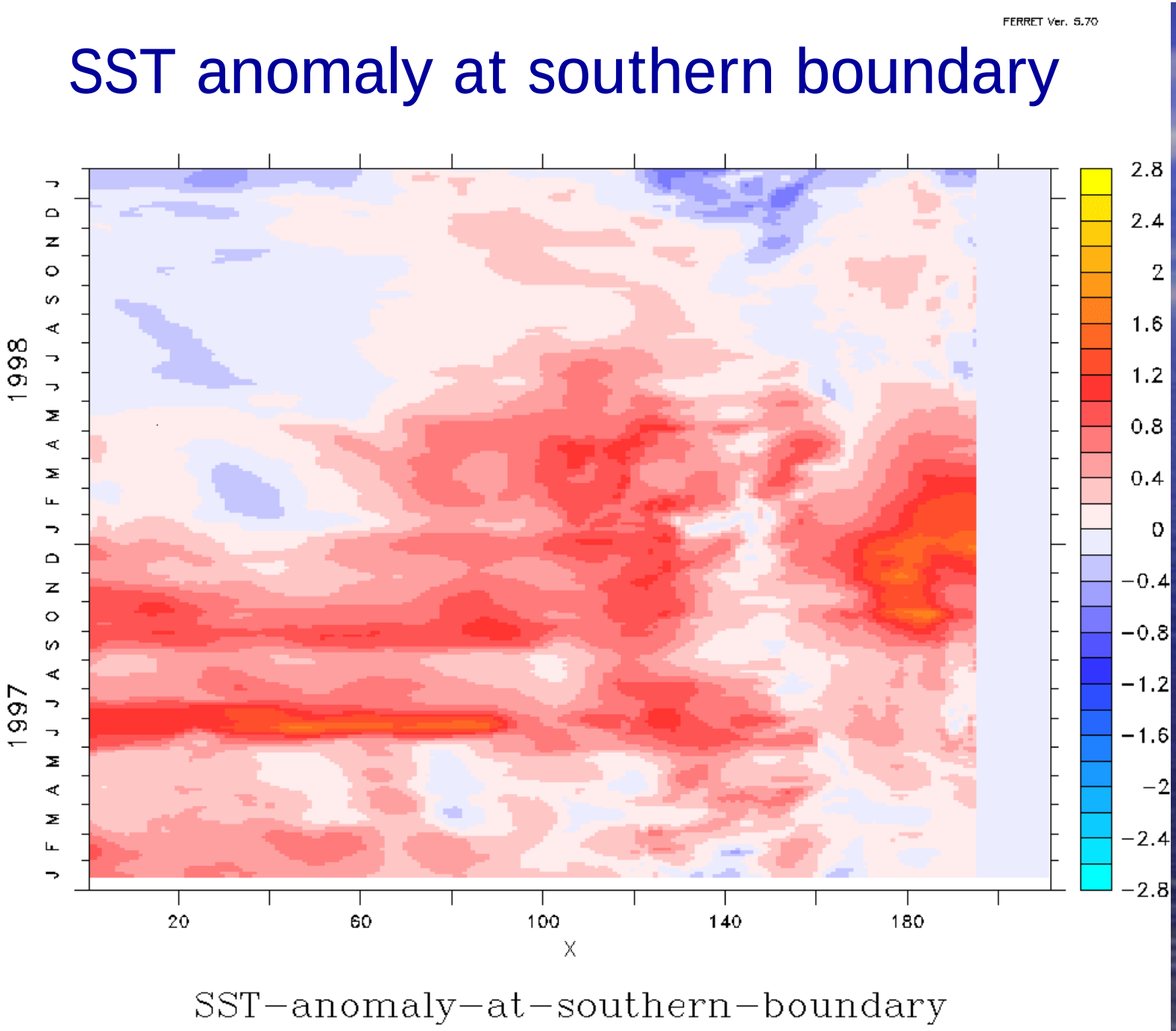
"Remote forcing" = 4 - 2

SSH anomaly at southern boundary

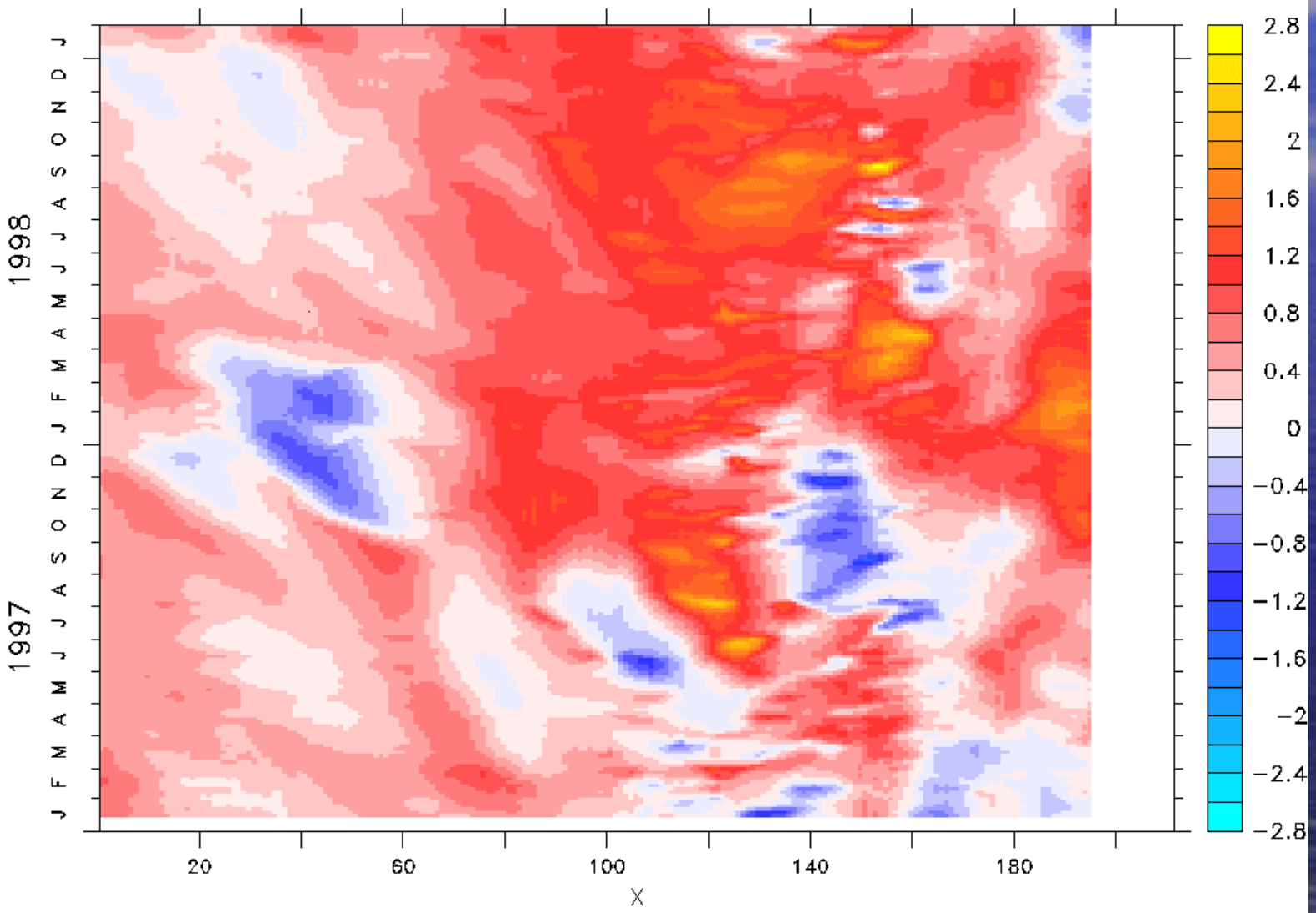


ssh−anomaly−at−southern−boundary

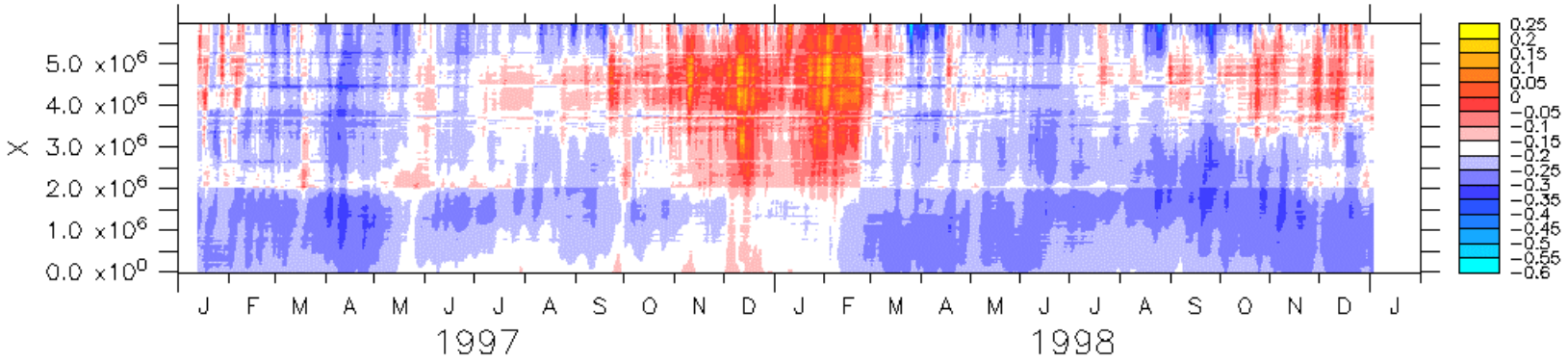
SST anomaly at southern boundary



100m T anomaly at southern boundary



Coastal SSH:
standard vs climatological run



zeta Variable Winds and Variable BC

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NOAA/PMEL TMAP
Oct 14 2004 13:52:01

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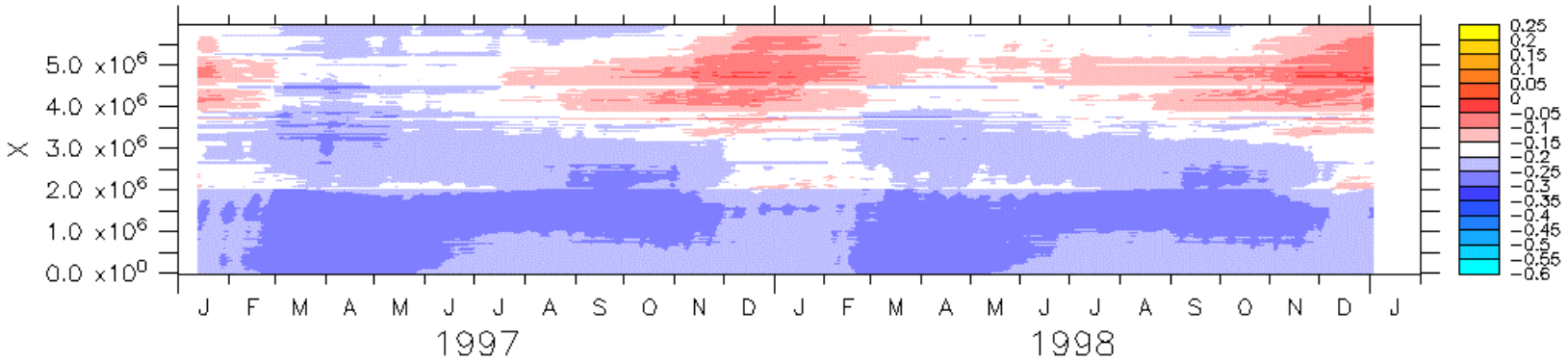
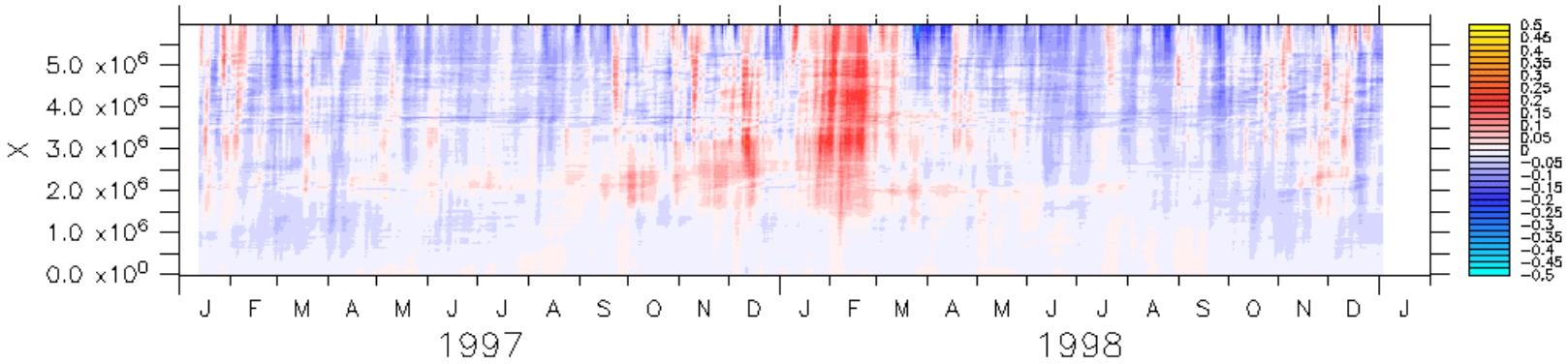


zeta Climatological Winds and Climatological BC

Locally vs remotely forced SSH

LOCALLY FORCED



zeta VW−CW both CBC

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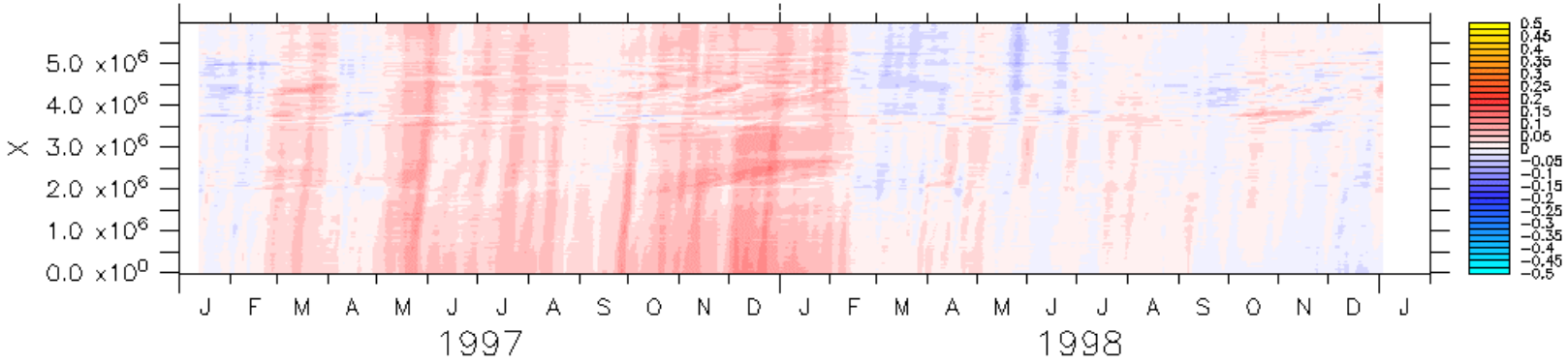
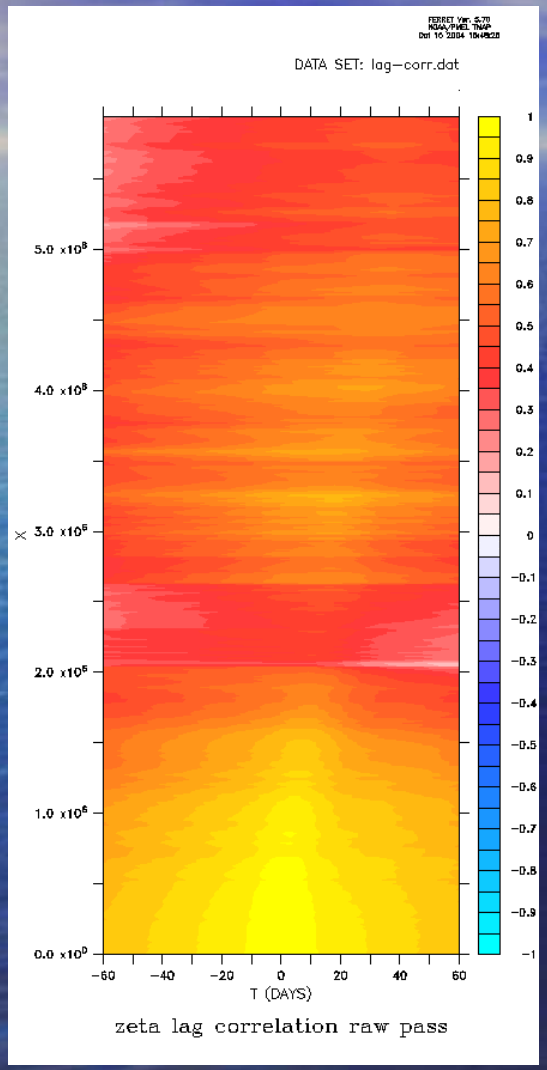
REMOTELY FORCED

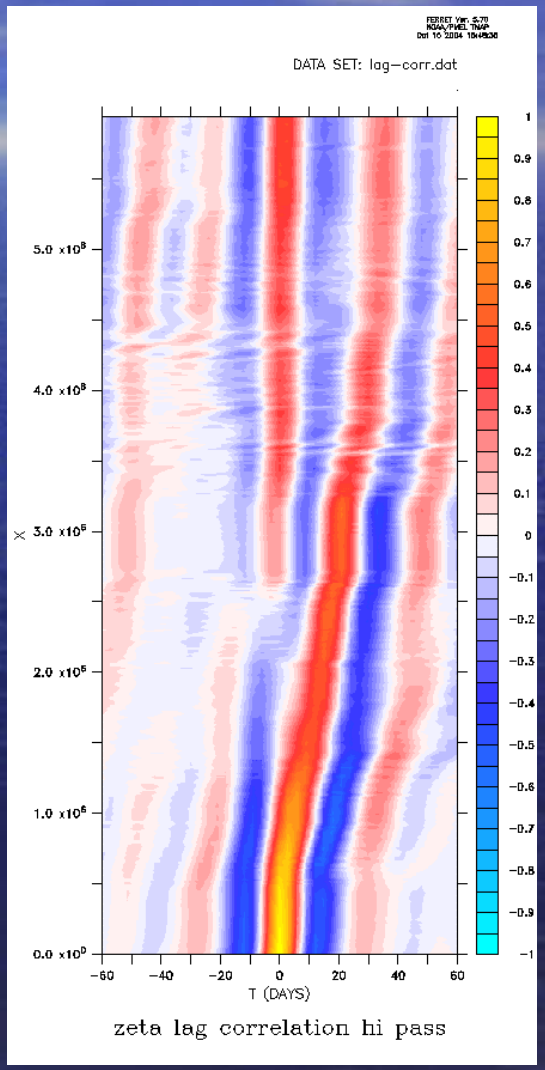


zeta VBC−CBC both CW

Lagged correlation of coastal SSH with value at southern boundary



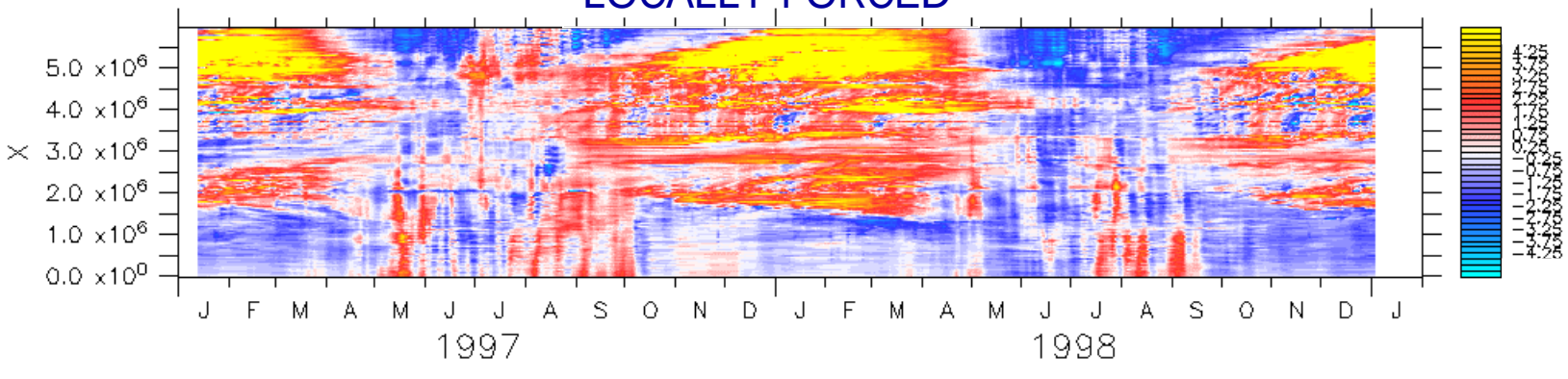
unfiltered



highpass

Locally vs remotely forced coastal SST

LOCALLY FORCED



ttop VW−CW both CBC

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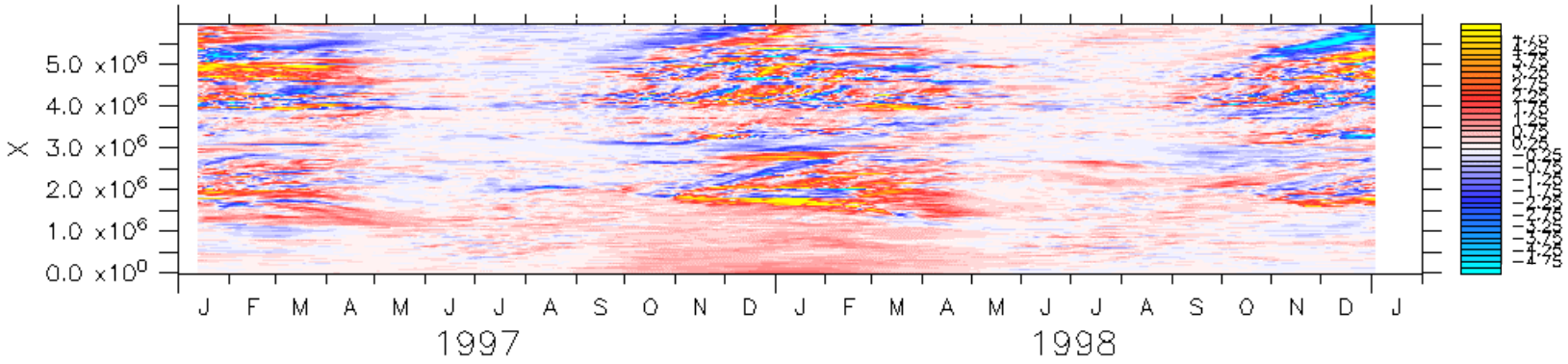
Y : 1

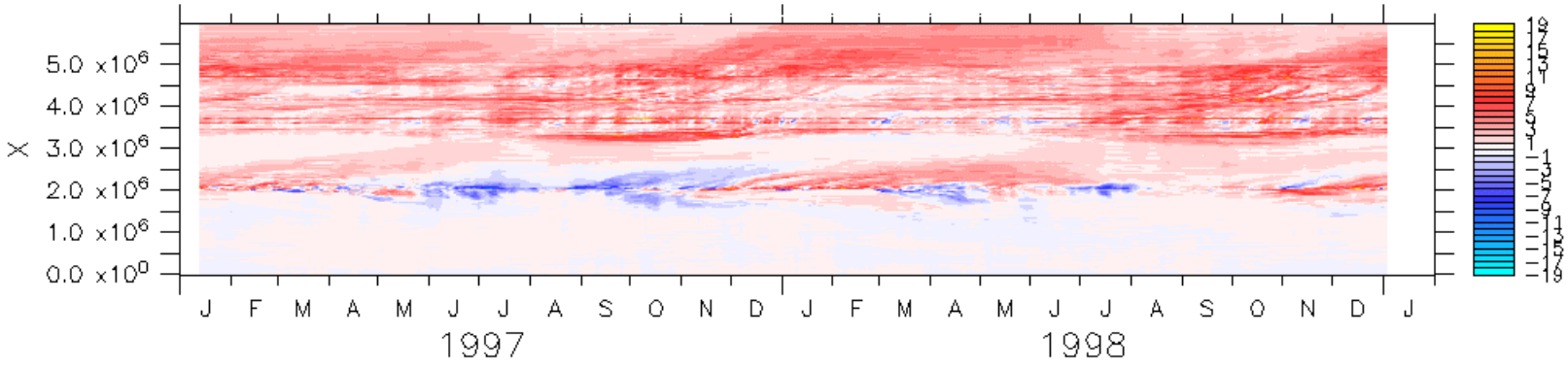
REMOTELY FORCED



ttop VBC−CBC both CW

Locally vs remotely forced coastal SSS

LOCALLY FORCED



stop VW−CW both CBC

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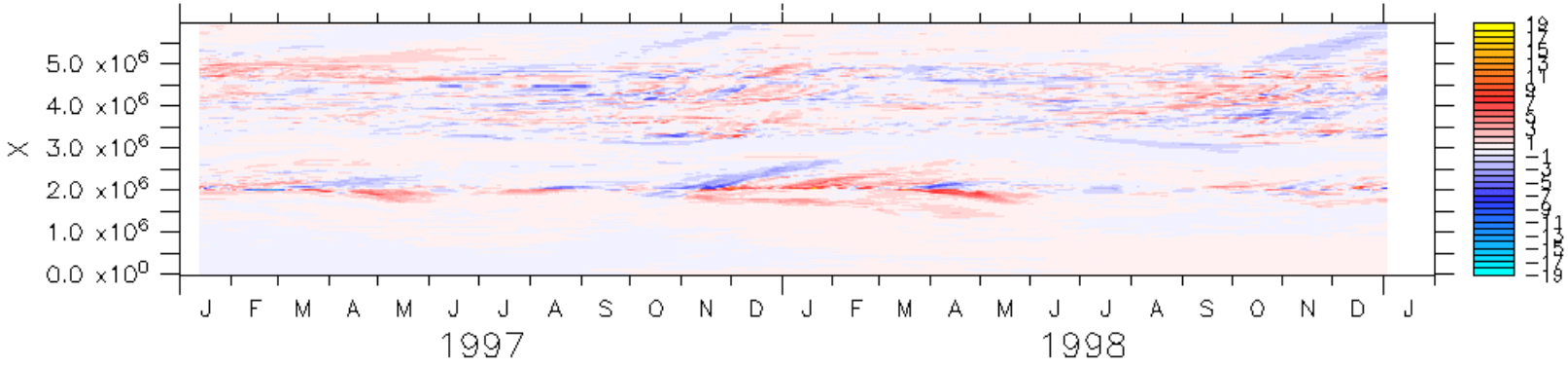


stop VBC−CBC both CW

Summary of results

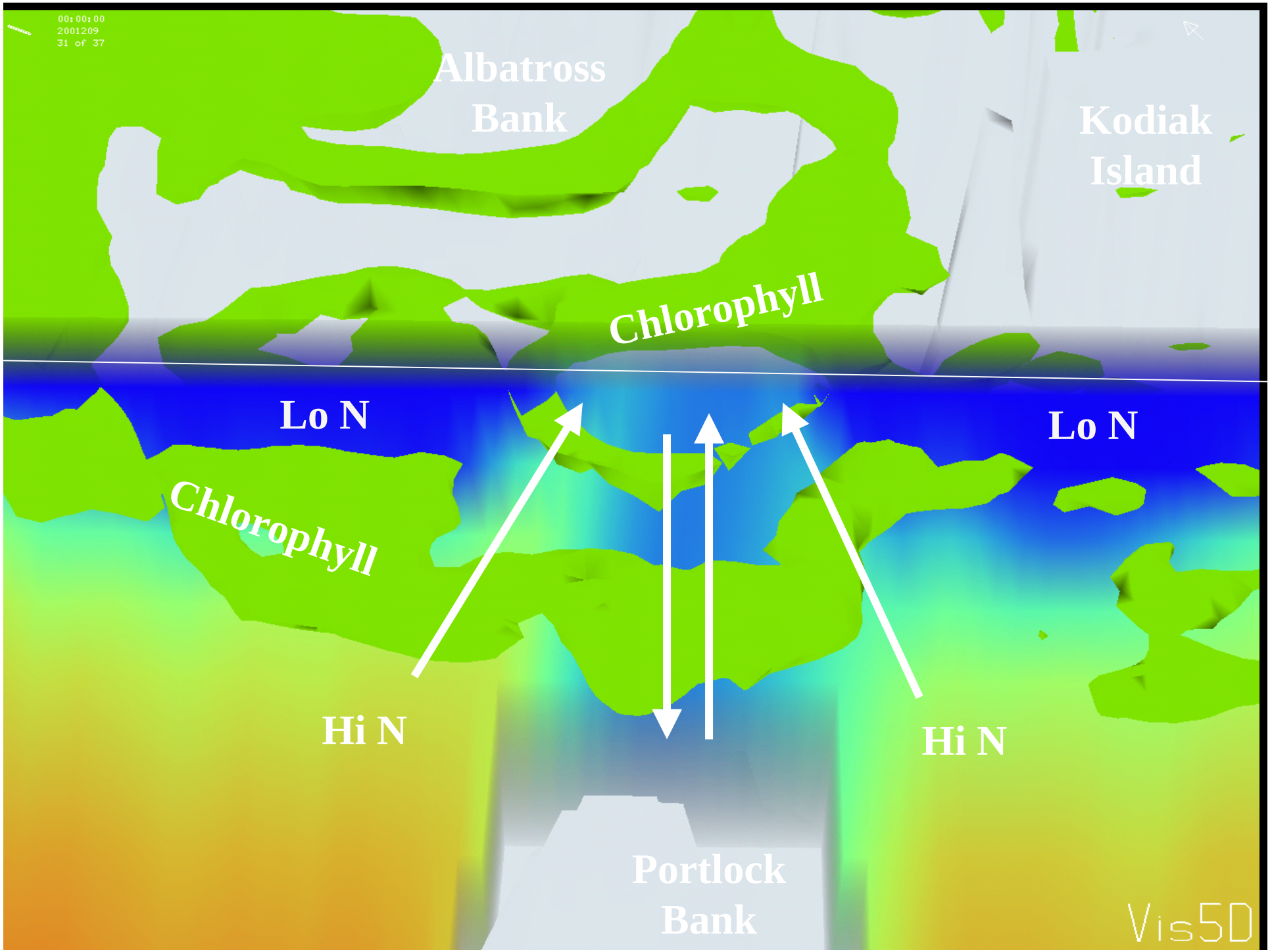
- SSH
  - Significant, wavelike remote forcing all along the coast (strongest in the south)
  - Strong local forcing in the north
- SST
  - Appreciable remote forcing in the south
  - Strong local forcing in the north
- SSS
  - forcing is all "local" but see alongshore propagation

Biological Implications

- Reduced upwelling all along the coast (both California and Alaska) during El Nino, both remotely and locally forced
- Strong locally forced temperature signal in the CGOA

Next Steps

- Further analysis of subsurface temperature signals; look for propagation along deeper isobaths
- Further analysis of upwelling at various depths
- Coastal EOFs
- Offshore EOFs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31 of 37
Albatross
Bank
Kodiak
Island
Chlorophyll
Lo N
Lo N
Chlorophyll
Hi N
Hi N
Portlock
Bank
Vis5D