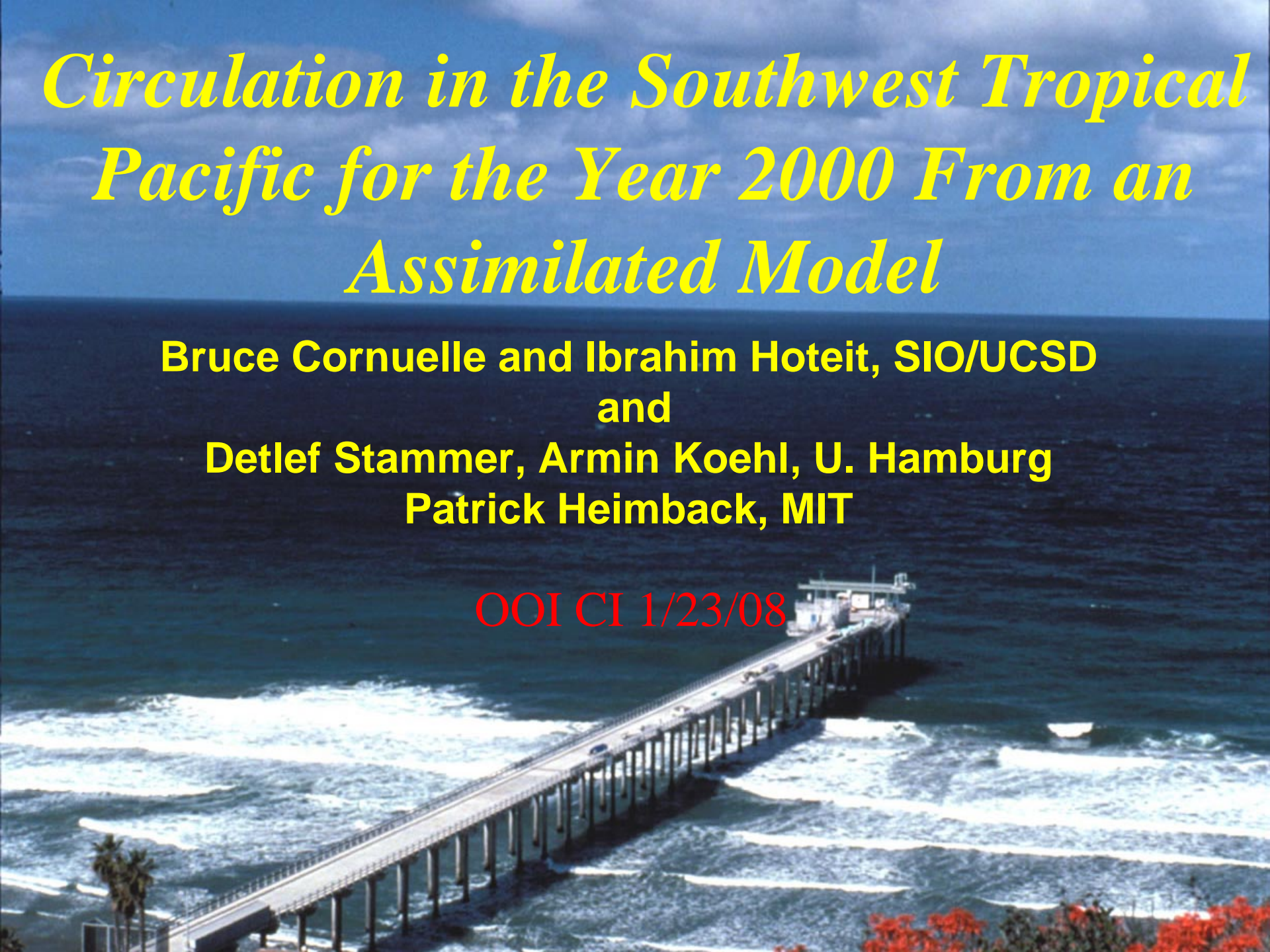


*Circulation in the Southwest Tropical
Pacific for the Year 2000 From an
Assimilated Model*

**Bruce Cornuelle and Ibrahim Hoteit, SIO/UCSD
and
Detlef Stammer, Armin Koehl, U. Hamburg
Patrick Heimback, MIT**

OOI CI 1/23/08

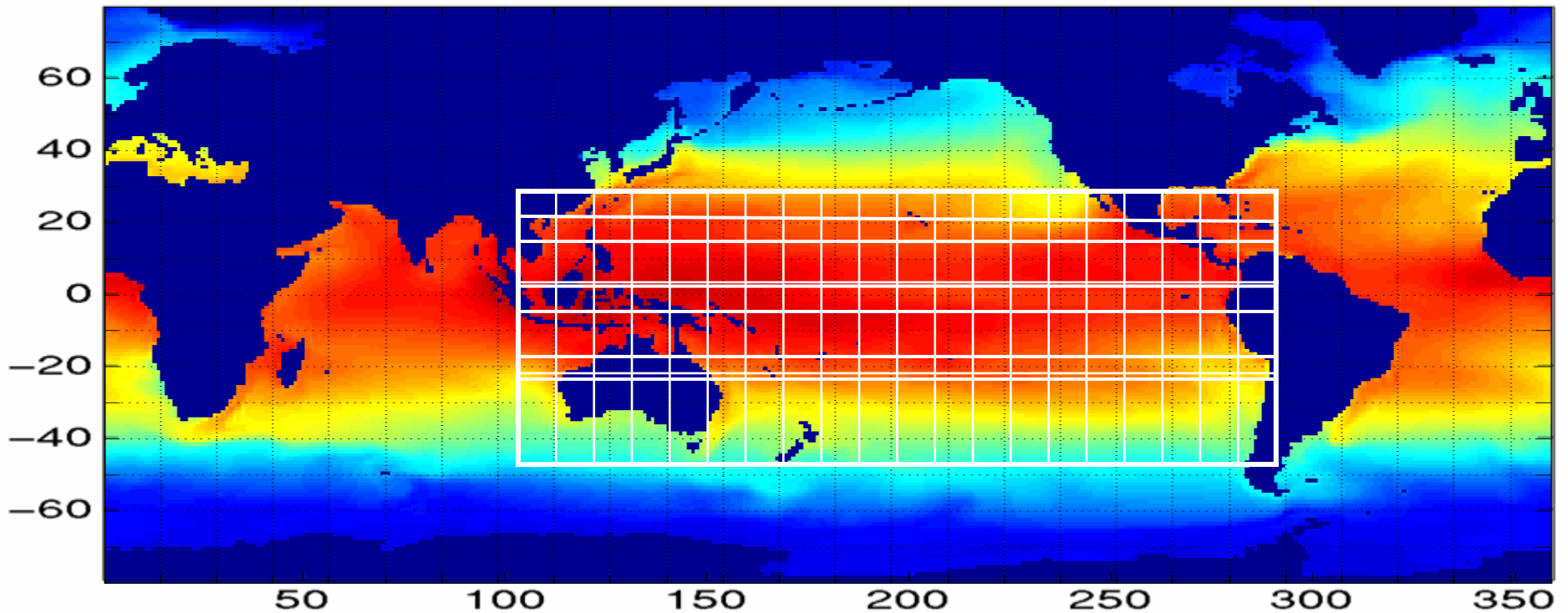


Goal: Realistic Model for Tropical Pacific Region

- Optimized to fit most observations
- Year 2000 only so far
- Show some comparisons with observations
- Examine model solution for South Pacific
 - Connection to western boundary, bifurcation
 - Connection to Equatorial band, including EUC
 - Sensitivity to forcing, resolution, topography

Regional Model Inside ECCO Global Domain

Global $1^\circ \times 1^\circ$ ECCO Model



“4DVAR”

- “Hard constraint”: model dynamics are not changed. (But adjust forcing and fluxes.)
- Use model adjoint and iterative descent to determine “reasonable” forcing, boundary conditions, and initial conditions to make a forward run that fits the data “within error bars”.
- Generally used as a hindcast for scientific analysis or model testing. Not guaranteed to fit the observations. Estimates “balanced” forcing fields.

Details

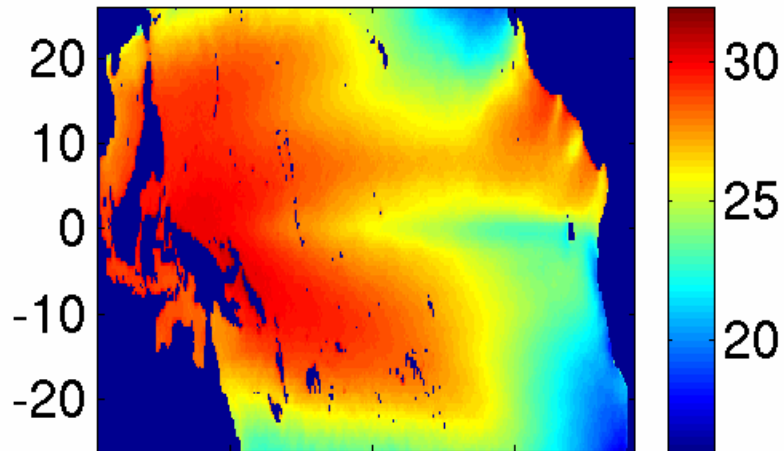
- Using ECCO assimilation system (MITgcm, Adjoint)
- Regional 1/3 deg. model: eddy permitting; 1/6 deg. tests
- One year period: 2000
- Datasets: TAO, SSH, SST, Drifters, T and S profiles
- Levitus IC, ECCO BC, controls are: IC, BC, HF, WS, E-P
- Start from NCEP-NCAR reanalysis or QSCAT
- Roughness penalty on corrections (Laplacian)
- Can we combine the datasets consistently with the model?

First Step: Sensitivity

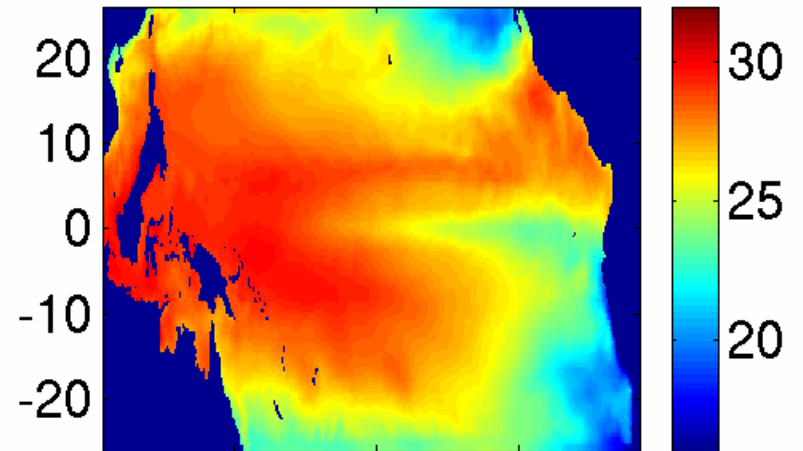
- Change wind stress, look at differences
 - Many fields: SST, SSH, u, v, T, S, ...
- Change resolution
 - What grid resolution is necessary?

Mean-00 SST ($^{\circ}\text{C}$)

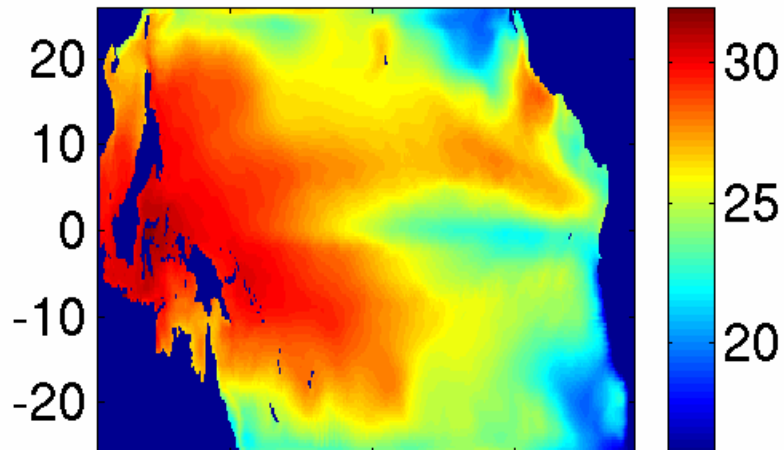
TMI Data



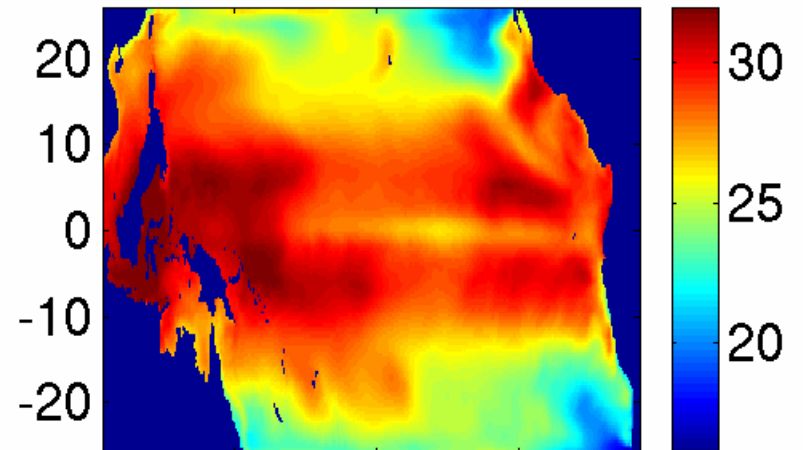
ASSIMILATION (b=NCEP)



REFERENCE - QSCAT

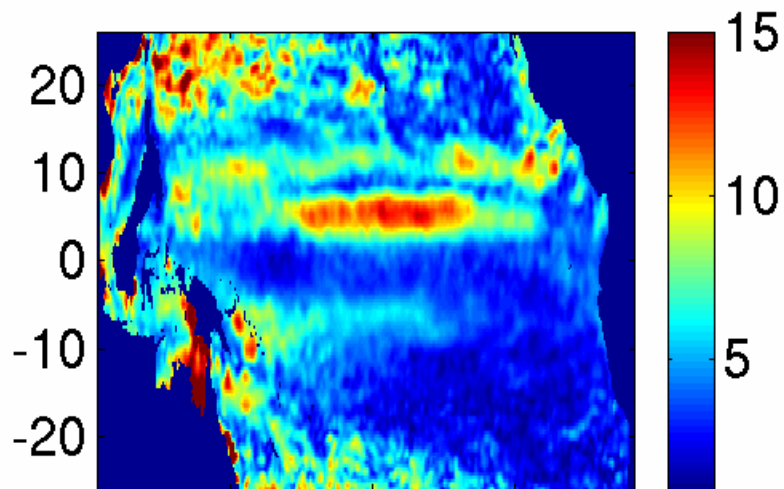


REFERENCE - NCEP

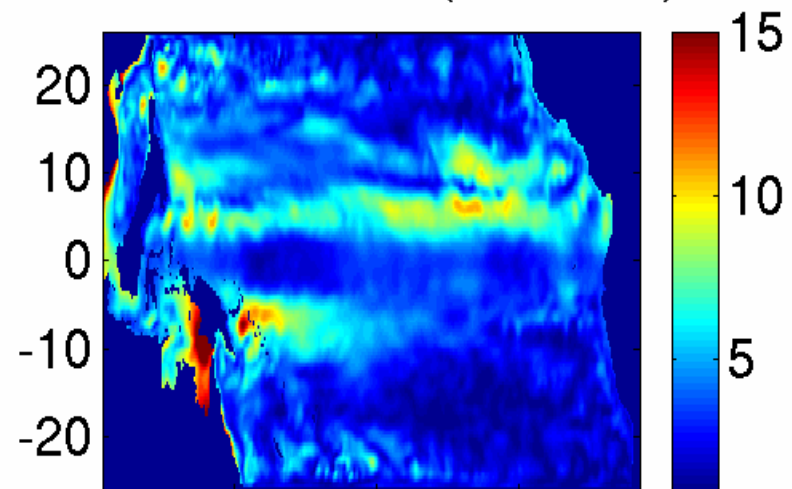


STD-00 SSH (cm)

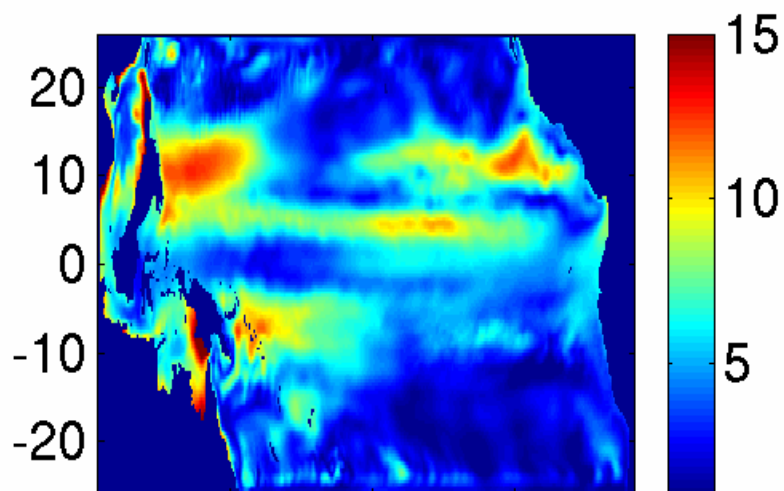
AVISO



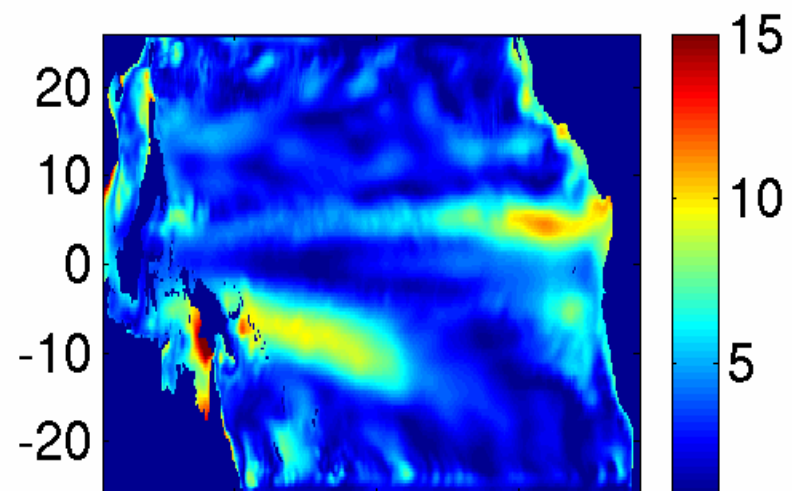
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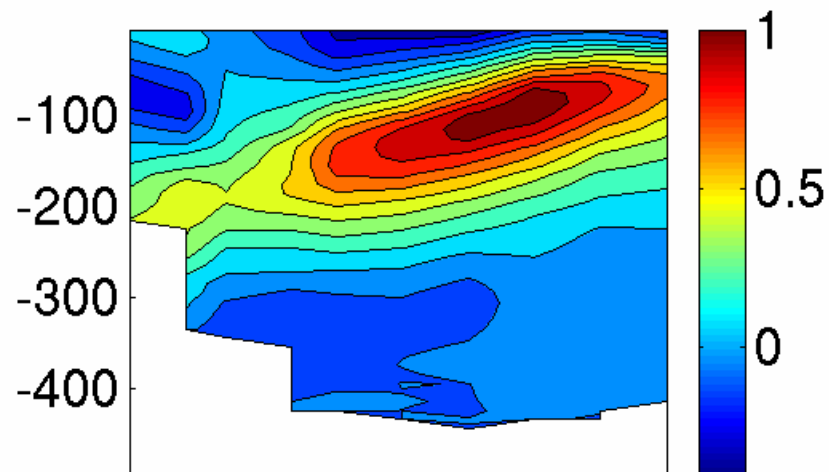


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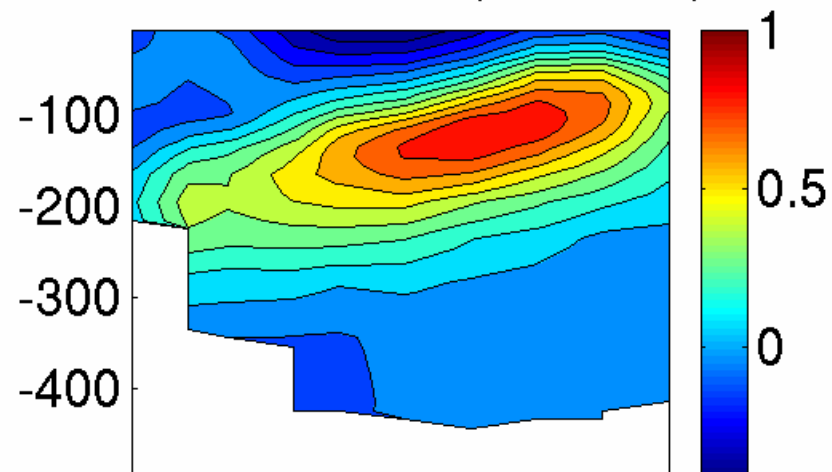


Mean Zonal Velocity (cm/s): Equator

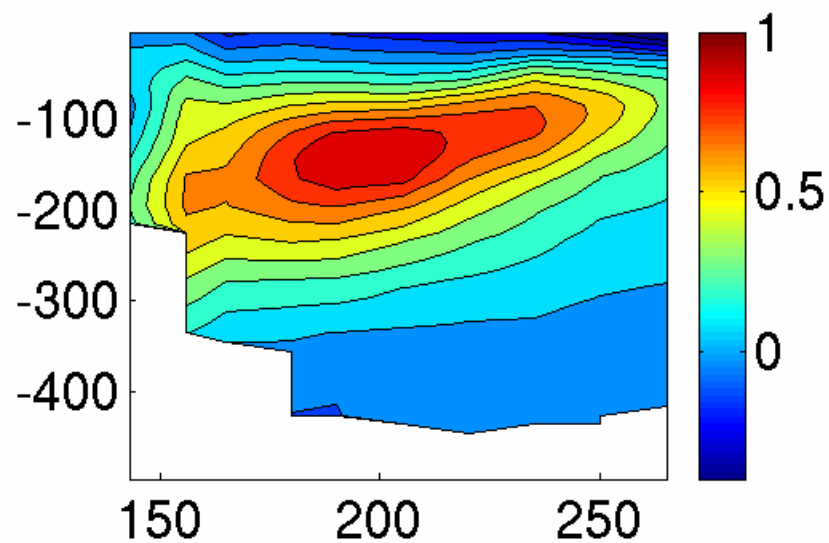
JOHNSON DATA



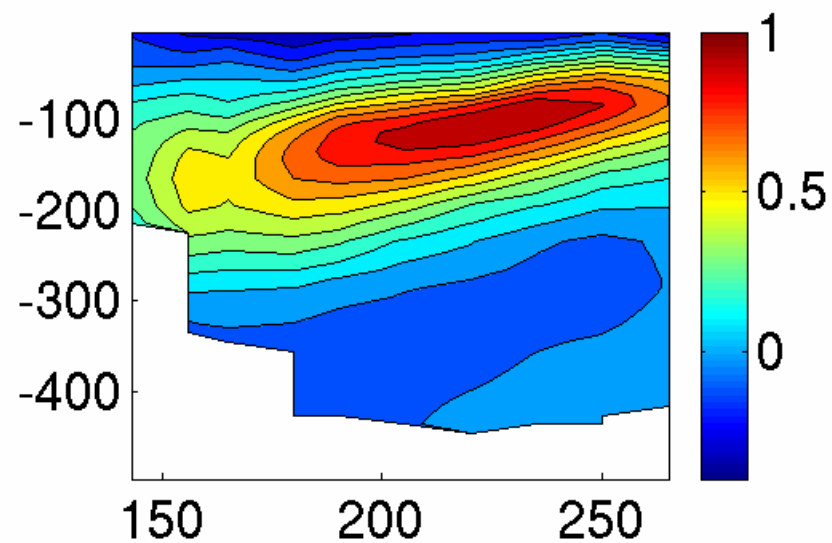
ASSIMILATION (b=NCEP)



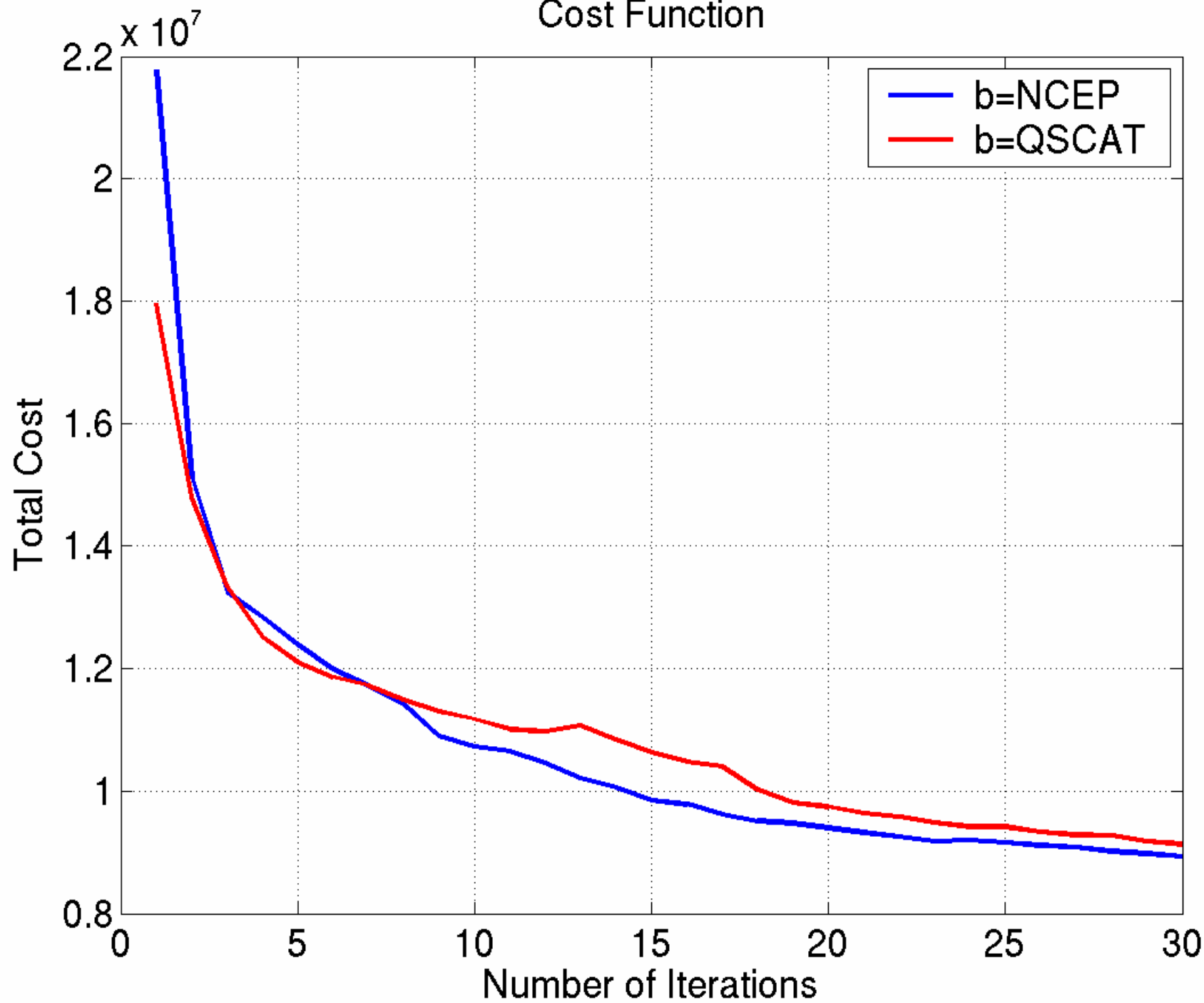
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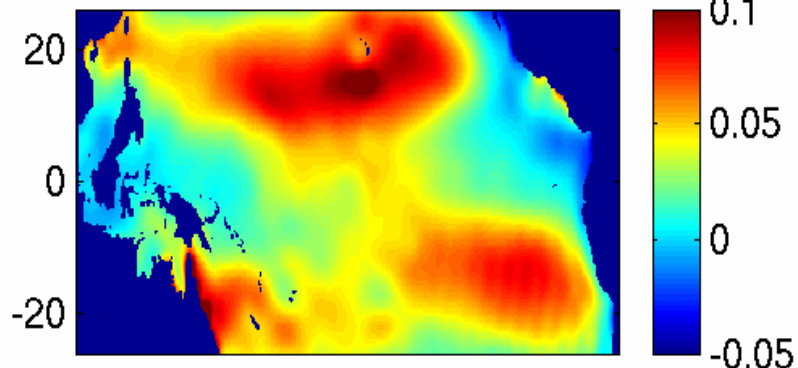
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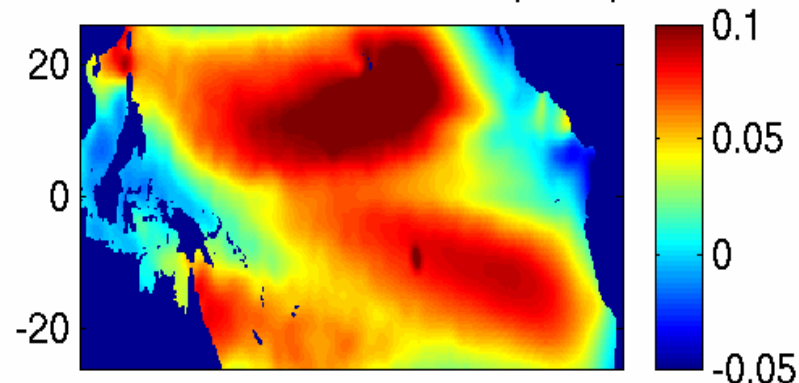
Cost Function



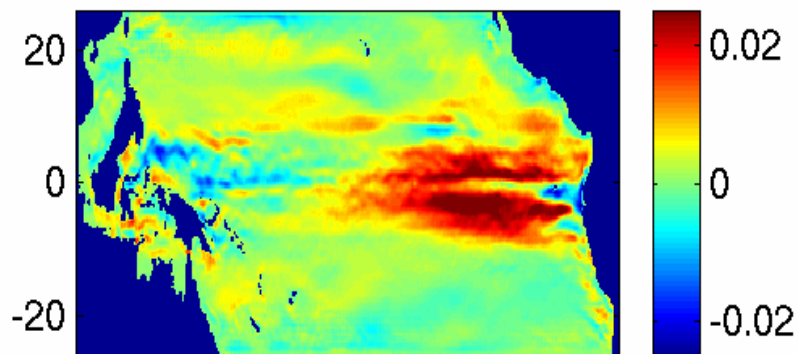
Mean-00 NCEP TAUU (N/m^2)



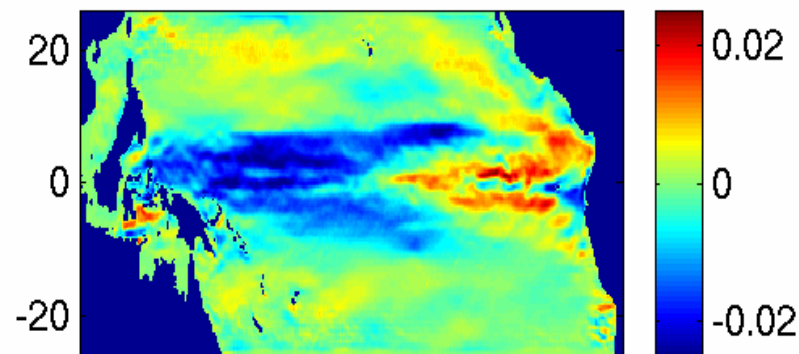
Mean-00 QSCAT TAUU (N/m^2)



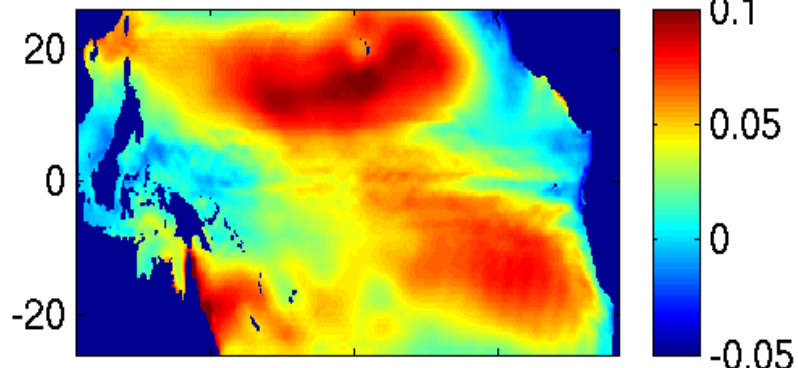
Mean-00 TAUU ADJ (b=NCEP)



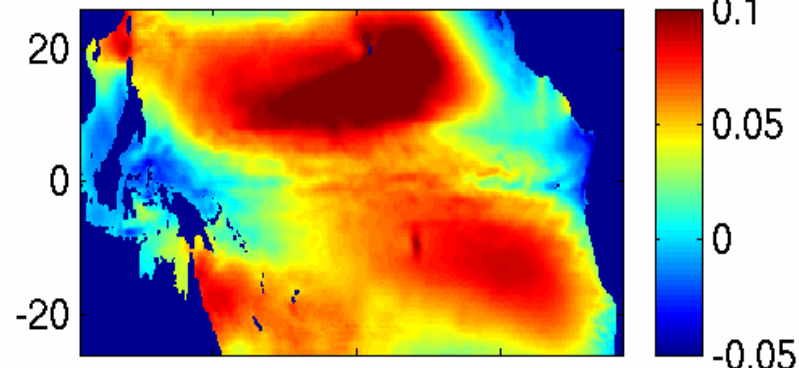
MEAN-00 TAUU ADJ (b=QSCAT)



Mean-00 TAUU (b=NCEP)



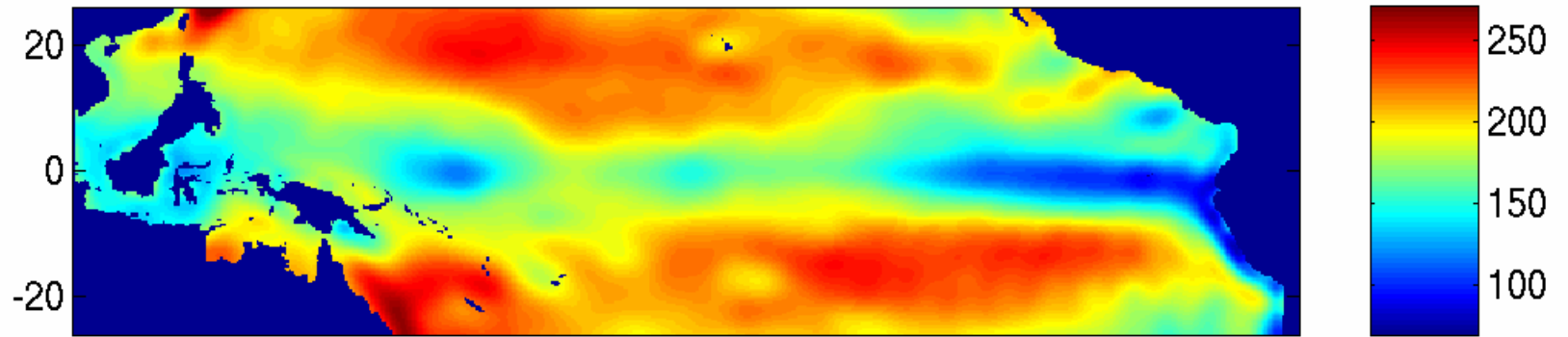
Mean-00 TAUU (b=QSCAT)



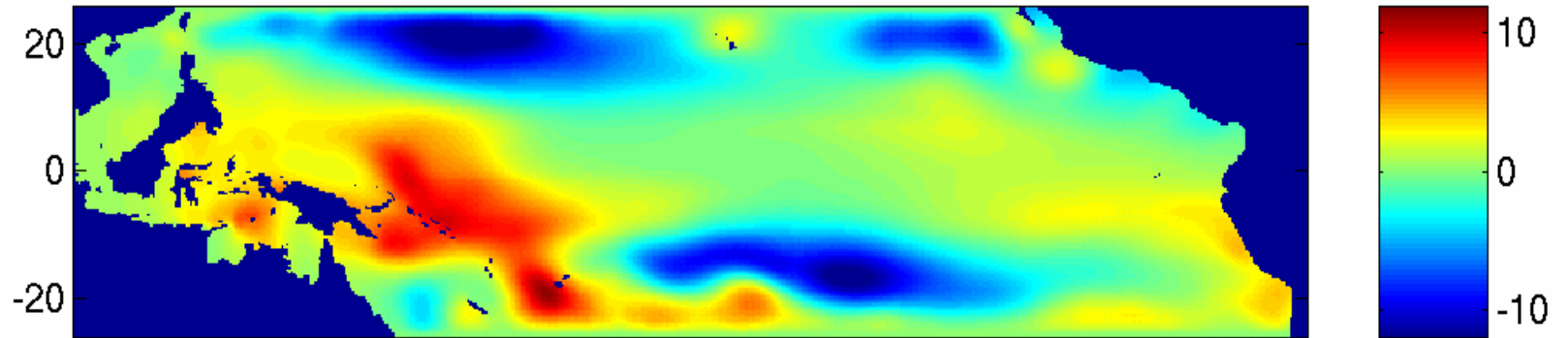
150 200 250

150 200 250

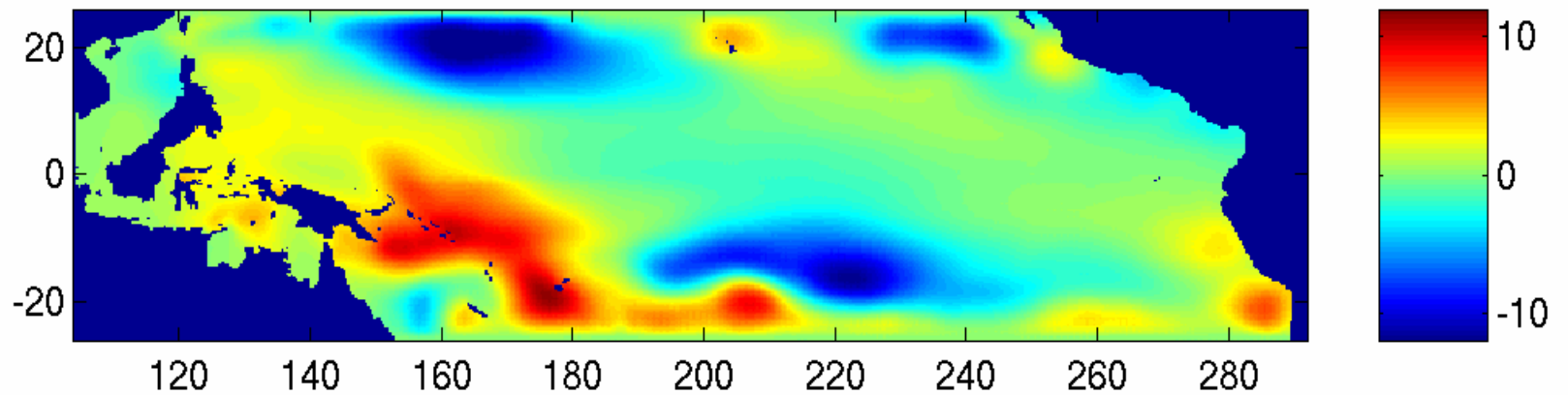
Mean-00 NCEP HFLUX (W/m^2)



Mean-00 HFL ADJ (b=NCEP)

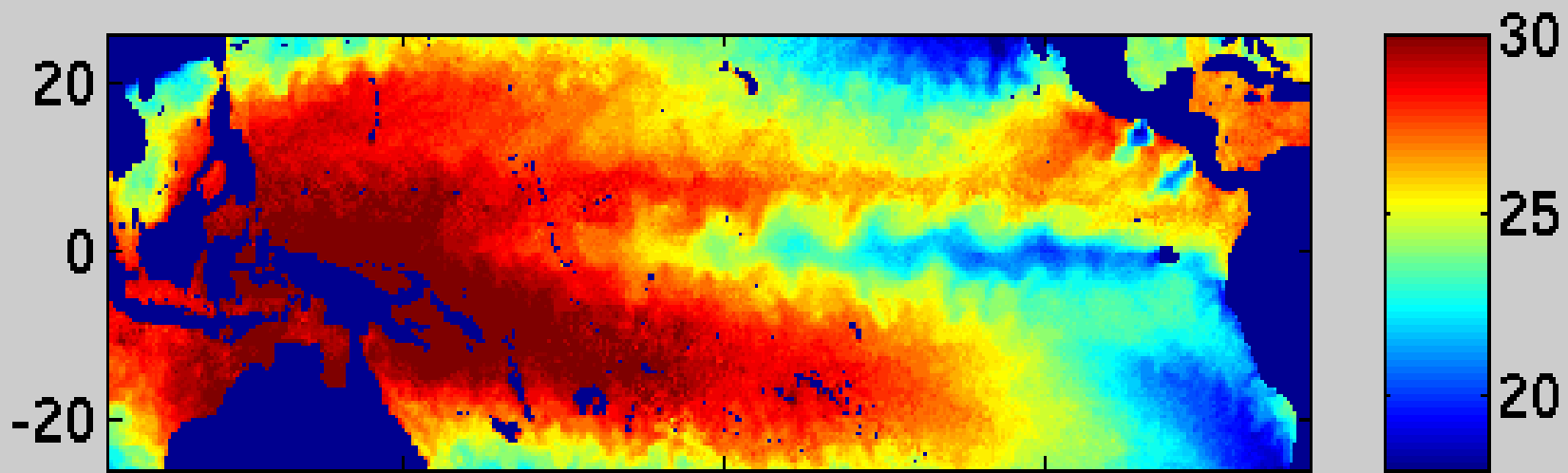


MEAN-00 HFL ADJ (b=QSCAT)



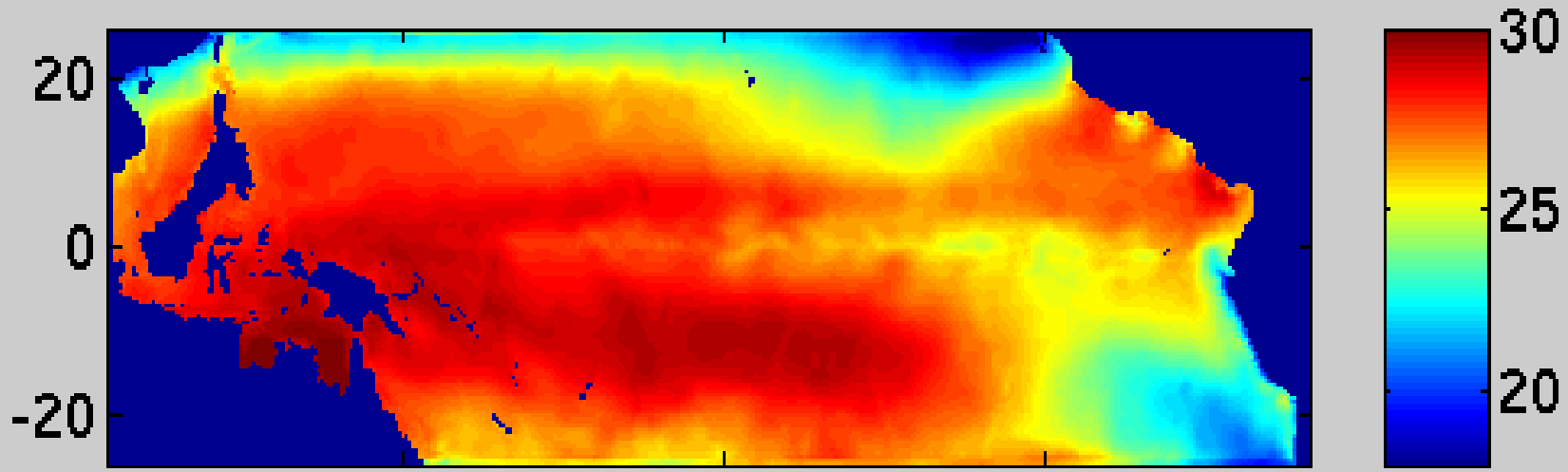
03-Jan-2000

TMI



150 200 250

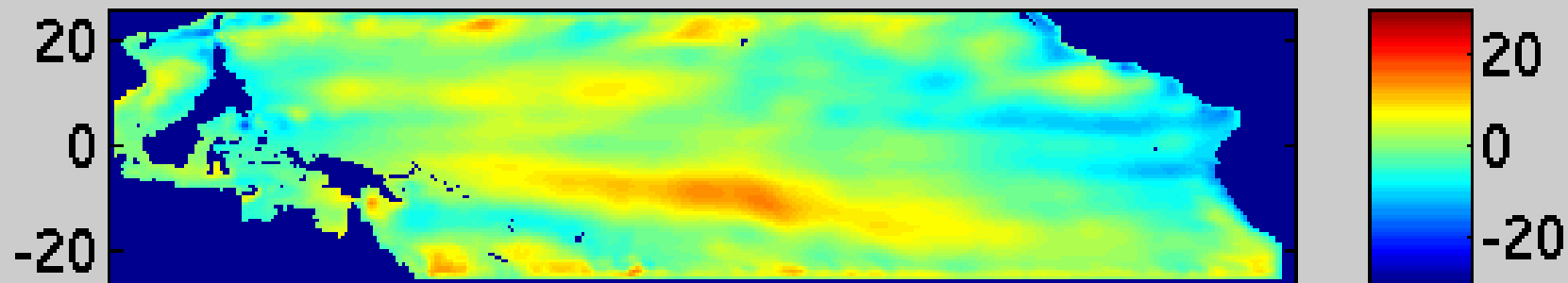
ASSIM



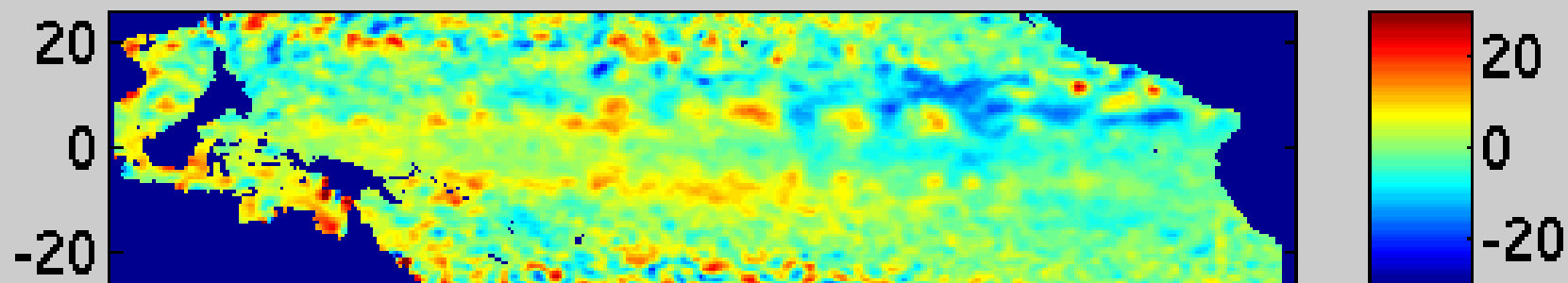
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07-Jan-2000

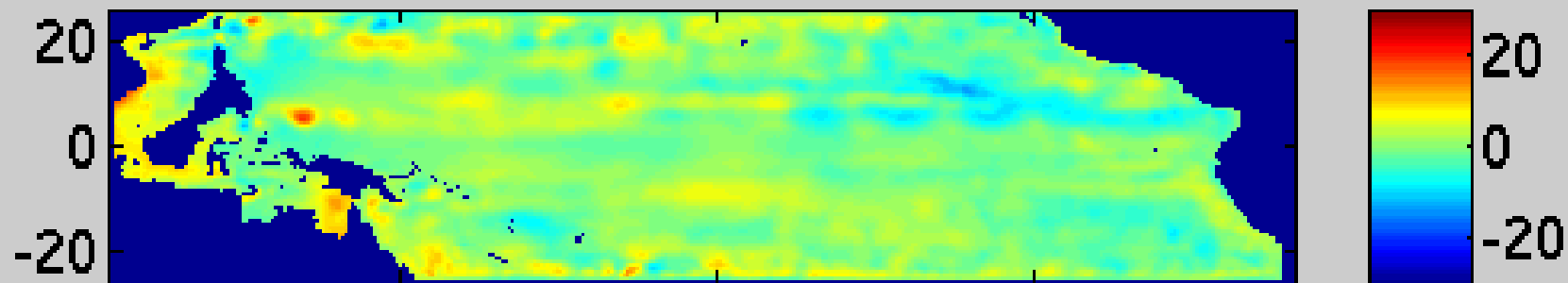
REF



AVISO



ASSIM

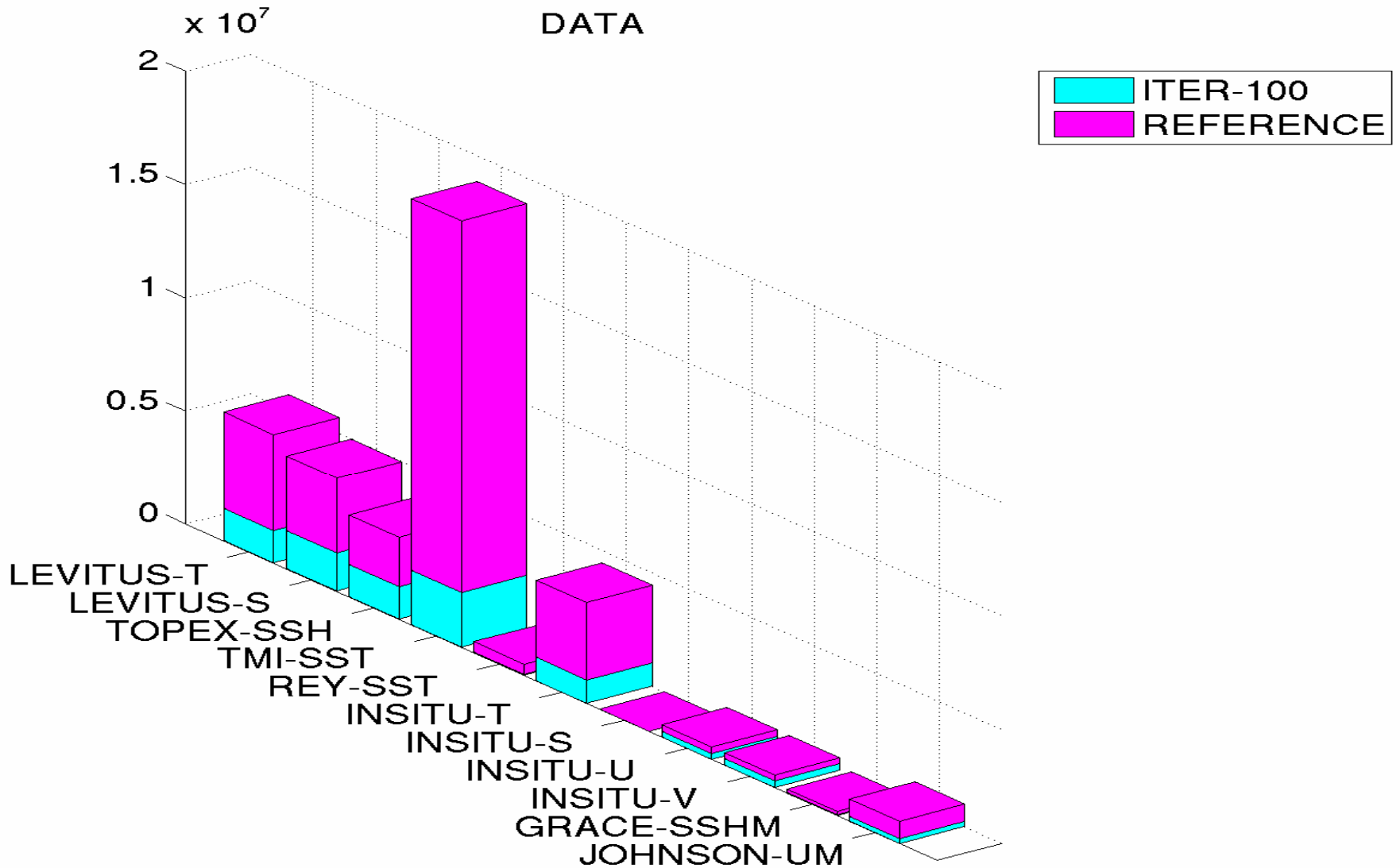


150

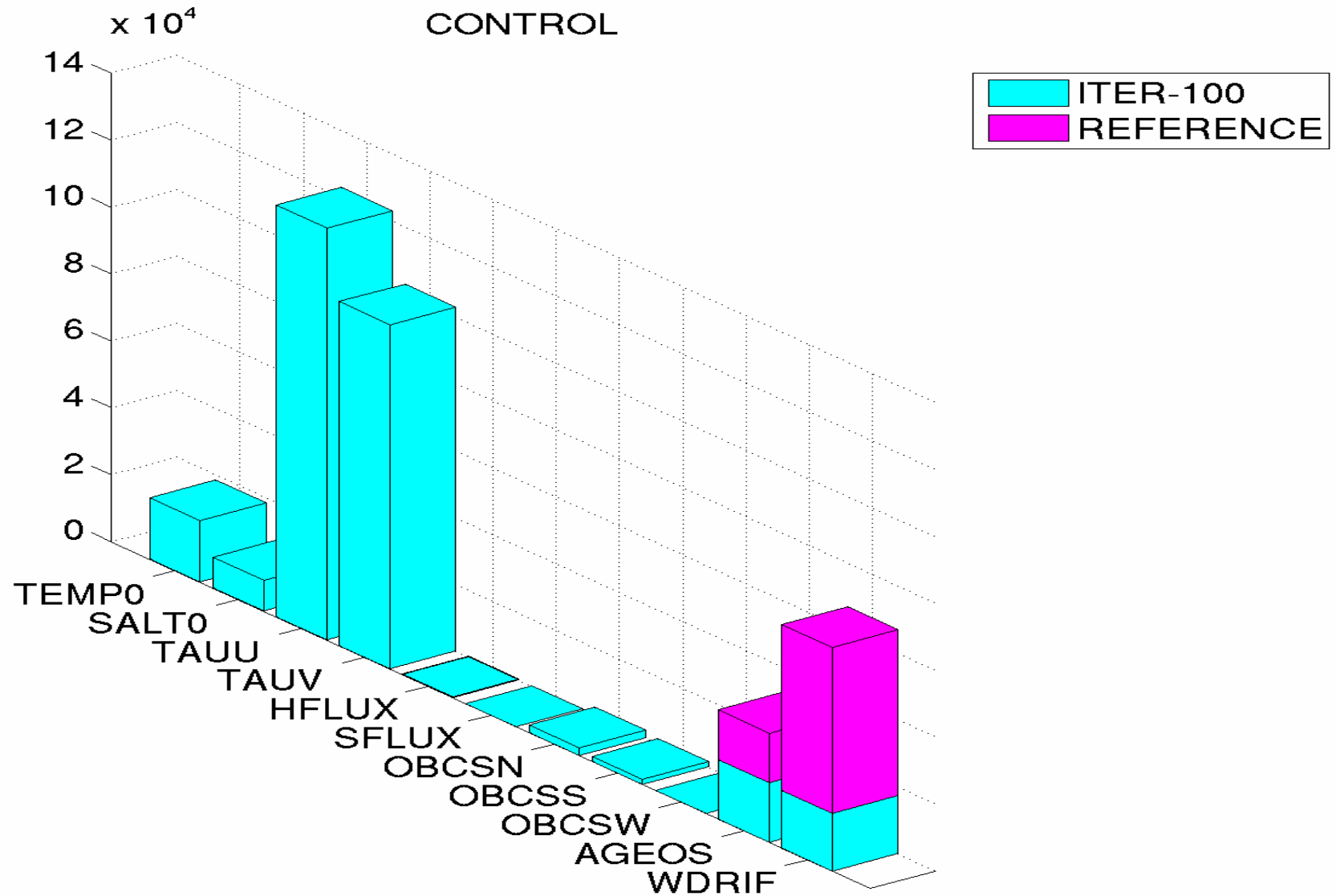
200

250

Data Cost Function Terms



Control Cost Function Terms



Summary

- Adjusted forcing useful at higher resolution
- SSCC jets in adjusted forcing
- QuikScat and NCEP forcing give no eastward currents in SPICE region
- WBC Bifurcation at 15S adjusted, vs 17S Q
- Topography interactions are a weak point of the large-scale runs
- Hope to adjust forcing over duration > 1 yr