

Historical Analysis of Marine Sea Level Pressure and Wind Components: the Good, the Bad, and the Ugly

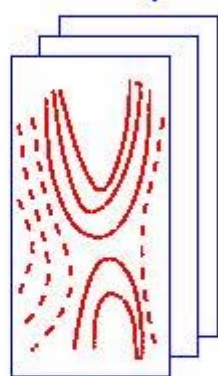
Alexey Kaplan
LDEO of Columbia University

4/30/02

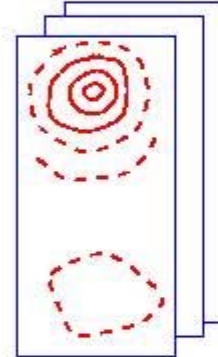
We represent covariance of the estimated anomalies in the space of its leading 80 EOFs and produce a least squares solutions for marine SLP, u, and v from COADS

APPROXIMATING COVARIANCE

$$C = E\Lambda E^T + E'\Lambda'E'^T$$

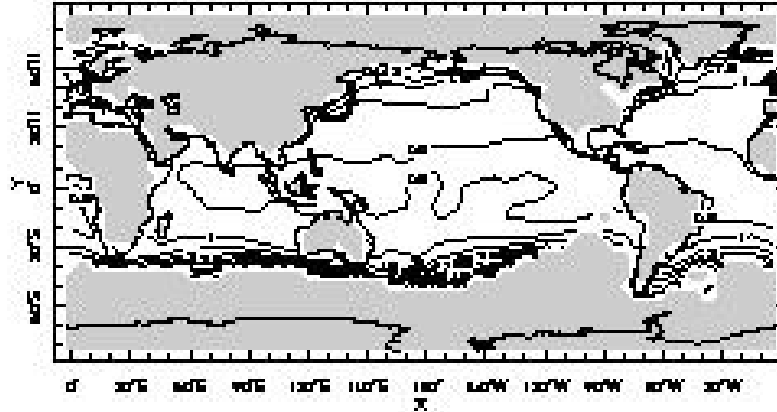


Reduced space
optimal analysis

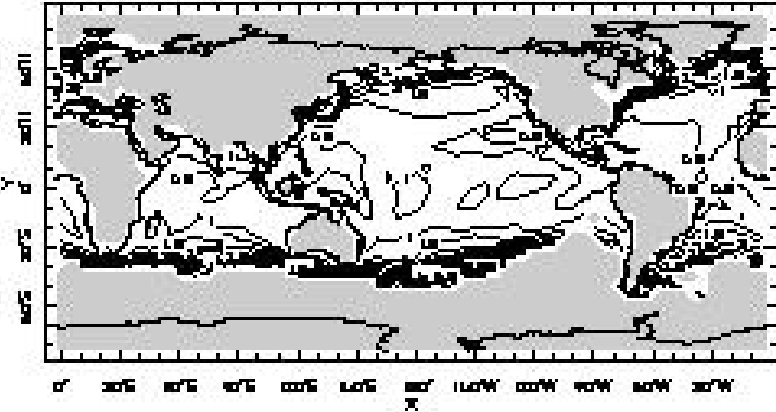


Successive corrections;
Kriging

(a) OI - CDAS

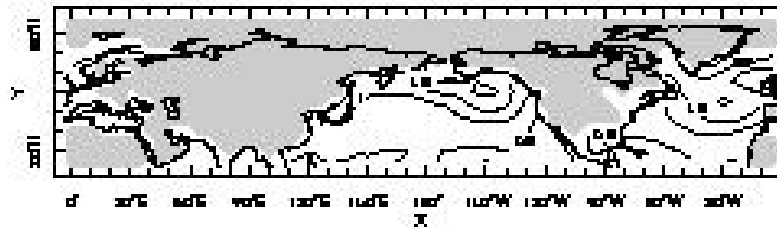


(b) COADS - CDAS

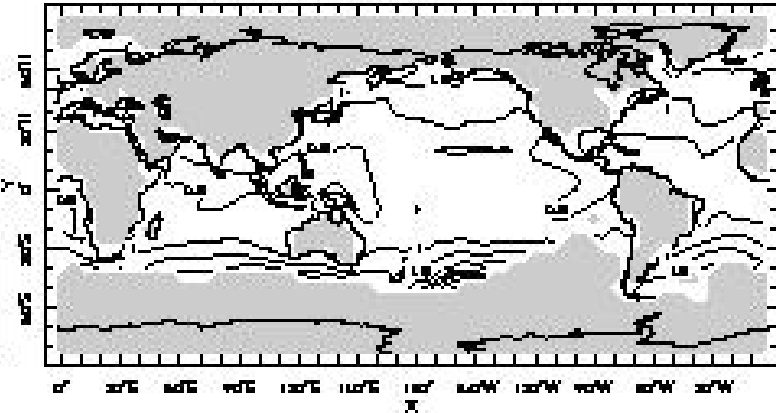


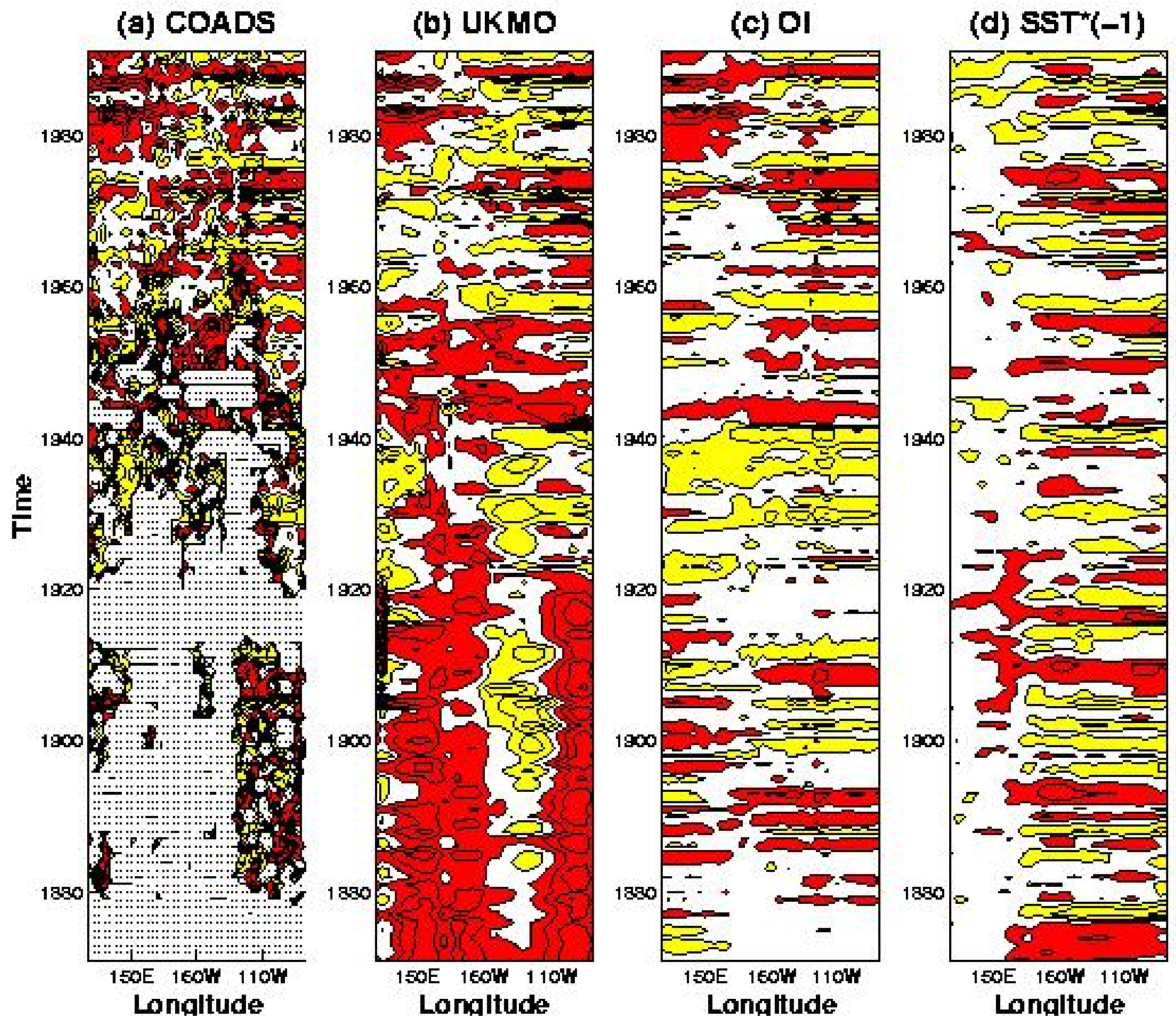
RMS for 1958-1992

(c) NCAR NH - CDAS

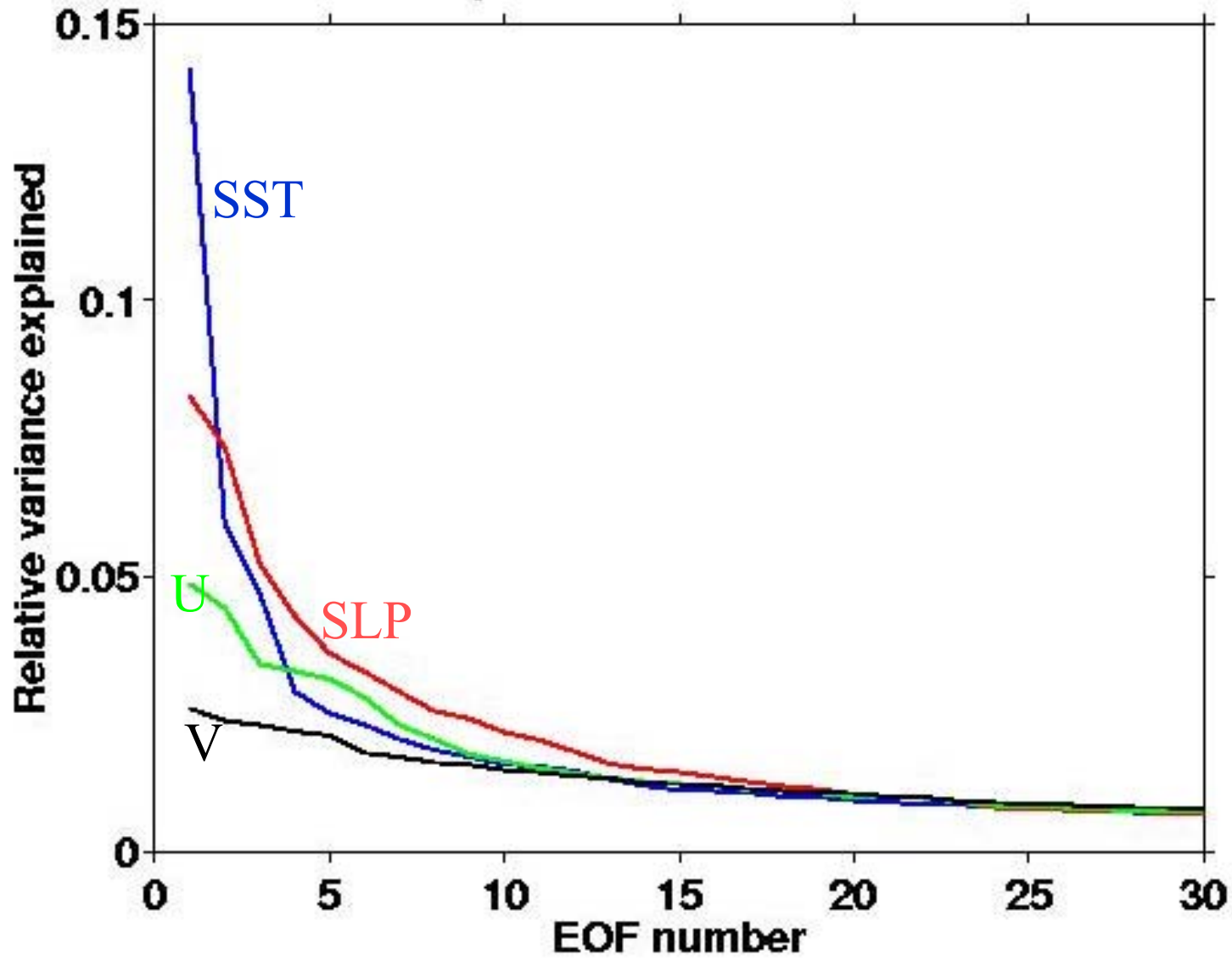


(d) UKMO - CDAS

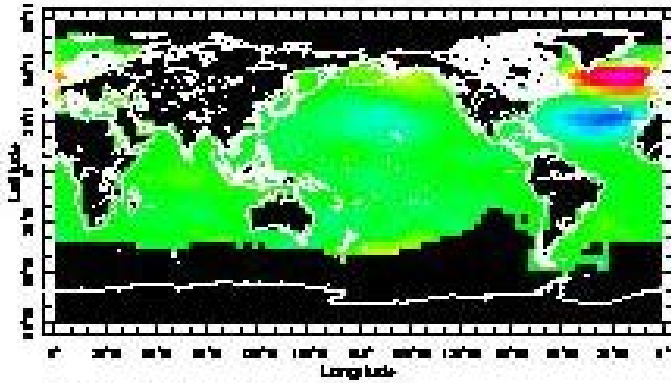




EOF spectra of COADS variables

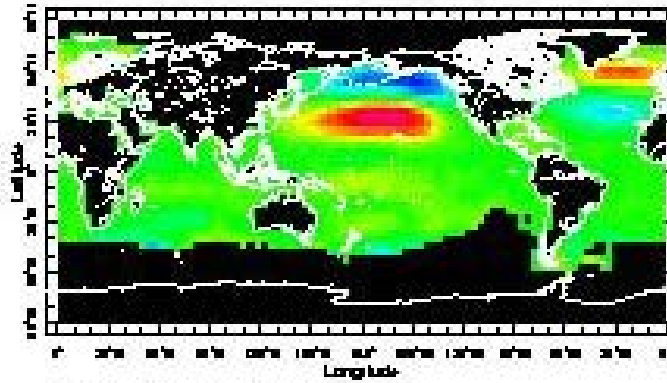


Leading EOFs of monthly zonal wind U



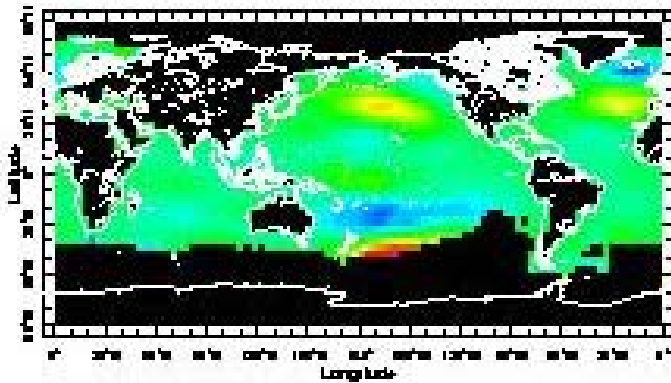
#1

GL_EOF | EOFs by weight | L=1
 point mean: 0.1181 ± 1.4e-02 range: [-0.1214 to 0.3762]
 GL_EOF BO Pct by
 COADS
 GL_EOF weight
 area-weighted



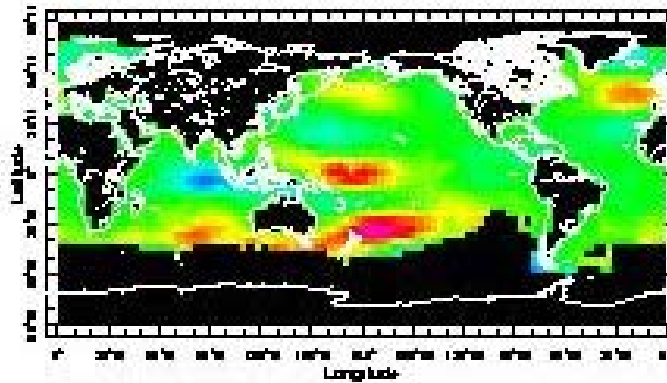
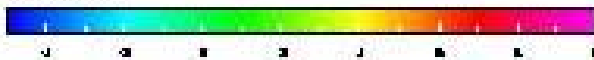
#2

GL_EOF | EOFs by weight | L=2
 point mean: 0.1709 ± 1.3e-02 range: [-0.0201 to 0.3629]
 GL_EOF BO Pct by
 COADS
 GL_EOF weight
 area-weighted



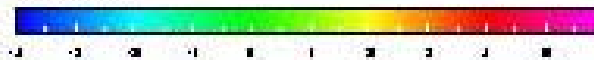
#3

GL_EOF | EOFs by weight | L=3
 point mean: 0.1501 ± 1.2e-02 range: [-0.0204 to 0.3202]
 GL_EOF BO Pct by
 COADS
 GL_EOF weight
 area-weighted

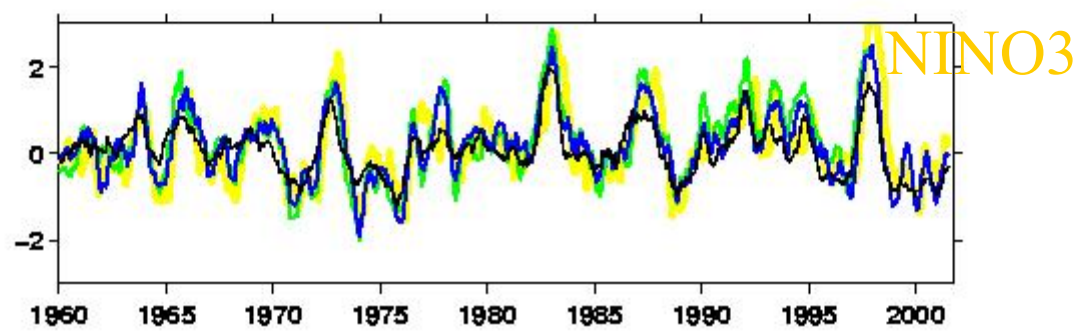
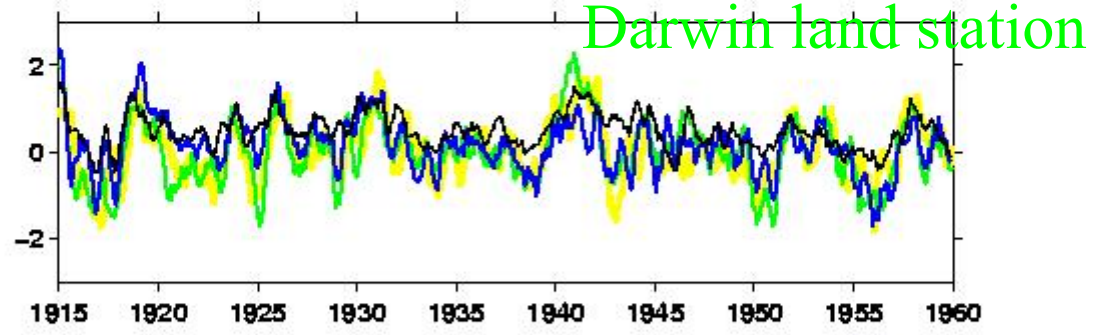
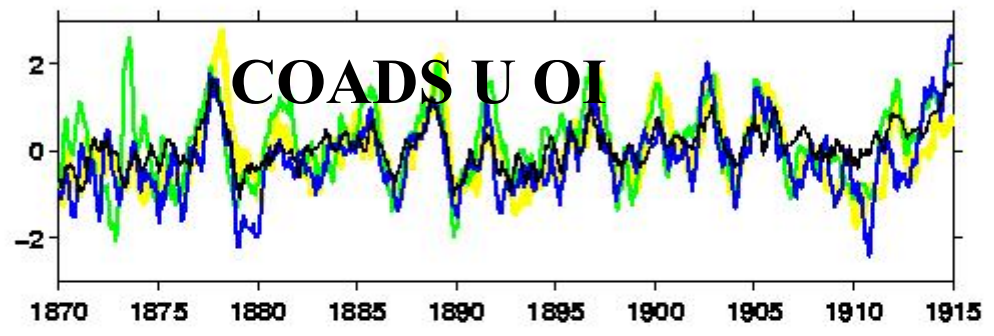
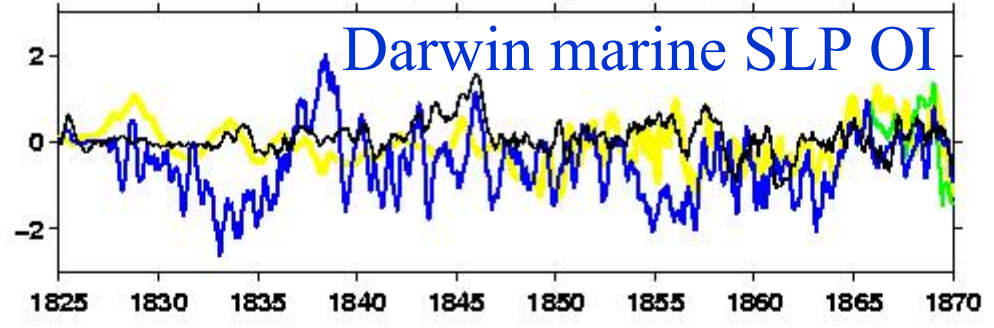


#4

GL_EOF | EOFs by weight | L=4
 point mean: 0.2042 ± 1.22e-02 range: [-0.0402 to 0.4742]
 GL_EOF BO Pct by
 COADS
 GL_EOF weight
 area-weighted



Darwin SLP, NINO3, and Eq Cent Pac U

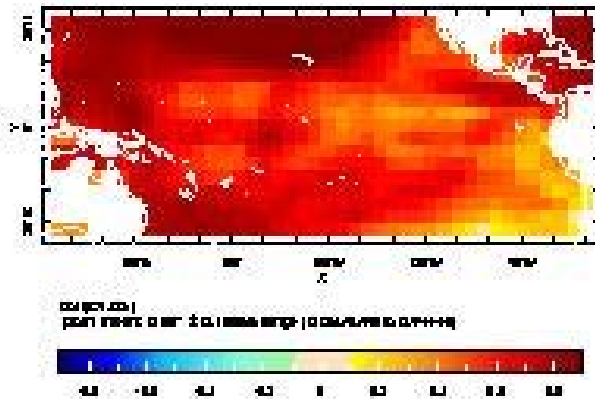


COMPARISON FOR TROPICAL
PACIFIC WINDS FOR 4 PRODUCTS:
Our OI; Da Silva (DS); NCEP-NCAR
reanalysis (RA); and FSU subjective
pseudo-windstresses
for period 1961-1993

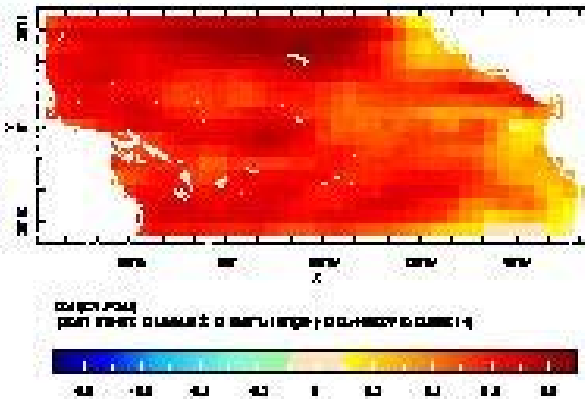
1. Direct point-by-point correlations
2. Geostrophic balance (correlation btwn pressure grad and f^* velocity)
3. Sea level response of Cane and Patton linear ocean model correlated with Smith (2000) Pacific sea level analysis

U 1961-1993 monthly correlations

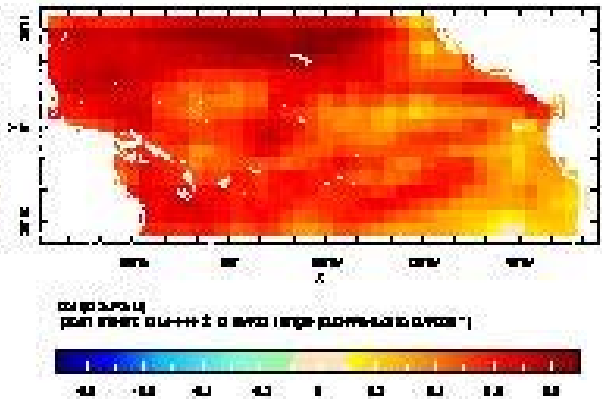
OI-DS



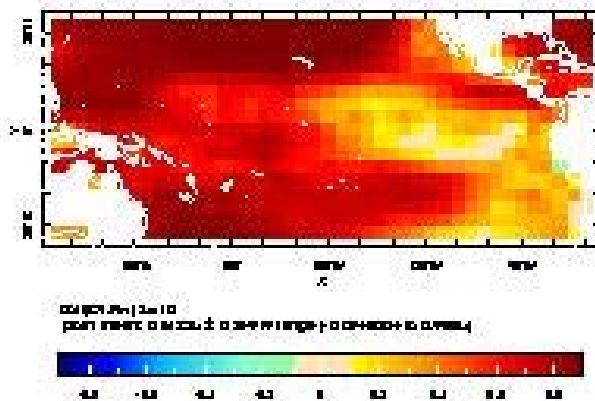
OI-FSU



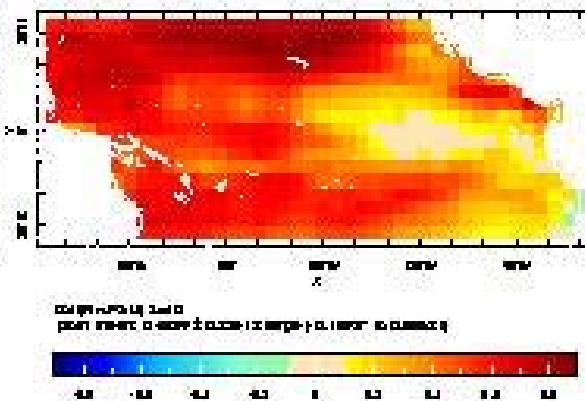
DS-FSU



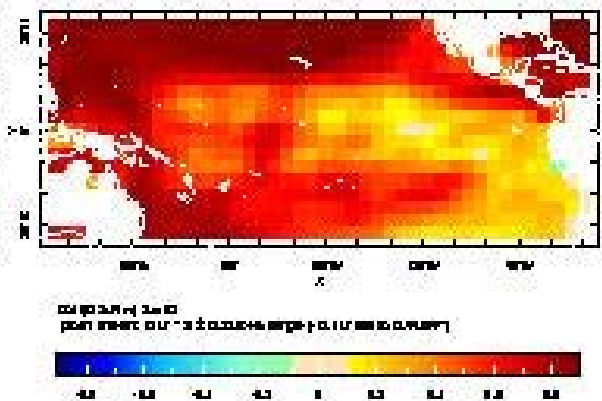
OI-RA



FSU-RA

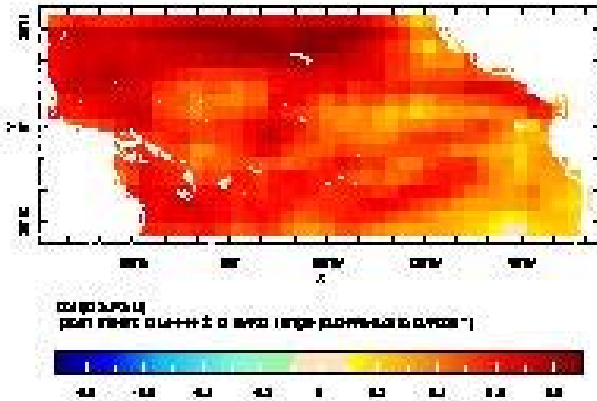


DS-RA

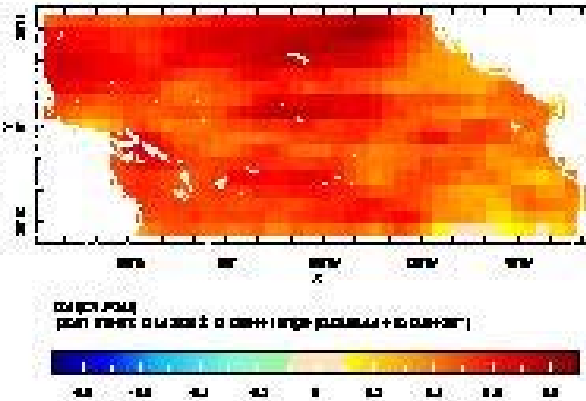


V 1961-1993 monthly correlations

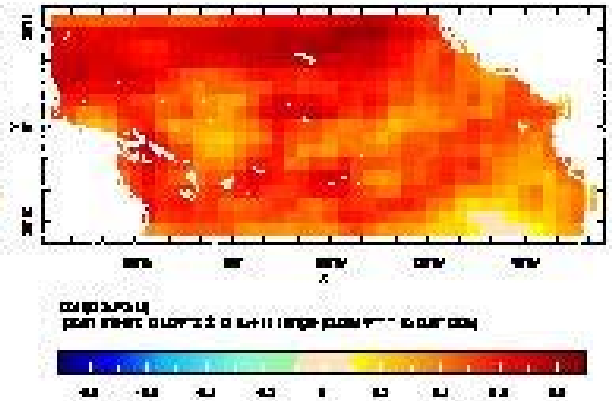
OI-DS



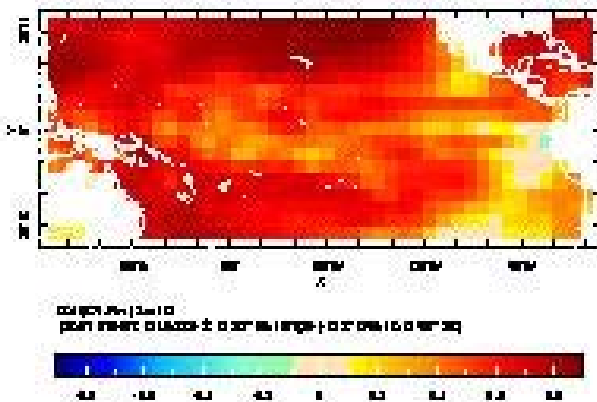
OI-FSU



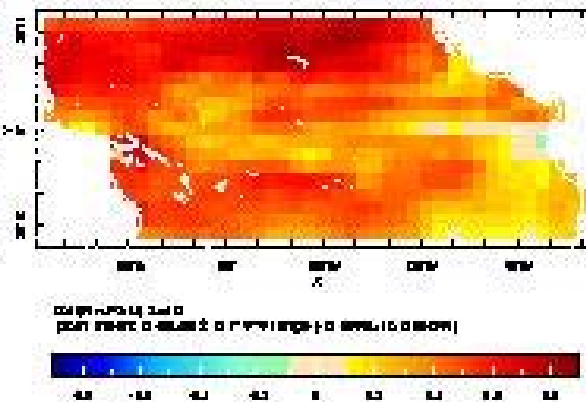
DS-FSU



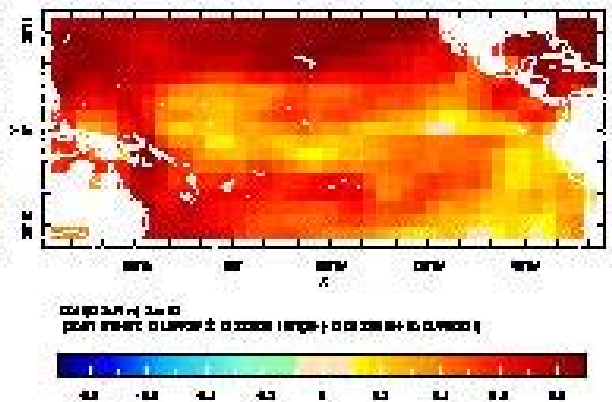
OI-RA



FSU-RA

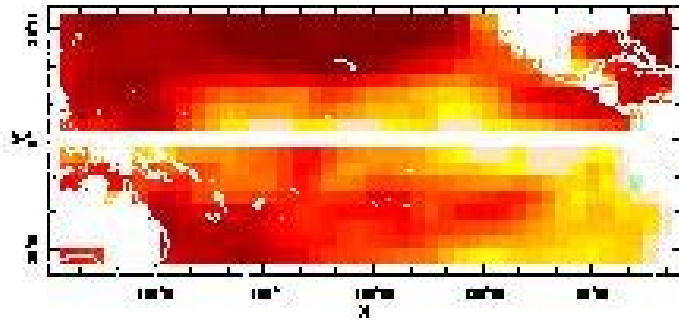


DS-RA

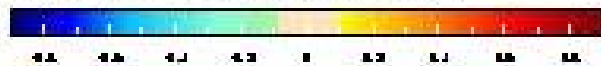


Zonal geostrophic balance: $\text{corr}[-dP/dy, f*U]$

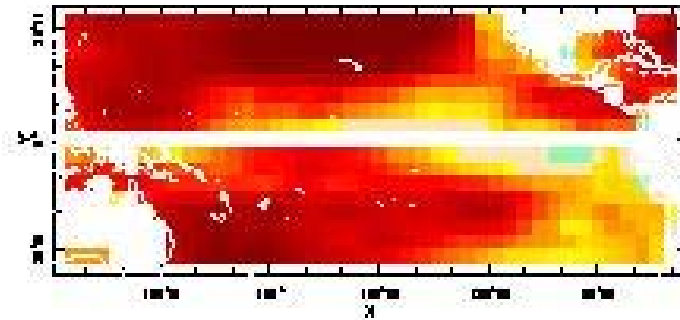
DS



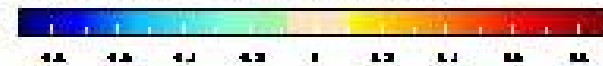
DS
point mean: 0.52009 ± 0.00000 range: $[-0.50191$ to $0.92459]$



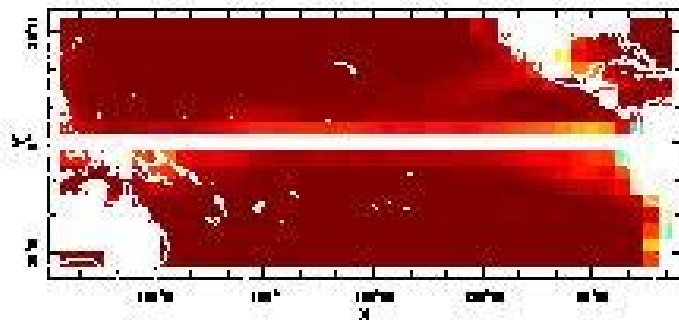
OI



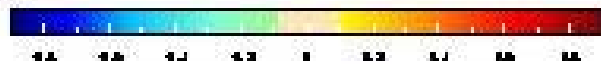
OI
point mean: 0.57211 ± 0.00189 range: $[-0.58198$ to $0.92710]$



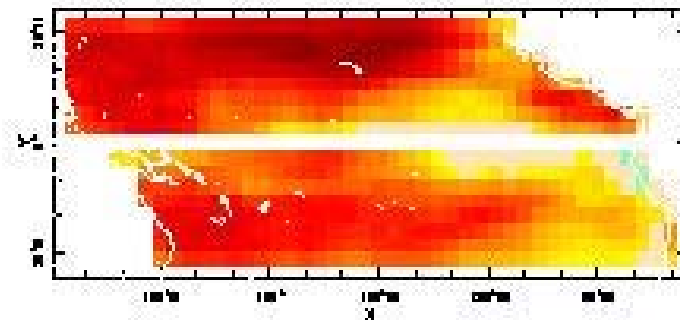
RA



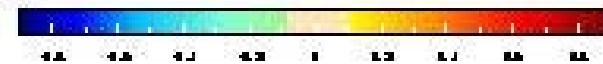
RA $C=10$
point mean: 0.52009 ± 0.16010 range: $[-0.00009$ to $0.97459]$



FSU

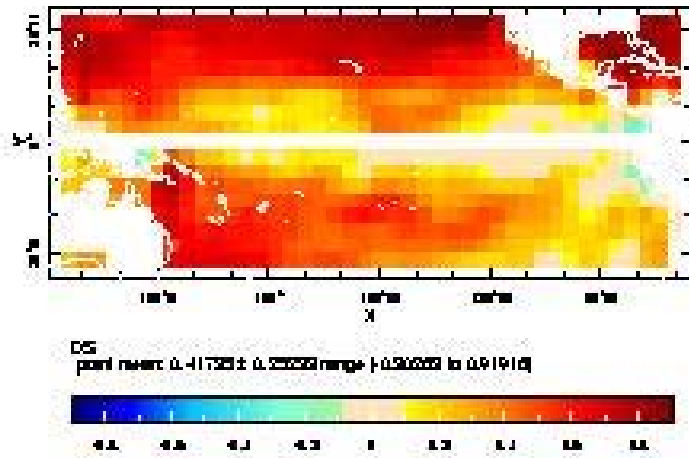


FSU
point mean: 0.48711 ± 0.00908 range: $[-0.24891$ to $0.87329]$

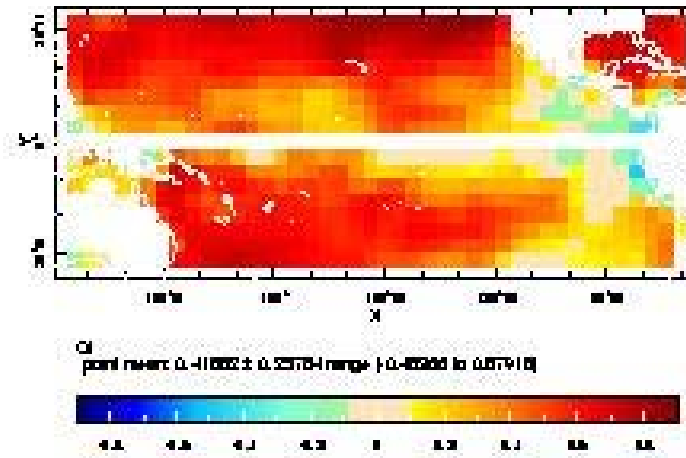


Meridional geostrophic balance: $\text{corr}[dP/dx, f*V]$

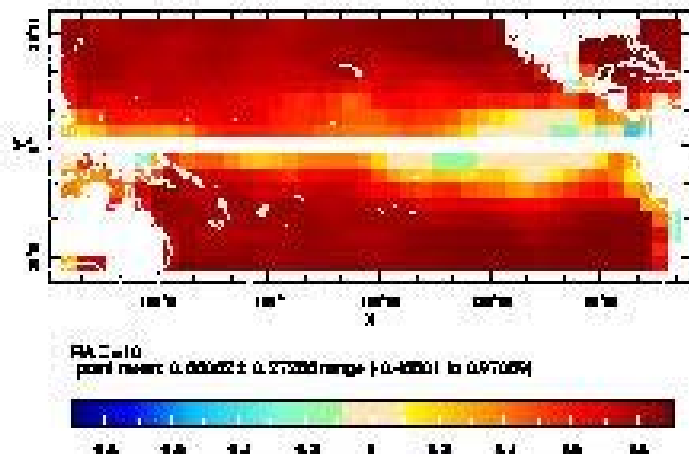
DS



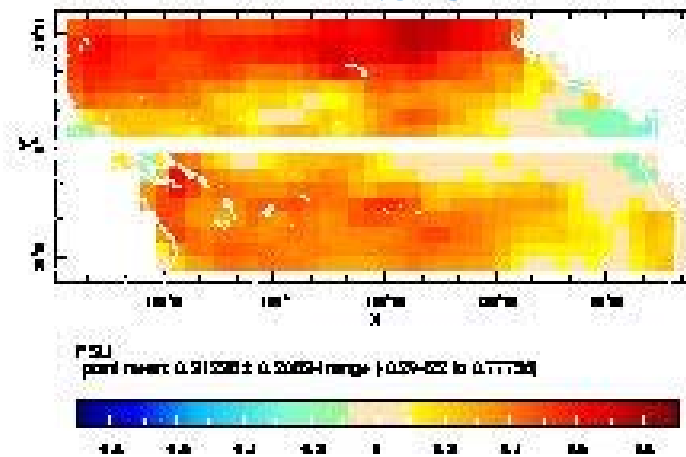
OI



RA

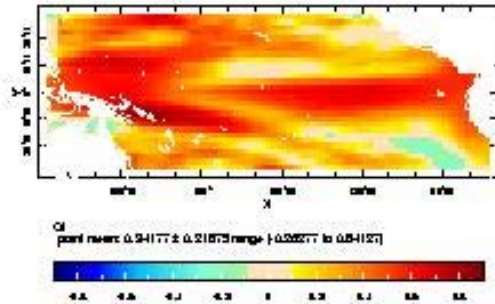


FSU

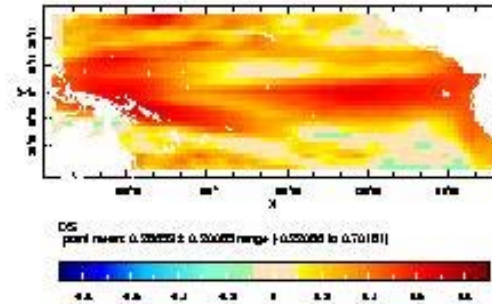


Sea level response from linear model

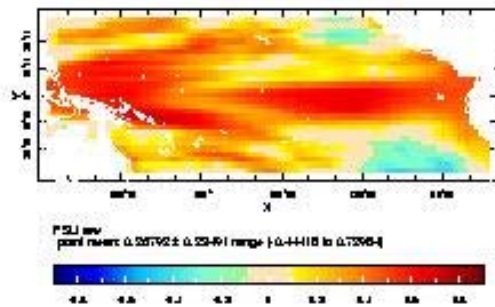
OI



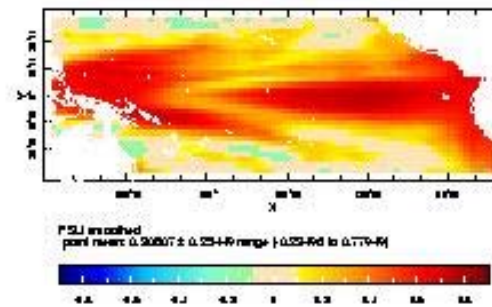
DS



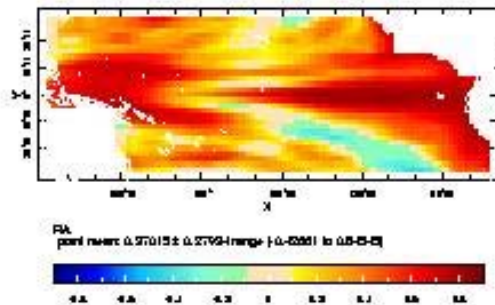
FSU



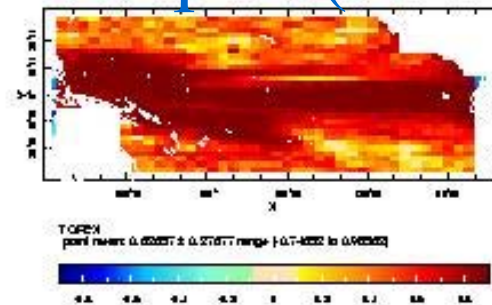
FSU smoothed



RA

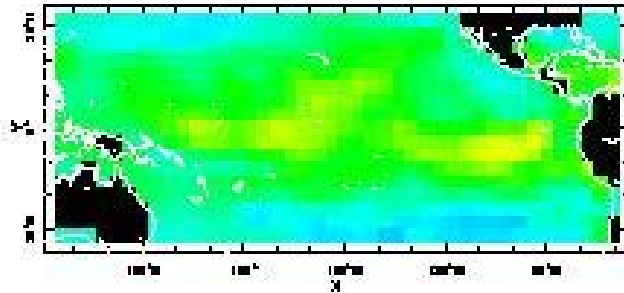


Topex (1991-)



1 month lagged autocorrelation for zonal windstress

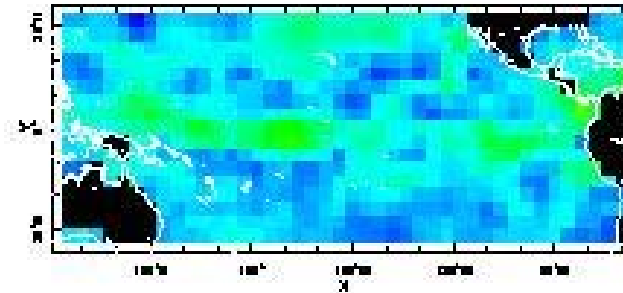
OI



Lag-1 autocorrelation for our OI
point mean: 0.27002 ± 0.10790 range: [0.0731-0.611] to [0.5-0.49]
Time period: 1961-1999



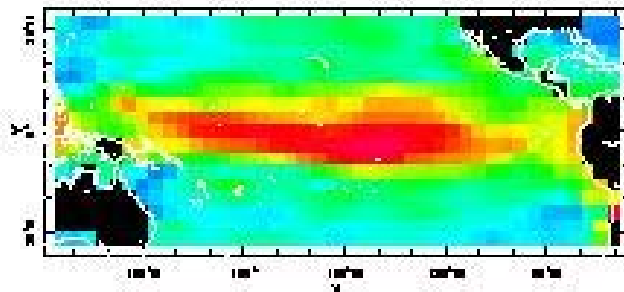
DS



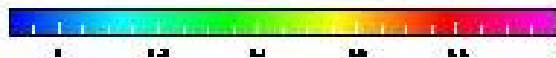
Lag-1 autocorrelation for our OI
point mean: 0.11902 ± 0.073-0.073 range: [-0.009-0.002] to [0-0.170]
Time period: 1961-1999



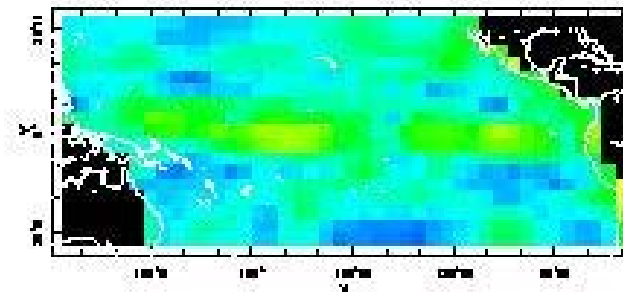
RA



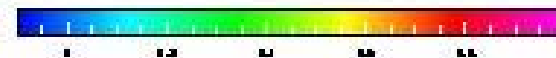
Lag-1 autocorrelation for our OI τ_{zx}
point mean: 0.28024 ± 0.21090 range: [0.0050-0.731] to [0.0000-1]
Time period: 1961-1999



FSU



Lag-1 autocorrelation for our OI
point mean: 0.16477 ± 0.10-0.02 range: [-0.02107-0] to [0.00000]
Time period: 1961-1999



CONCLUSIONS:

winds are not that bad!