CORE Forcing Updates, NCAR Plans and Flux Applications

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Forcing Updates

- ISSCP – FD continues to be the rate limiter, ~18 months delay.
- All of 2007 available June of 2009, 2006 re-processed with 3 year (06-08) filling.
- Operating on a 2 year update cycle ie. 2007-08 in June of 2010.
- Not pursuing any changes to corrections, but would respond to suggestions.

BUG in NCAR Fluxes
Wind direction correction $-10^{o} < \alpha < 10^{o}$
NOT IN CORRECTED FORCING AT GFDL

BUG

$U = U \cos \alpha - V \sin \alpha$

$V = U \sin \alpha + V \cos \alpha$

CORRECT

$U' = U \cos \alpha - V \sin \alpha$

$V = U \sin \alpha + V \cos \alpha$

$U = U'$

For small α : $(\cos \alpha - 1) \approx 0$; $\sin \alpha \approx \alpha$

ERROR $\delta V \approx - V \alpha^{2} < 3\%$

Mediterranean Experience with ECMWF

CLOSE BUDGETS :   Qnet = -6 ± 3 W/m² ;   P+E = -.50 → -1.00 m/yr

W/m²	ERA-40	Bulk	Wind	SST	SW/LW	qair	Precip
SWnet	162	202			**183**		
LWnet	-79	-87		-88	**-80**		
Latent	-86	-80	-99	-100		**-91**	
Sens	-10	-12	-14	**-16**			
Qnet	-13	24	2	-2	-13	**-4**	
m/yr							
E	-1.08	-1.02	-1.27	-1.28		**-1.17**	
P	.39						**.47**
P+E	-.69	-.64	-.89	-.90		-.79	**-.70**

Corrections are based on means over limited time periods.

Therefore, trends may be spurious !!!

Normal Year Forcing :

- Based on 1984-2000 , has not been updated
- Not intended for ocean-ice
- Could modify for air-ice fluxes
- Could have done air temp and humidity better

Sea Ice

Given: Y year time series : U, V, $X=\{\,T,\ q\,\}$, SSX, ISX, fice

Construct : , $S = (U^2+V^2)^{1/2}$, focn= (1-fice)

Transform: SU, SV, $F = S[\text{fice}\,(X-ISX)+\text{focn}\,(X-SSX)]$, (fice ISX), (focn SSX)

High Pass Filter :

Inverse Transform using 1997 phase :

Yields : **SU, SV , F, (fice ISX), (focn SSX)**

NYF :

$$U' = \mathbf{SU} \,/\, \mathbf{(SU^2 + SV^2)}^{1/4} \quad ; \quad V' = \mathbf{SV} \,/\, \mathbf{(SU^2 + SV^2)}^{1/4}$$

$: S'U' = \mathbf{SU} \quad ; \quad S'V' = \mathbf{SV}$ for $S' = (U'^2+V'^2)^{1/2}$

Find X' : $S[\text{ fice } X' - \textbf{fice ISX}) + \text{focn } X' - \textbf{focn SSX})\ ] = \mathbf{F}$

NYF (proposed):

$X' = \mathbf{F} \,/\, S' + \textbf{(fice ISX)} + \textbf{(focn SSX)}$

Despike

NB: CORE I NYF designed for ocean forcing only : fice = 0

Case g3_5_23.211
ANN Mean   Years 0146-0150
grid cell mean ice thickness   m
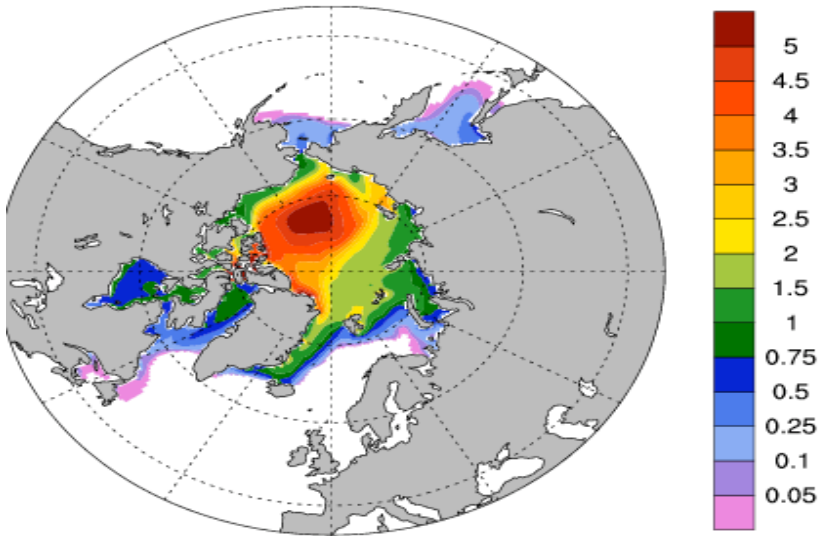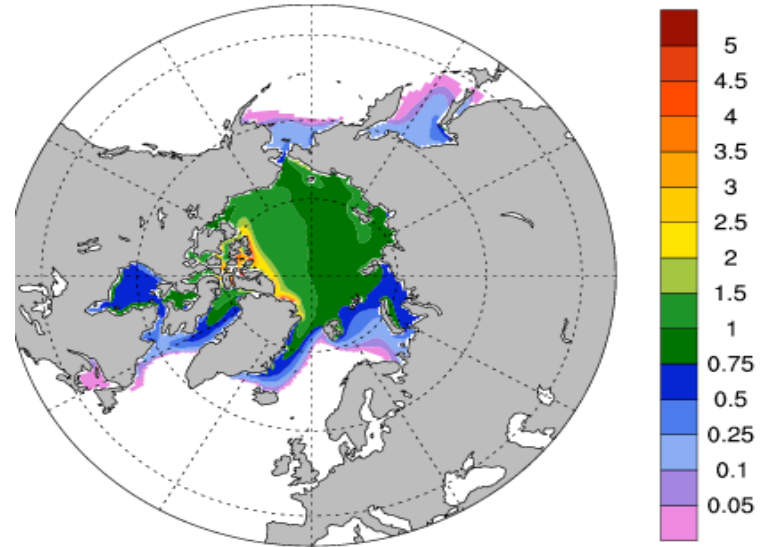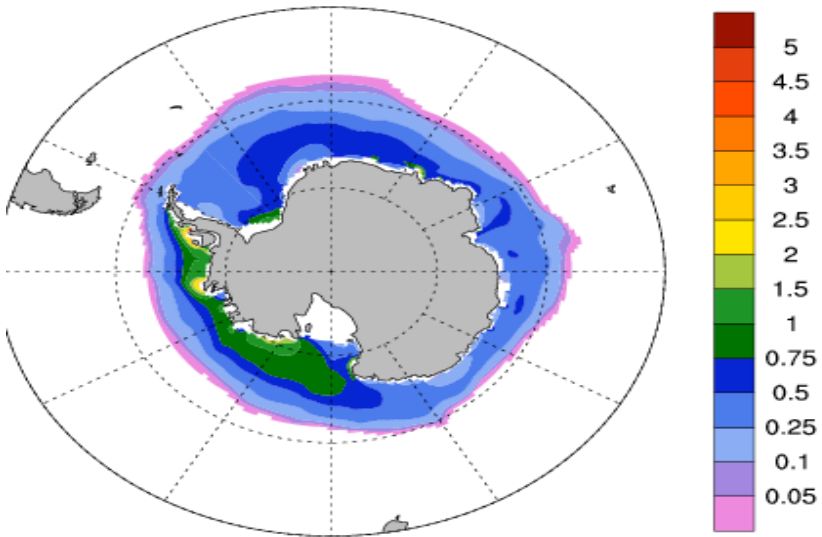
Case g.b29.01
ANN Mean   Years 0051-0060
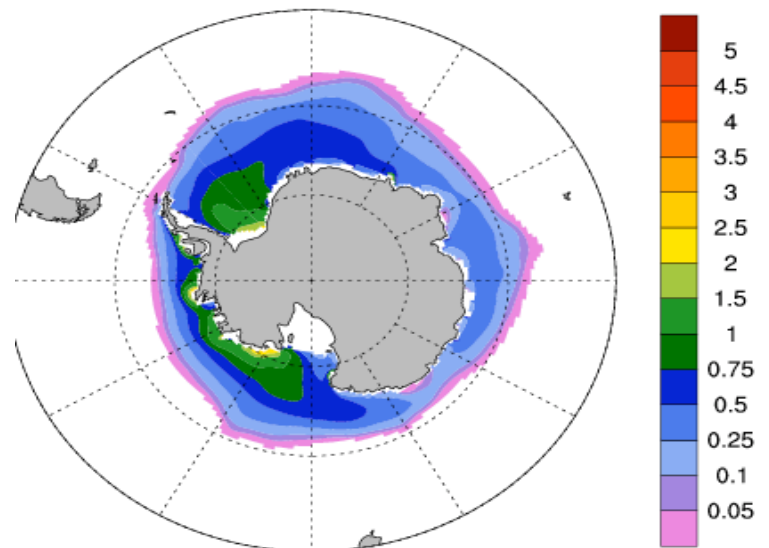grid cell mean ice thickness   m

grid cell mean ice thickness   m

grid cell mean ice thickness   m

NCAR Plans for CORE

- Follow 8th WGOMD Meeting Report using CORE II (1948 – 2007 ???)
- Results will be used for 1 type of prediction experiments

FLUX APPLICATIONS

- Means
- Implied Heat Transport
- Coupling coefficient
- Trends
- Climate Indices

Implied transports

ECMWF – Dash-dot orange
Large and Yeager – Dashed blue
NCEP – Dashed magenta
NOC1.1a – Solid black
Trenberth residual – Dashed black
UWM/COADS – Solid greys
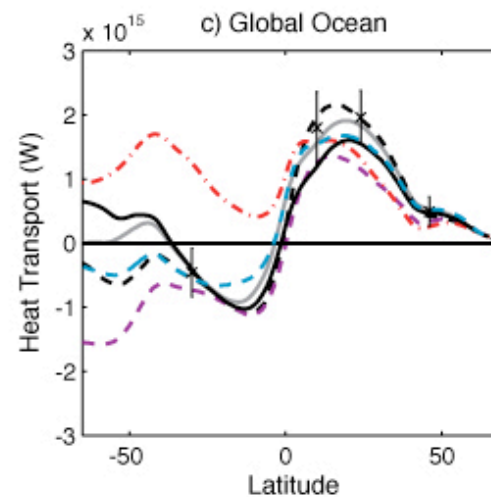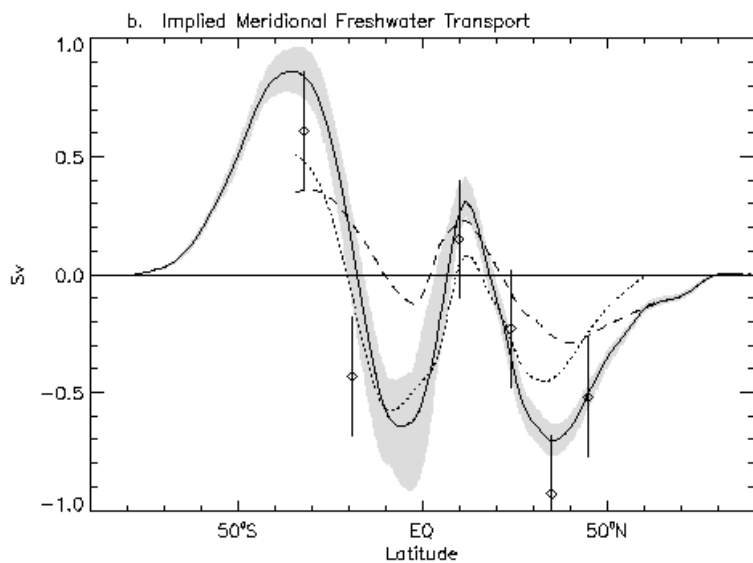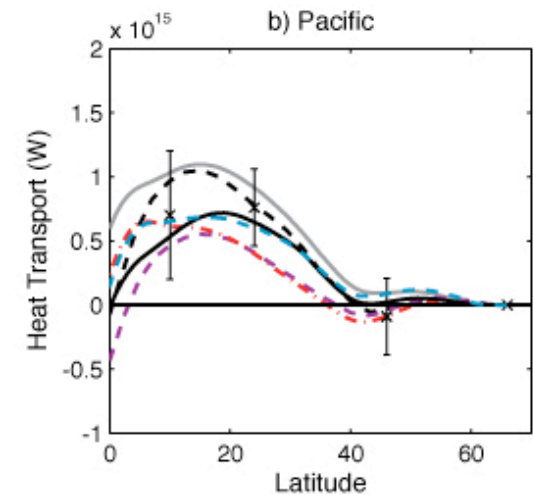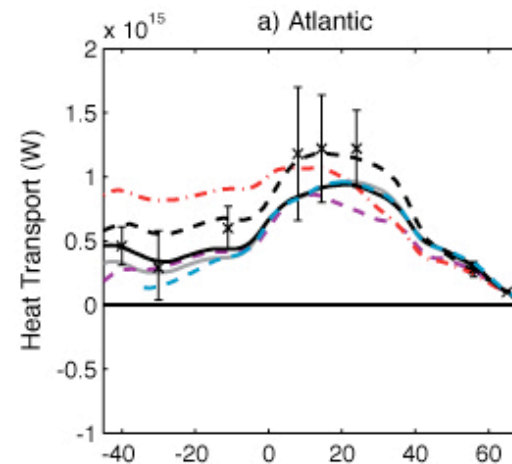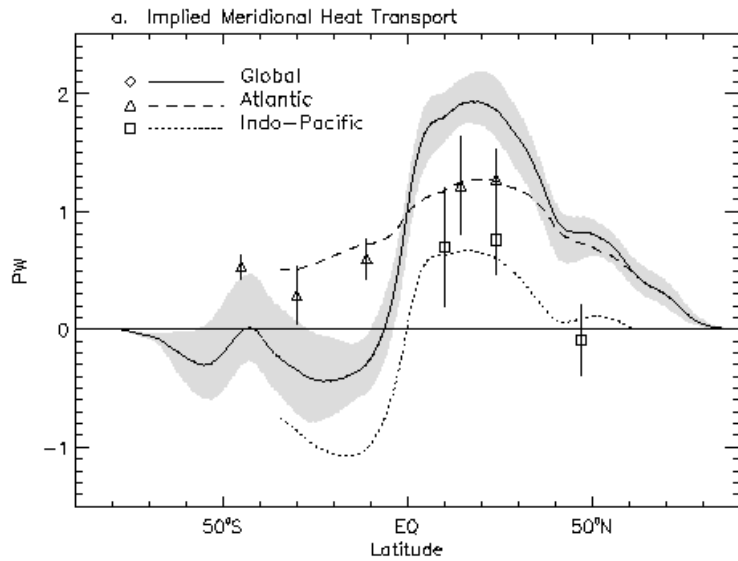
TRENDS IN FLUX ANNUAL ANOMALIES

Qas   =   SWnet   + LWdwn + LWdup + Qsen   + Qlat

　　　 =   Qsky   + Qpbs

　　　 =   Qsky   + Qsst   + Qair

Qsky   =   SWnet + LWdwn

Qpbl =   Qsst   + Qair = LWdup + Qsen   + Qlat

Qair   =   U   (Ce   qair + Ch Tair)

Qsst   = - U   (Ce   qsat(SST)   + Ch SST) - σ SST^4

Qnet =   focn Qas   + fice Qio

C_{as} = ∂Qnet /∂SST   = ∂(focn Qsst) / ∂SST

SST coupling coefficient

Annual SST Anomaly (C)
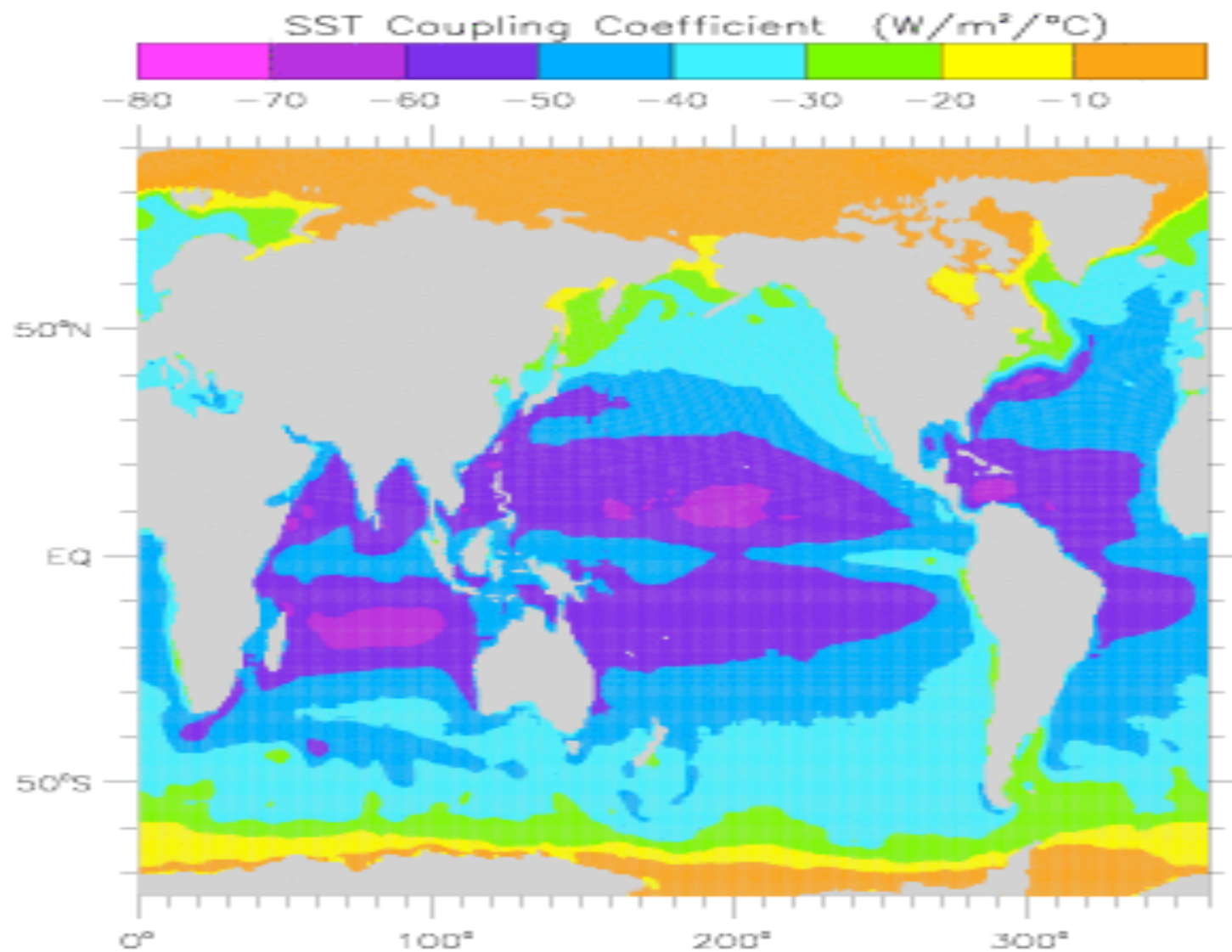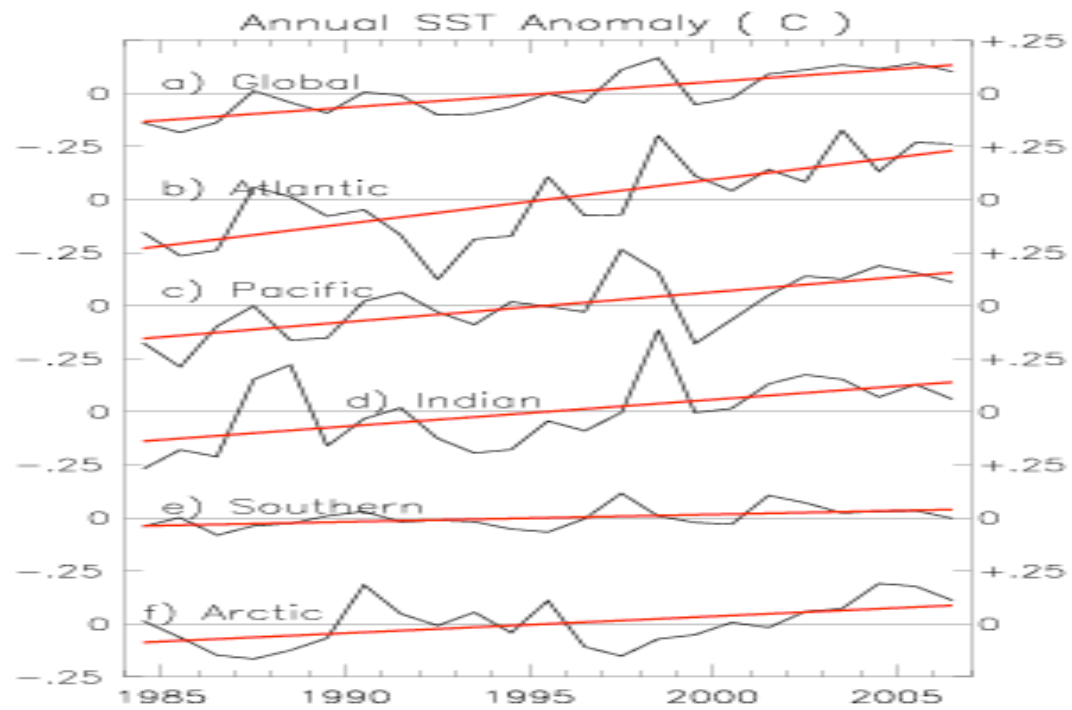
Δ$_{23}$ (W/m²)	Global	Atlantic	Indian	Pacific
Qsst	-12.9	-21.3	-15.3	-15.9
Qair	6.8	11.5	6.6	9.4
Qpbl	-6.2	-9.8	-8.7	-6.5
Qsky	-3.0	-0.2	-5.6	-5.4
Qnet	-9.1	-10.1	-14.3	-11.9

Inter-annual Climate Variability

a) North Atlantic Oscillation Index   (NAO)

b) North Pacific Index   (NPI)

c) NINO 3.4 SST Anomaly (°C)

d) Southern Oscillation Index (SOI)

e) SLP-based Antarctic Oscillation Index (AAO)
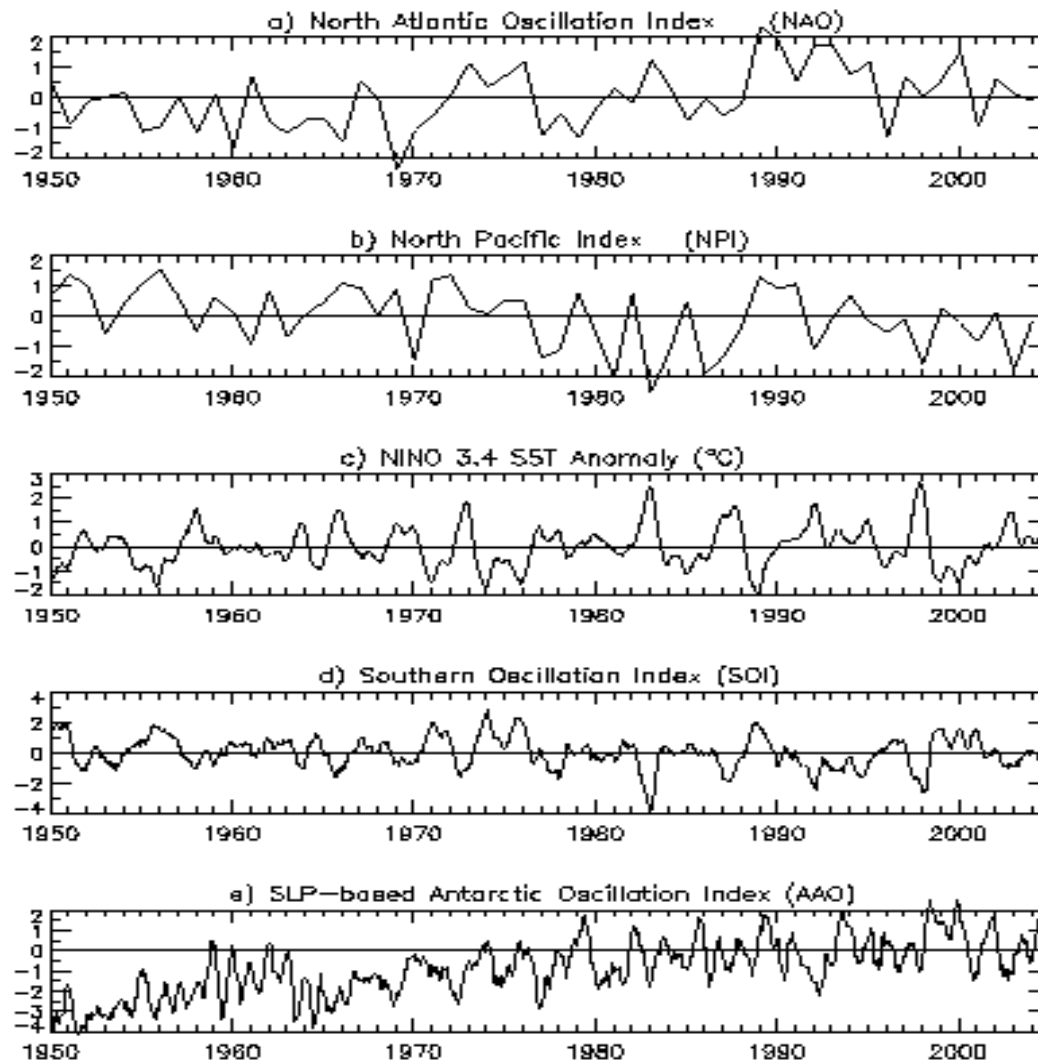
Regression slopes :
Fluxes on NAO index
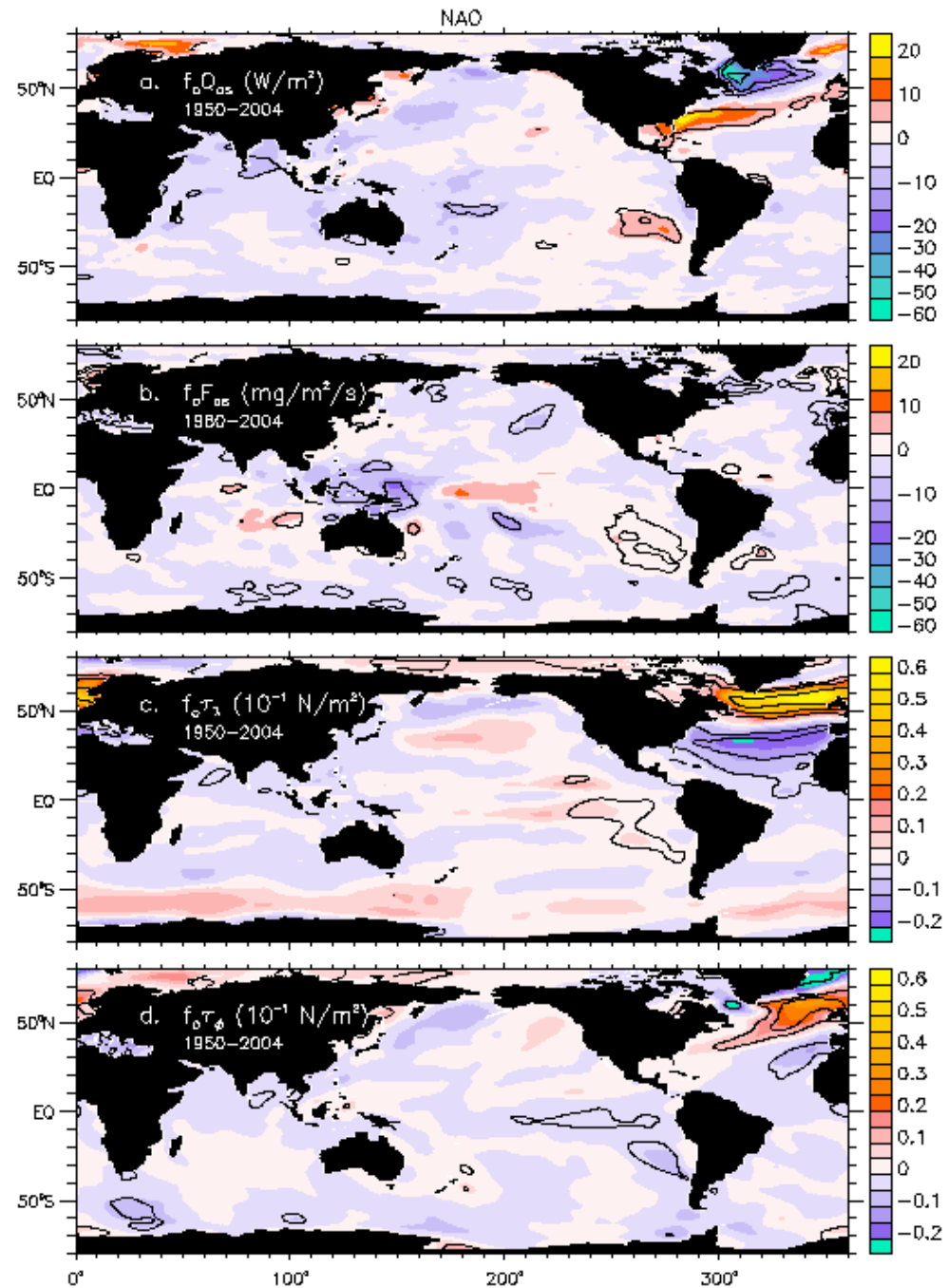
Regression slopes :
Fluxes on SIO index

δV