



TCs in Coupled Models at GFDL

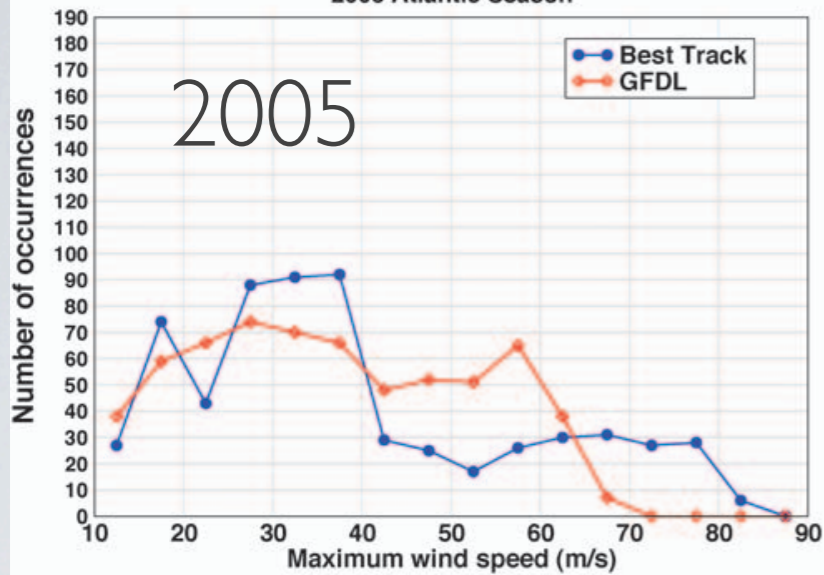
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Hyeong-Seog Kim^{1,3},
Ming Zhao^{1,4}, Tom Delworth¹,
Tom Knutson¹, Takeshi Doi²

1-NOAA/GFDL 2- Princeton U.
3-WillisRE 4-UCAR

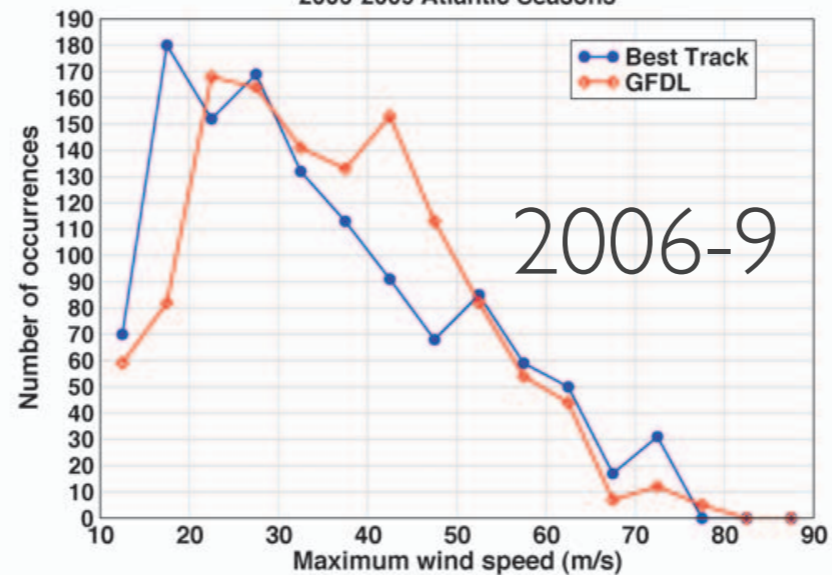
At: First Workshop of the US-CLIVAR Working Group on
Hurricanes and Climate

Improved representation of GOM eddies improves intensity forecast in GFDL model – added after 2005 season

a) Distribution of Maximum Winds Per 120h Forecast Period
2005 Atlantic Season

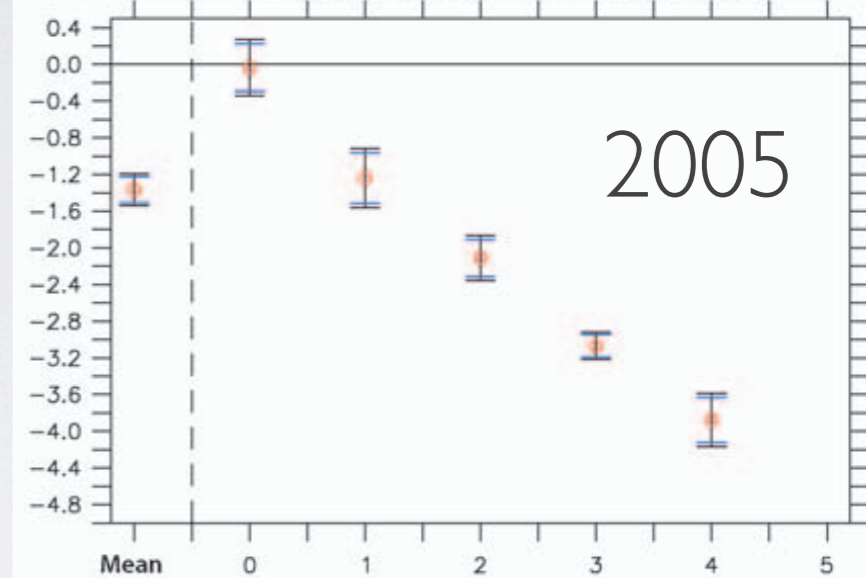


c) Distribution of Maximum Winds Per 120h Forecast Period
2006-2009 Atlantic Seasons

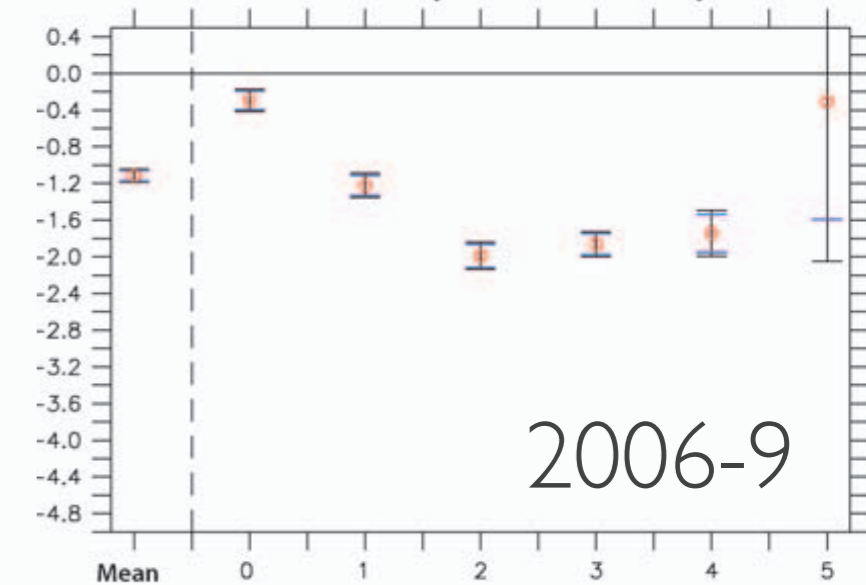


GHM

SST(+2 days) - SST (-2 days)



SST(+2 days) - SST (-2 days)



SST change in following TC

GFDL High Resolution Coupled Model Development

Scientific Goals:

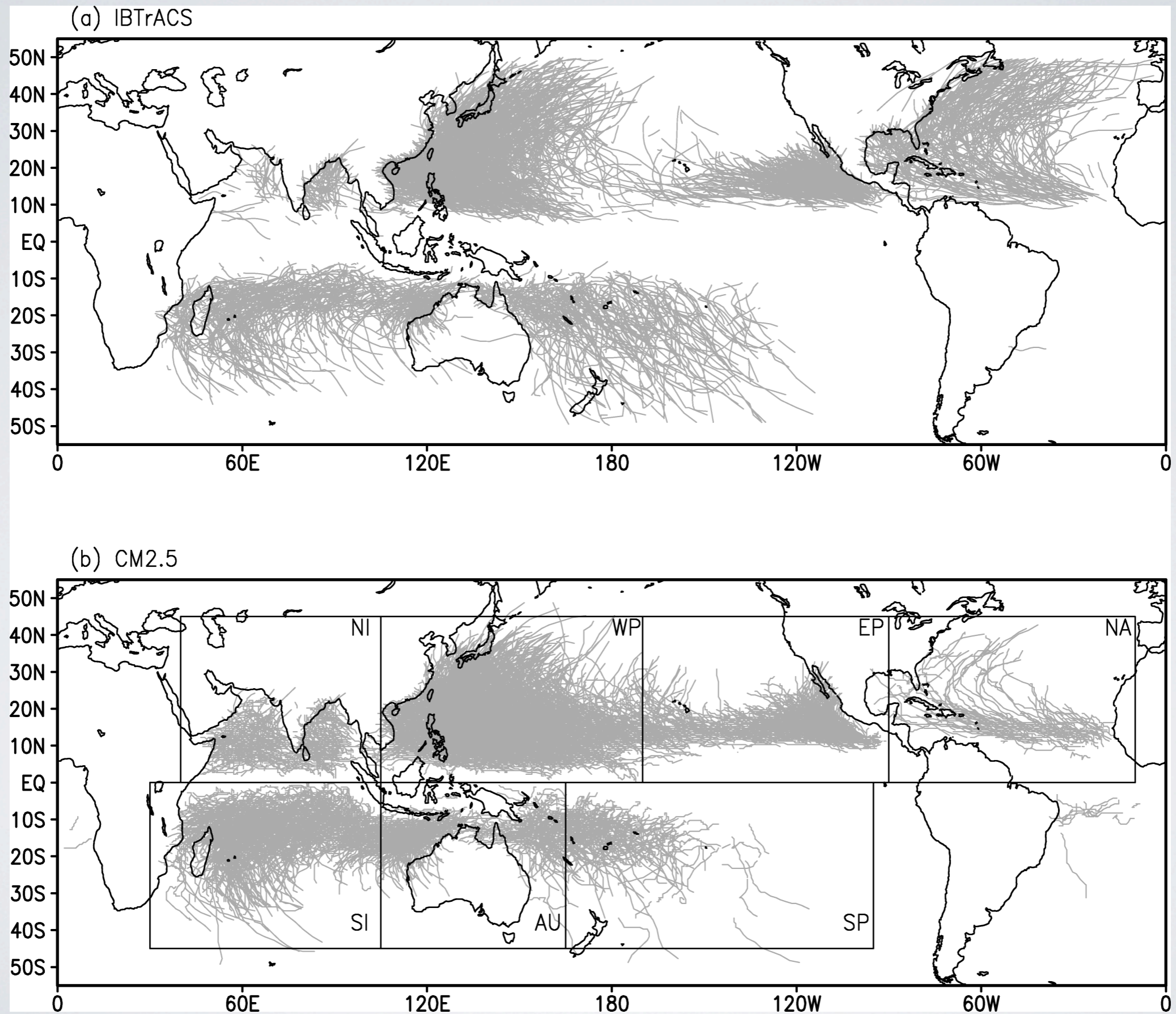
- Developing improved models (higher resolution, improved physics and numerics, reduced bias) for studies of variability and predictability on intra-seasonal to decadal time scales
- Explore impact of atmosphere and ocean on climate variability and change using a high resolution coupled model
 - New global coupled models: CM2.4, CM2.5, CM2.6, ...

	Ocean	Atmos	Computer	Status
CM2.1	100 Km	250 Km	GFDL	Running 
CM2.3	100 Km	100 Km	GFDL	Running
CM2.4	10-25 Km	100 Km	GFDL	Running
CM2.5	10-25 Km	50 Km	GFDL/GAEA	Running 
CM2.6	4-10 Km	50 Km	GAEA	Running

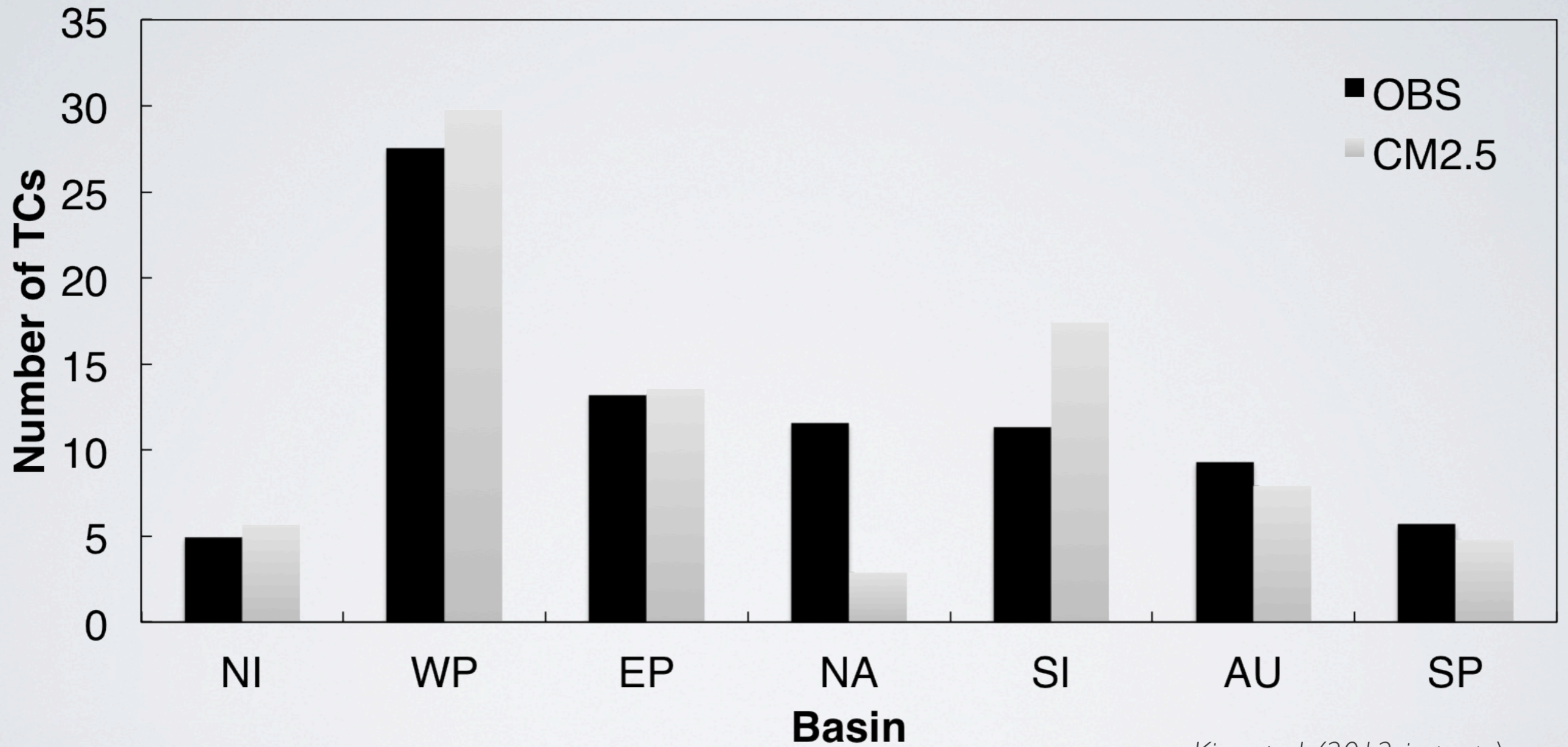
Delworth et al. (2012, J. Clim., in press)

TC Tracks in CM2.5 and Obs.

Kim et al. (2012, in prep.)

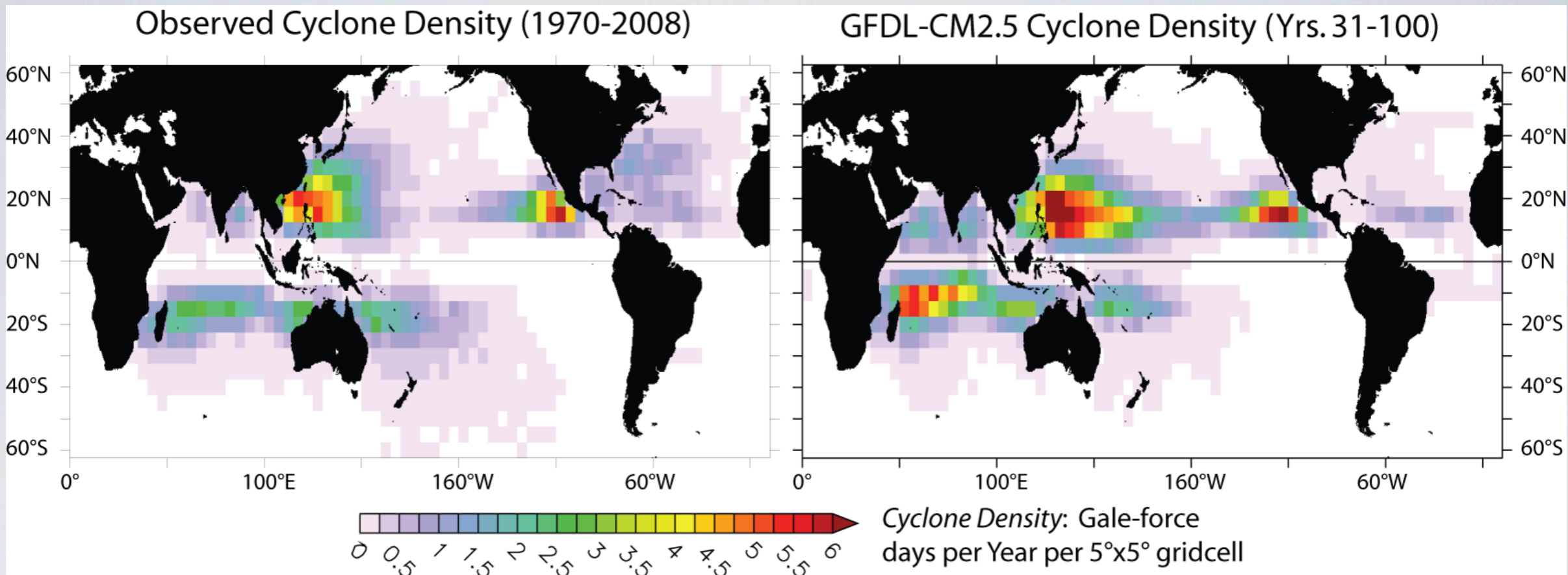


50-Year Genesis per Basin

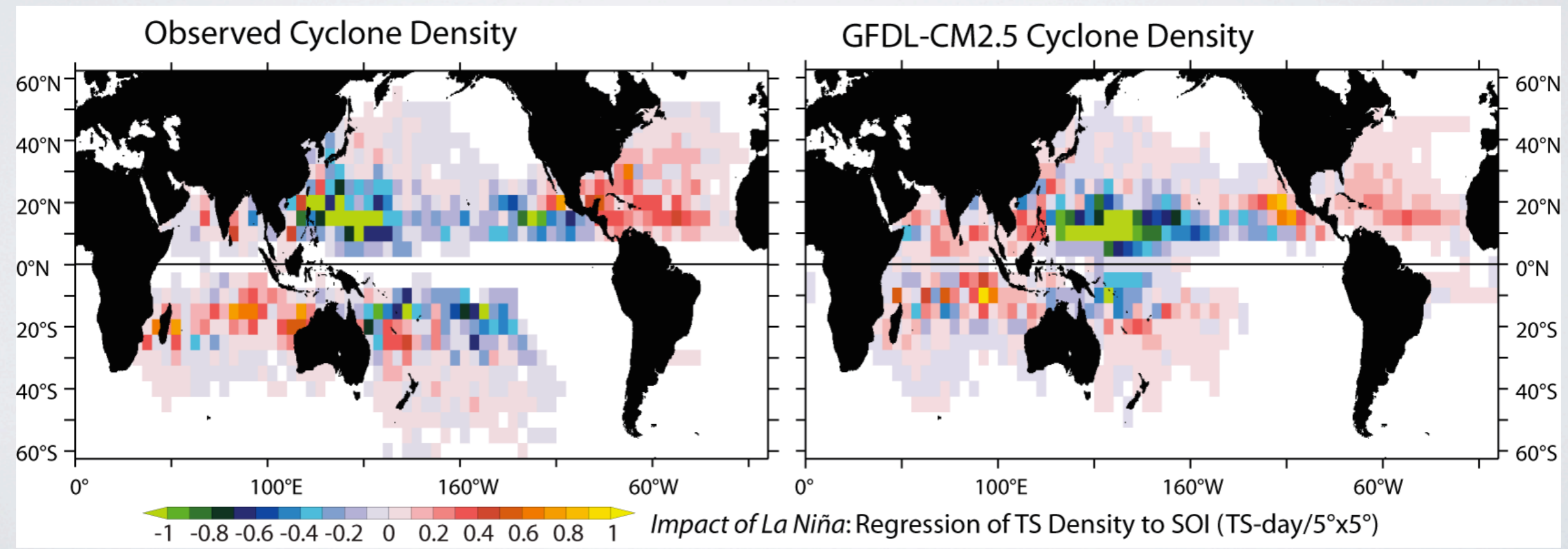


Kim et al. (2012, in prep.)

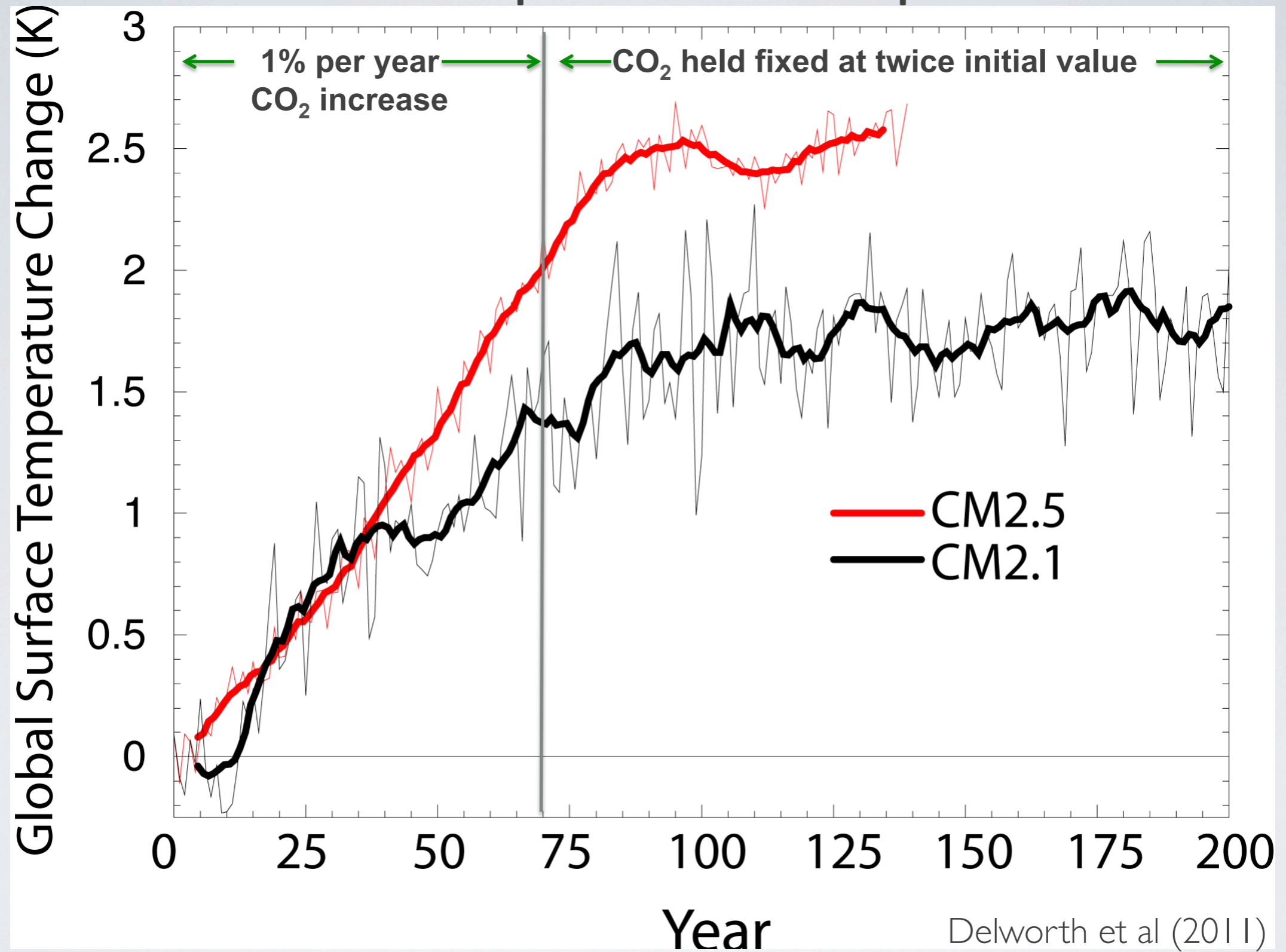
Mean



Regression to SOI

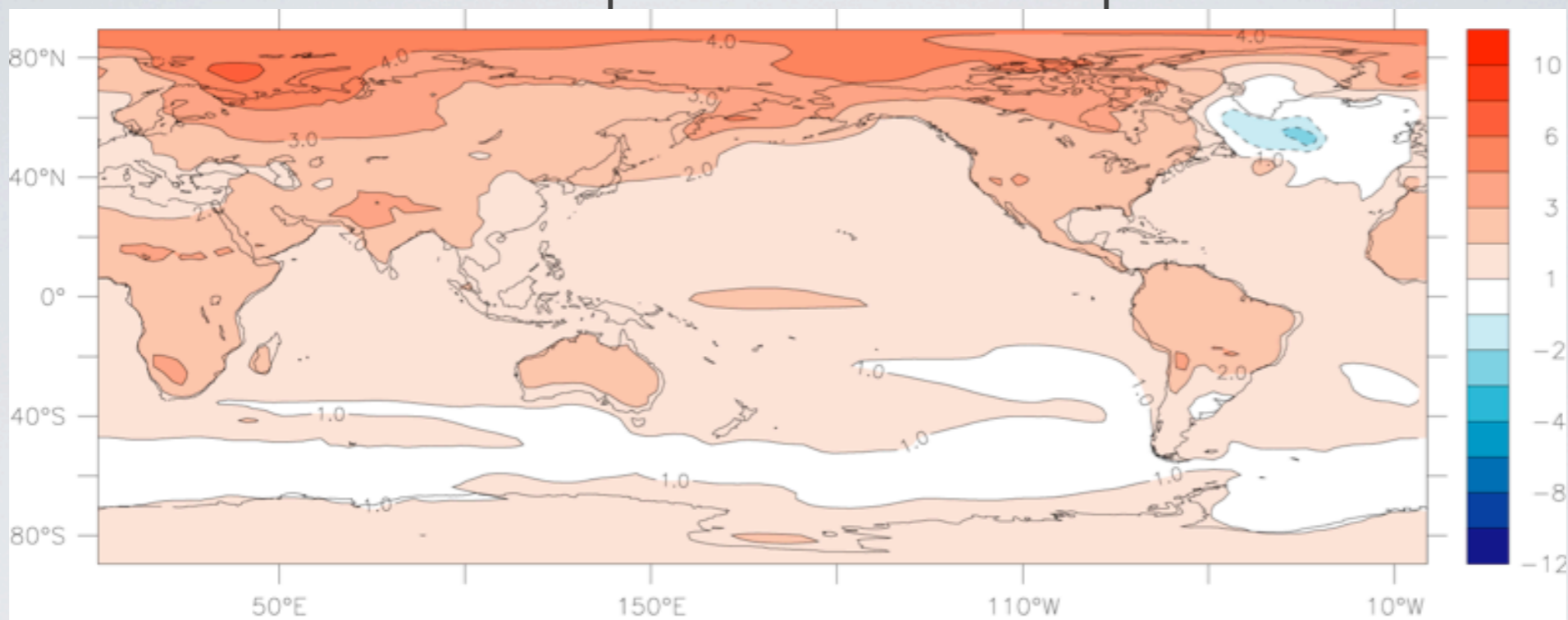


Global Surface Temperature Response to 2xCO₂

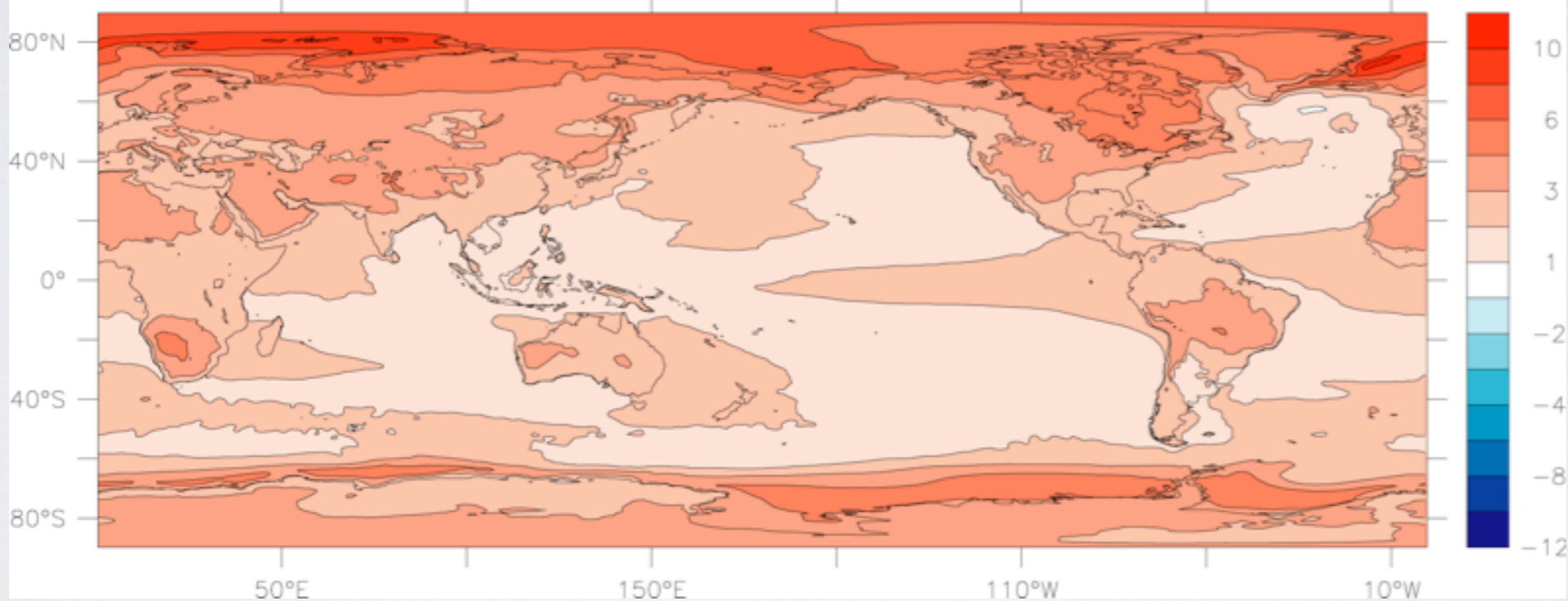


Global Surface Temperature Response to 2xCO₂

CM2.1
(lo-res)



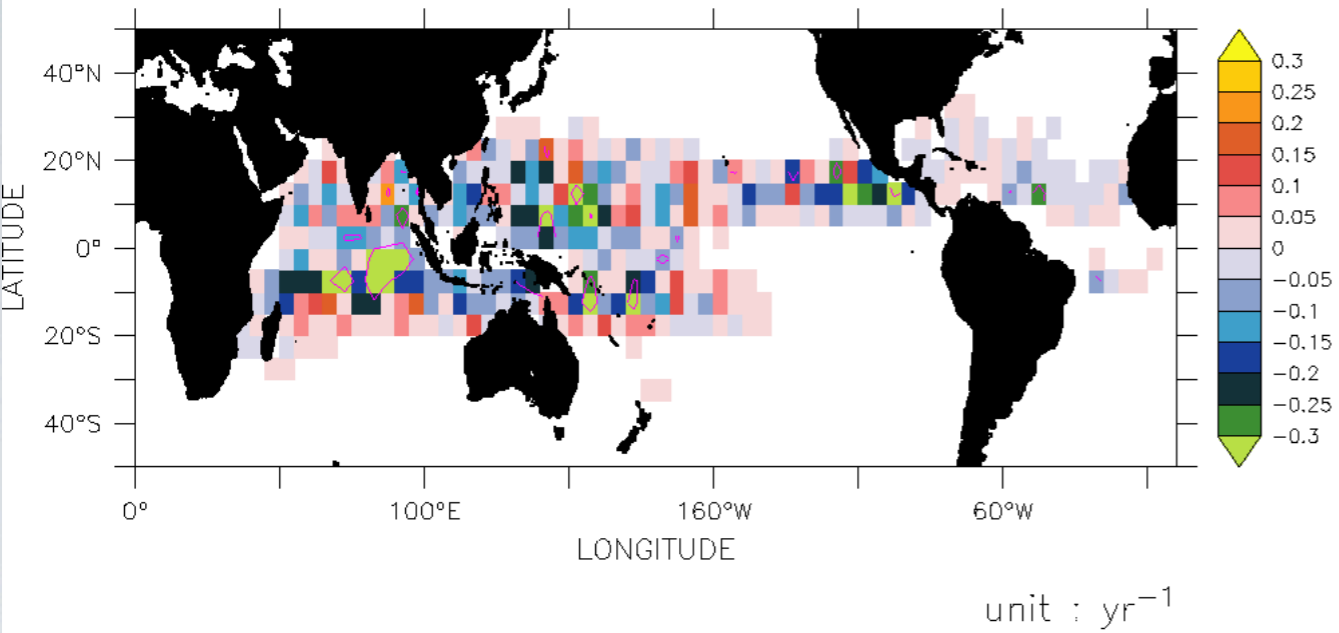
CM2.5
(hi-res)



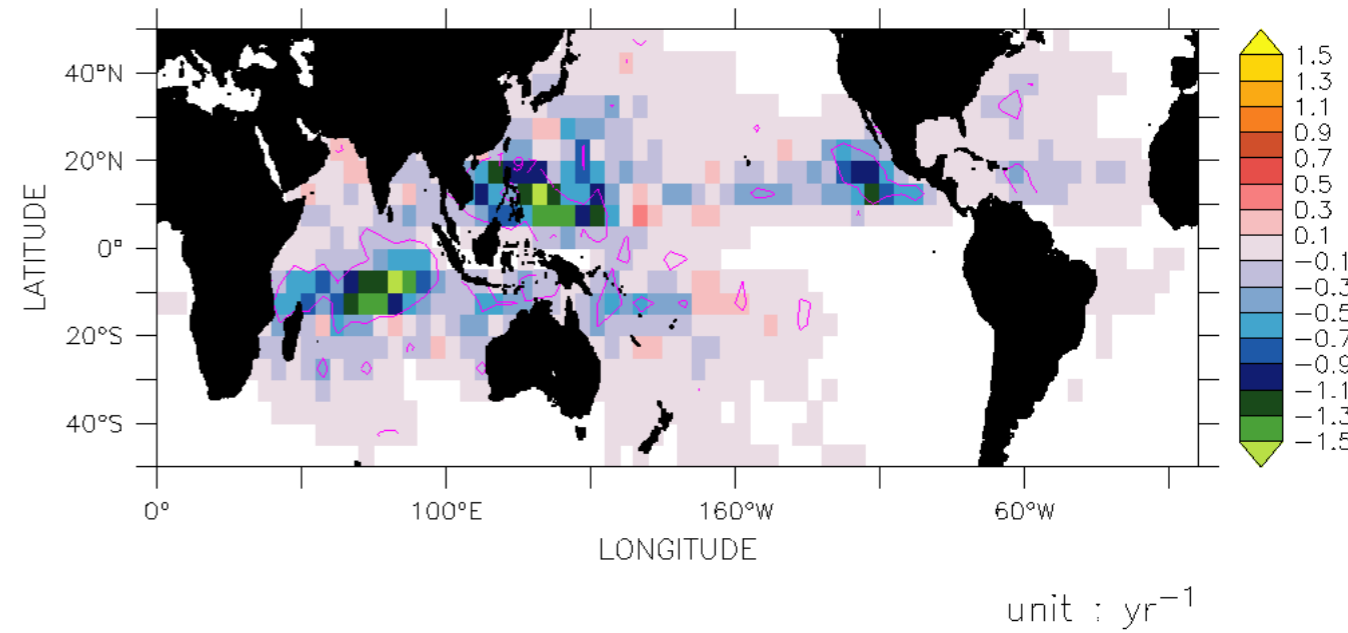
Delworth et al (2012, J. Clim. In press)

CM2.5 C03 (2XC02 minus 1XC02)

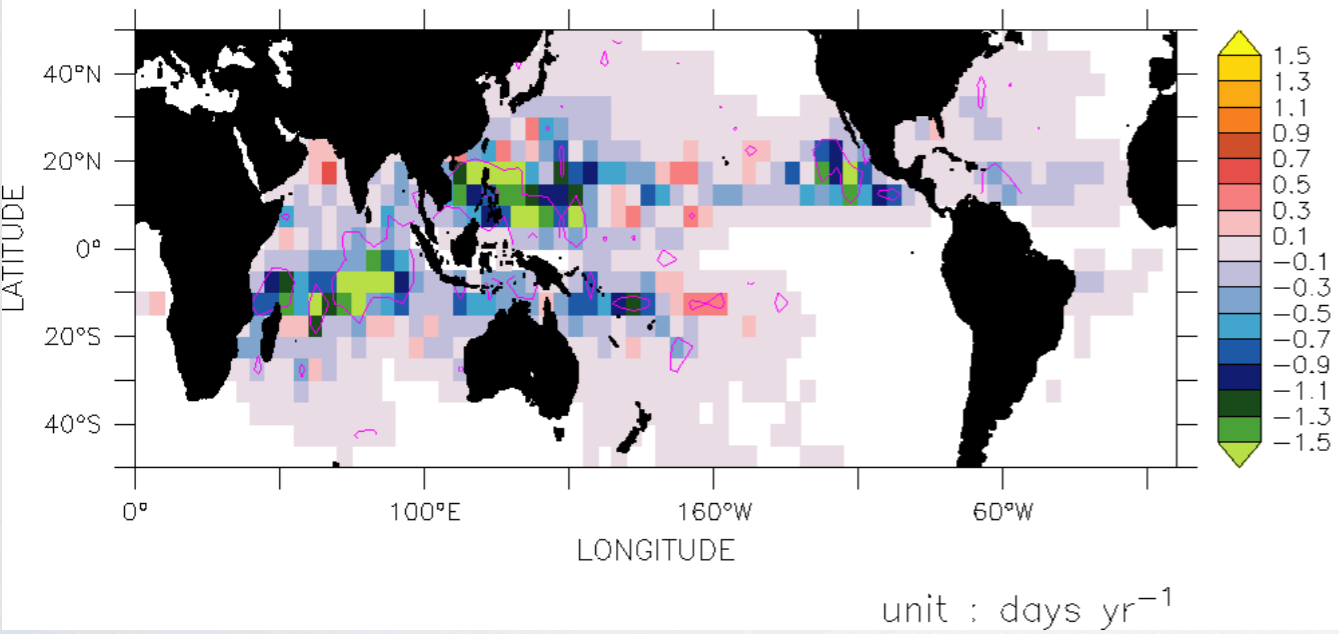
(a) The number of TC Genesis



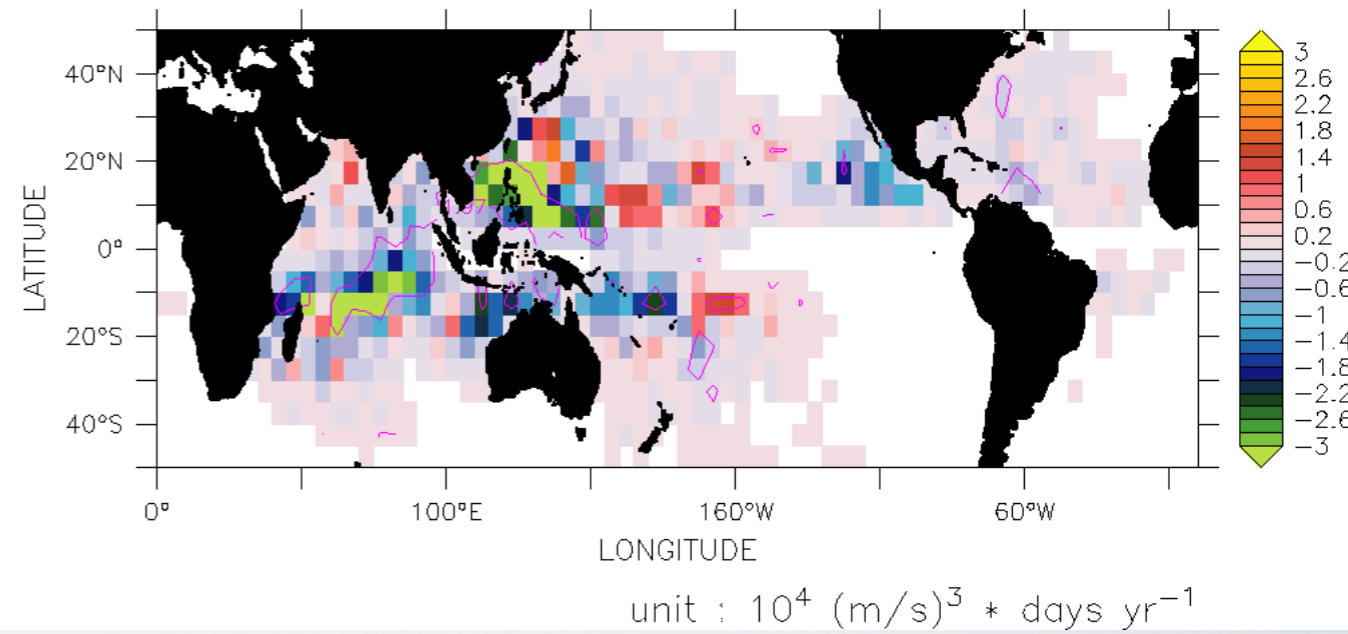
(b) The number of TC Passage



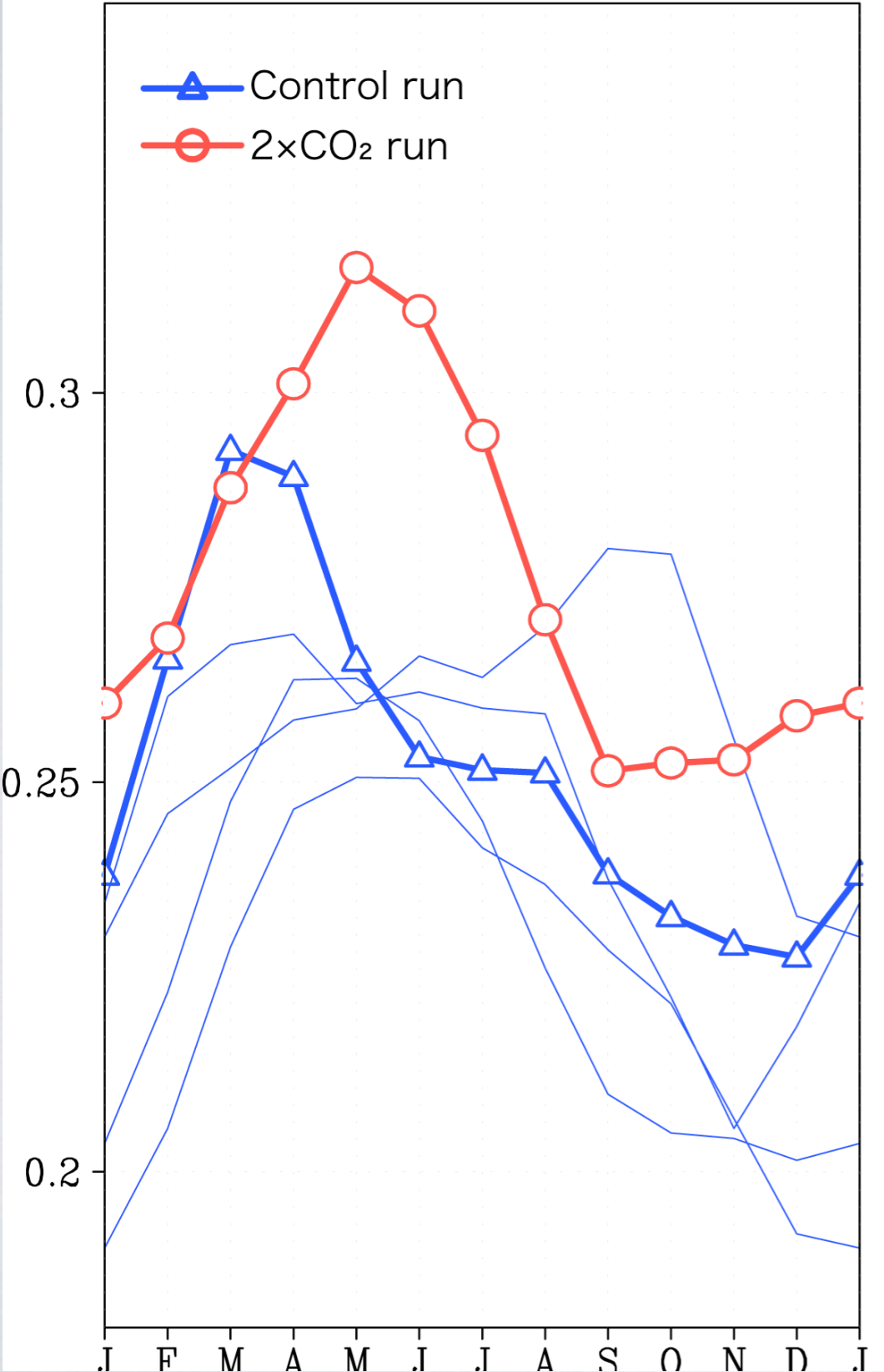
(c) Days of TC occurrence



(d) PDI



(a) Standard deviation of interannual variations of SST averaged in MDR (°C)



In CM2.5, seasonal phase-locking of MDR SSTA variability shifts in response to 2xCO₂: interannual variability of Natl TCs increases

	(a) Mean $\frac{\sum_{y=91}^{y=140} f(y)}{50}$	(c) Warm SST _{MDR} years	(d) Cold SST _{MDR} years
Observation	6.51	+0.95	-1.28
CM2.5-Control	6.56	+2.12	-1.07
CM2.5-CO ₂ doubling	5.88	+2.55	-1.42
CO ₂ doubling run minus Control run	-0.68	+0.43 (+20%)	-0.35 (-33%)

Thought for addt'l experiment

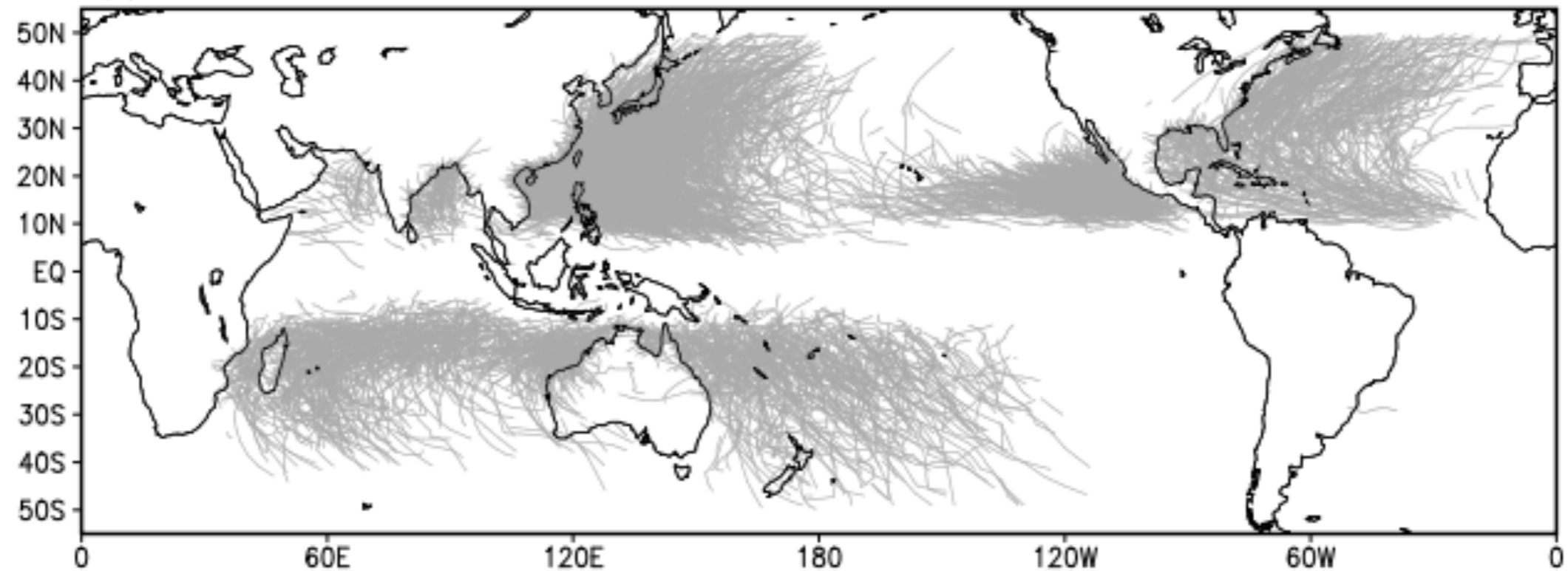
- Force AGCMs with MME pattern of SSTA from coupled models' CO₂ response + CO₂ doubling in AGCM.

MME either from:

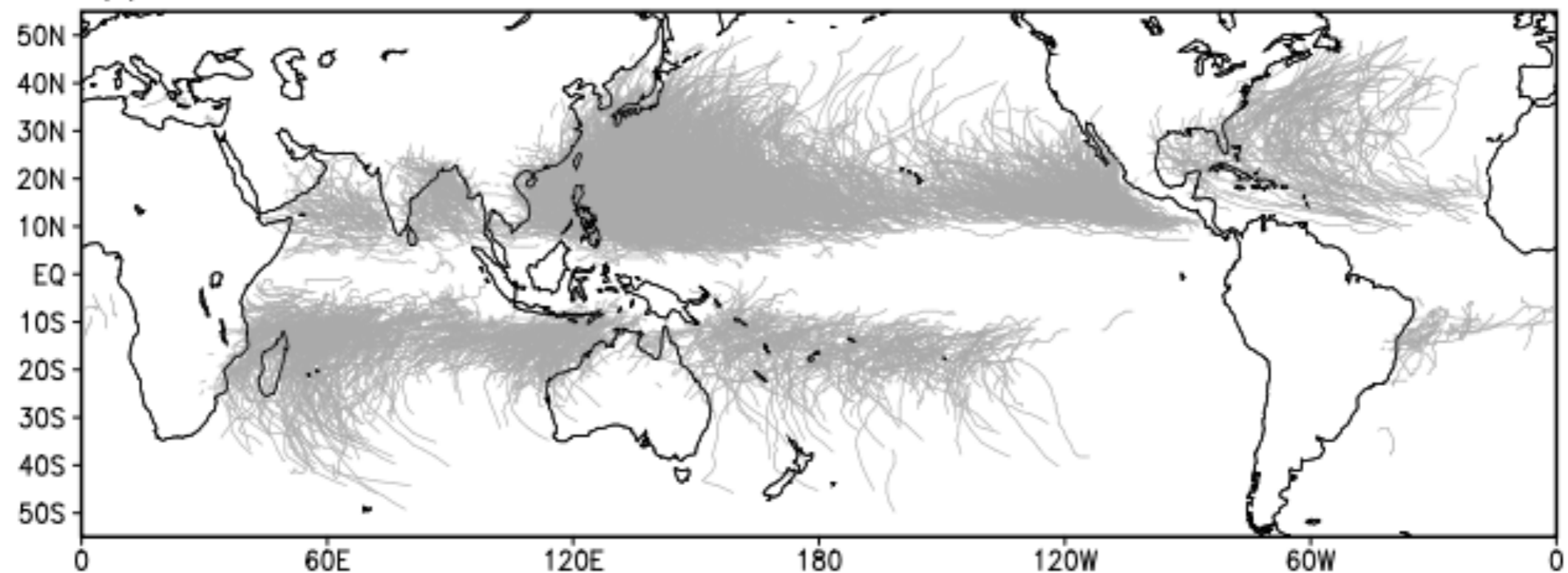
- CMIP3/CMIP5
- High-res CGMCs

Coupled version of Zhao et al. HiRAM

(a) IBTrACS

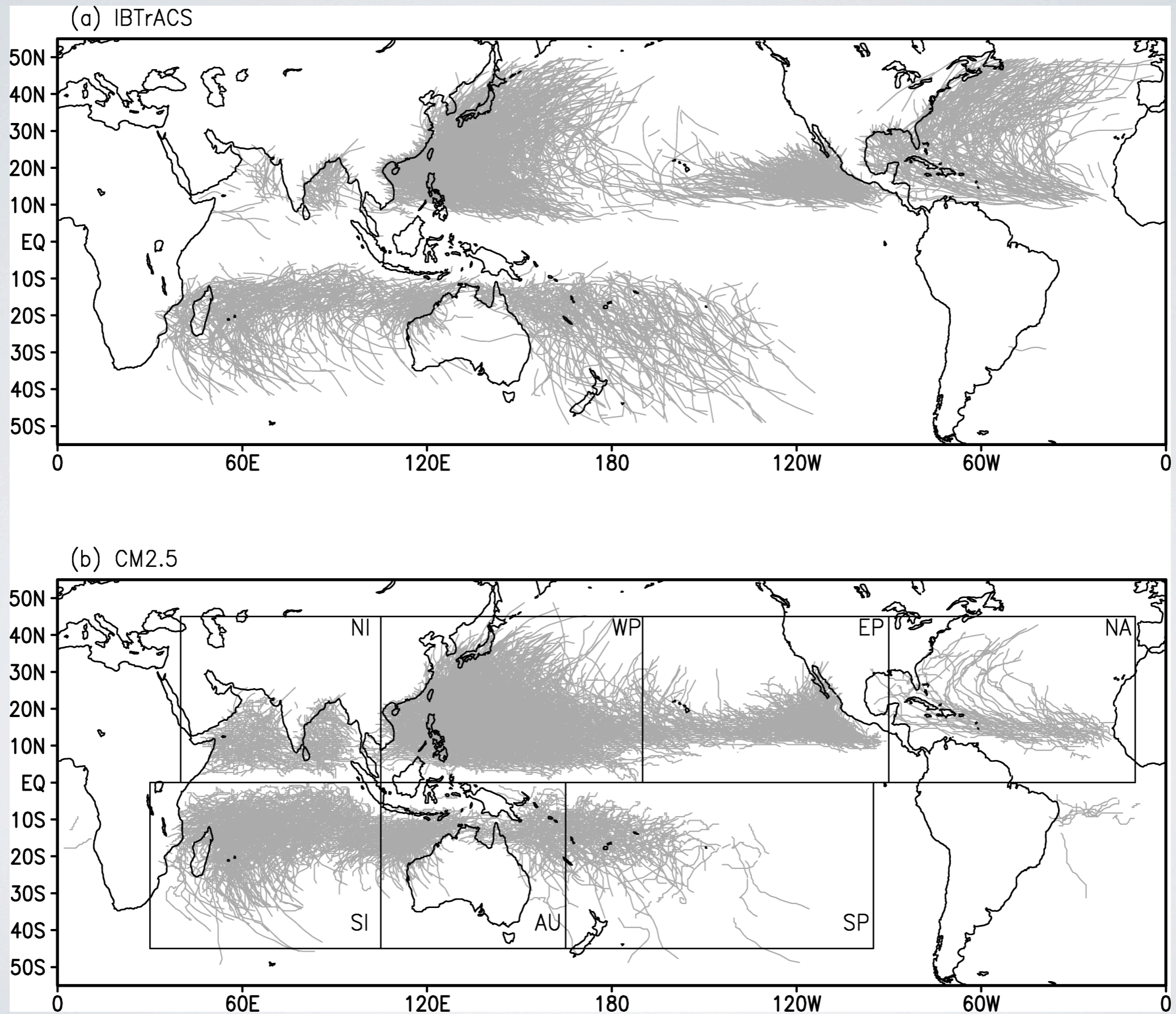


(b) CM2.5 HIRAM

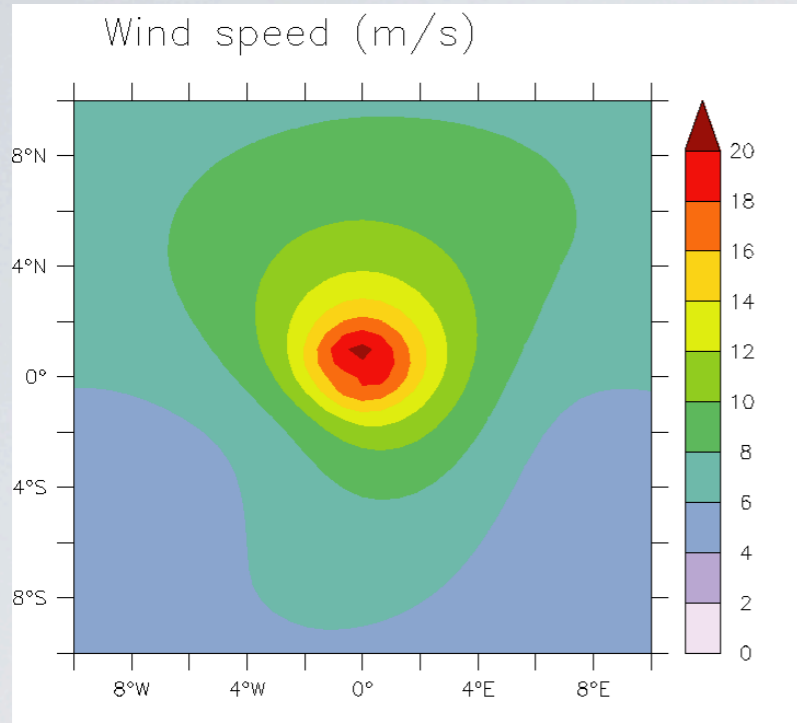


TC Tracks in CM2.5 and Obs.

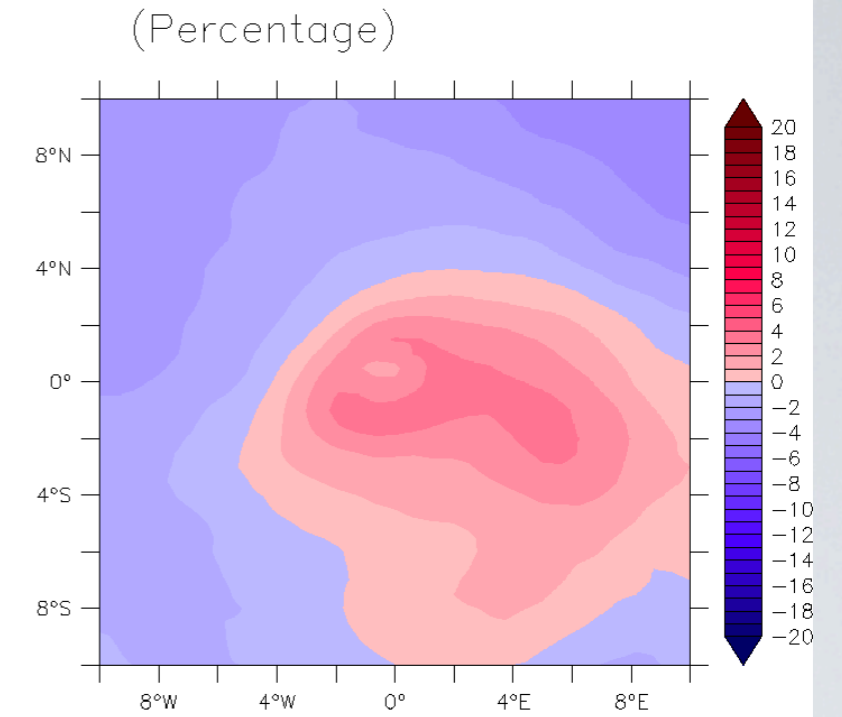
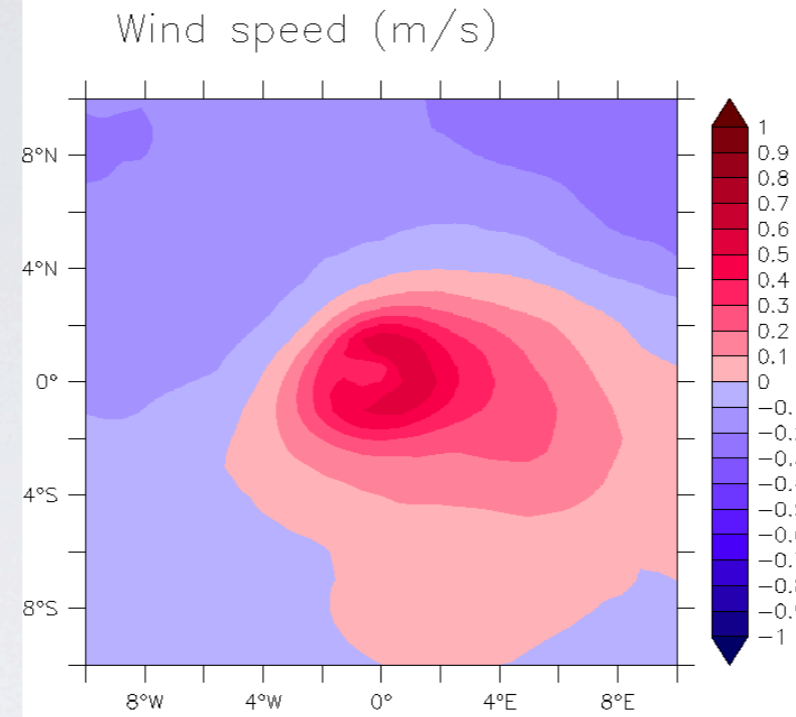
Kim et al. (2012, in prep.)



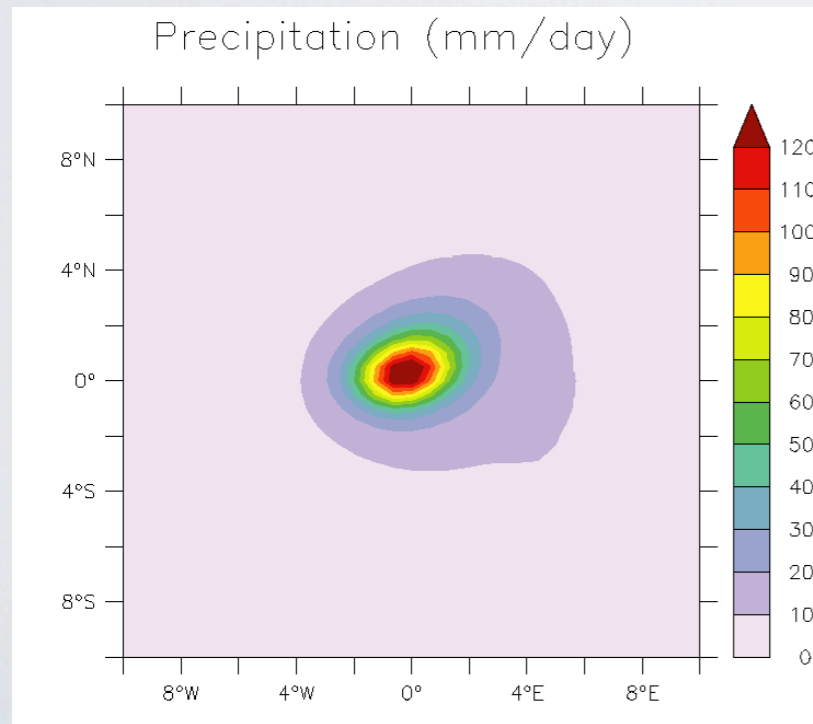
Control mean



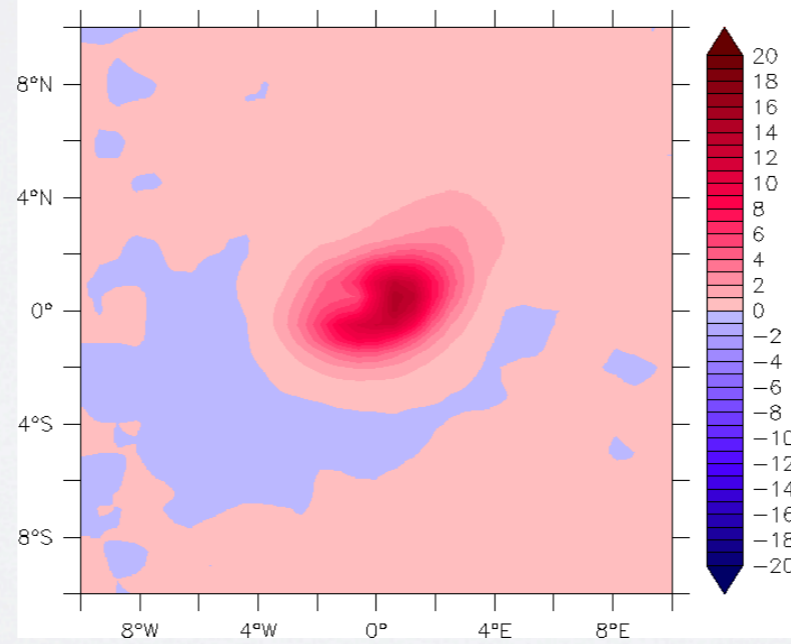
CM2.5 Current minus CO₂X2 GL



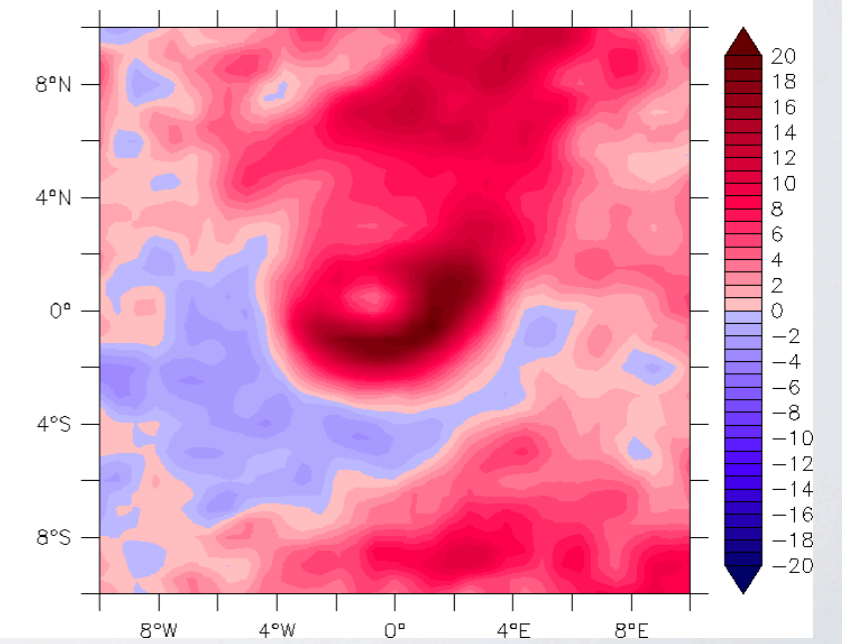
Precipitation (mm/day)



Precipitation (mm/day)

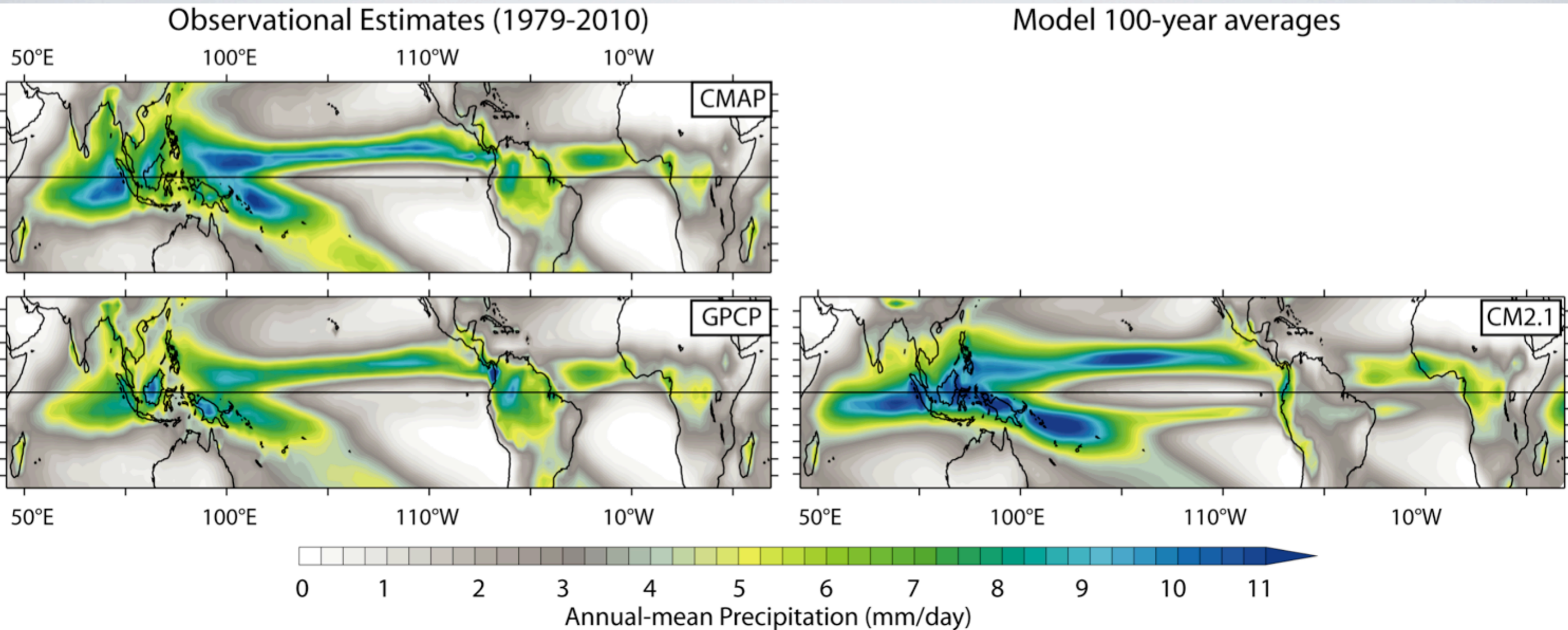


(Percentage)



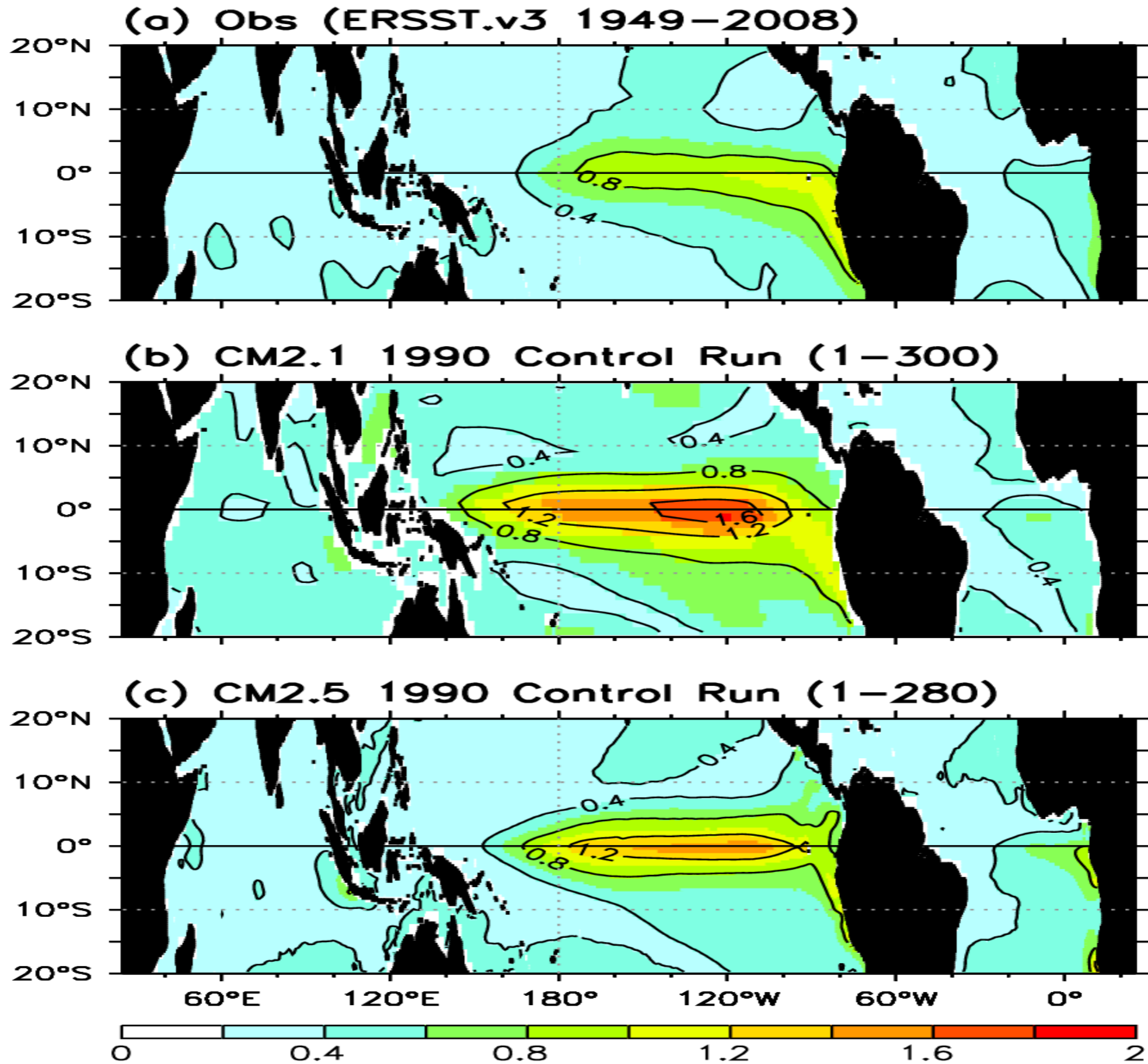
Some Aspects of Tropical Climate Improve with Resolution

Annual Tropical Precipitation on 2.5x2.5 Grid



Adapted from Delworth et al (2011)

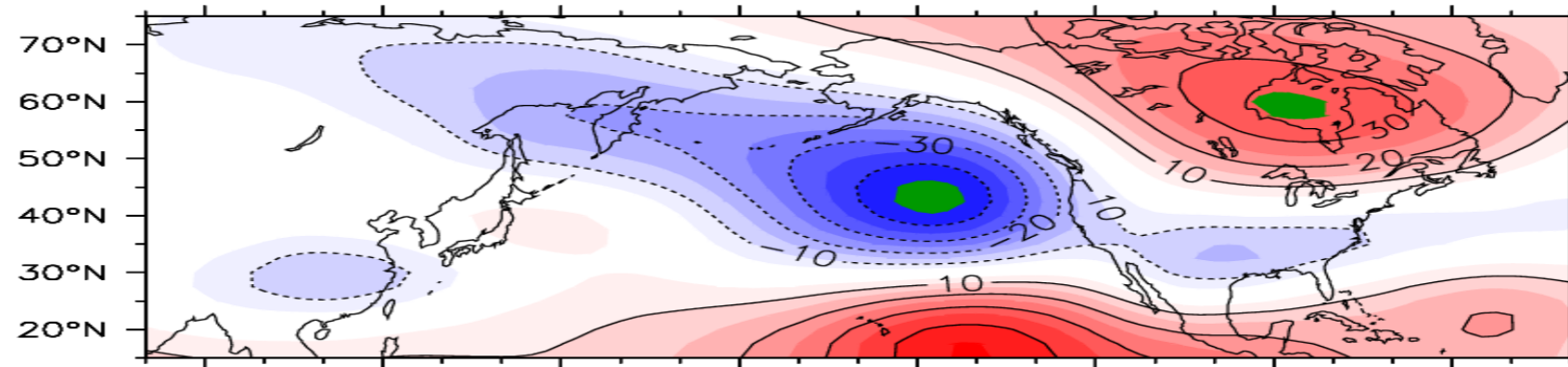
Interannual standard deviation of SST



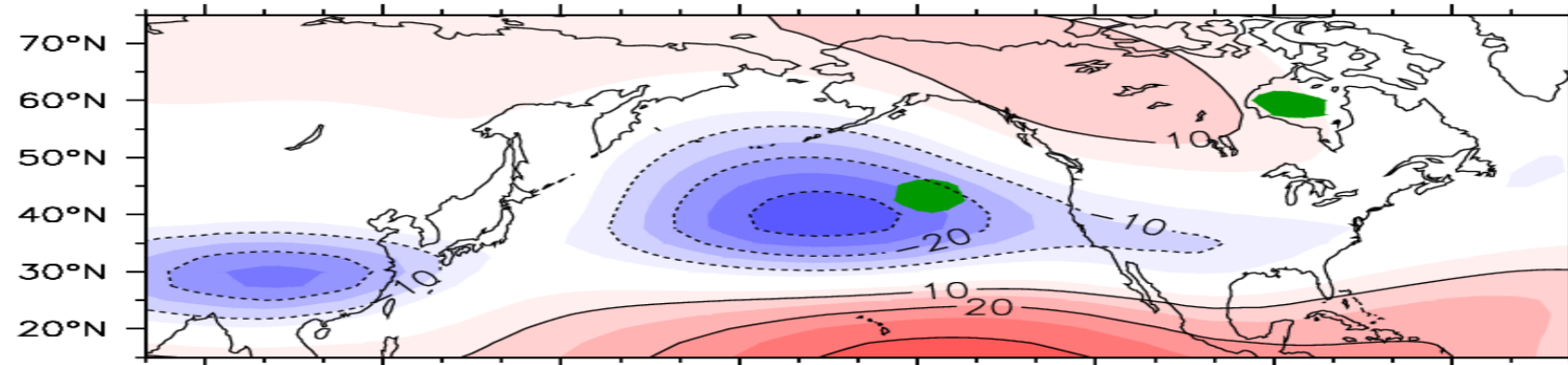
Delworth et al. (2012, J. Clim., in press)

Detrended DJF 200 hPa height anomaly
regressed onto detrended DJF NINO3 SSTA

(a) NCEP/NCAR Reanalysis (1961–2001)



(b) CM2.1 1990 Control Run (11–290)



Delworth et
al. (2012, J.
Clim., in
press)

Figure 17 DJF 200-hPa geopotential height anomalies regressed onto DJF NINO3 SSTAs, computed using (a) the NCEP/NCAR Reanalysis (Kistler et al. 2001) for 1961–2001; (b) the CM2.1 1990 control run for years 11–290; (c) the CM2.5 1990 control run for years 11–270. The zero contour is omitted. Green shading in all panels indicates the positions of the observed extrema over the North Pacific and Canada. Prior to computing the seasonal anomalies and regressions, all time series were detrended by removing a 20-yr running mean.