

Characteristics of tropical cyclones in high-resolution models of the present climate

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Hurricane Working Group

- The U.S. CLIVAR Hurricane Working Group
 - Produce a set of model experiments to improve understanding of TCs in climate models
- Specifically:
 - Interannual variability of TCs: 20th century-present
 - Changes of TCs in a warming climate

SST Forcing

- Climatological
- Warming
 - SST + 2K
 - Double CO₂
 - SST+2K and Double CO₂
- Historical
 - Hadley Centre SST 1980-2009

SST Forcing

➤ Climatological

➤ Warming

- SST + 2K
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➤ Historical

- Hadley Centre SST 1980-2009

Models

Climatology

Historical

Model	Resolution (km)	Years	Ensembles	Years	Ensembles
CAM5.1	100	24	1	-	-
ECHAM5	84	10	1	-	-
FSU	106	5	1	28	3
GEOS-5	56	19	1	28	3
GFDL	50	21	1	30	3
GISS	111	20	1	19	3
MRI	60	-	-	25	1
NCEP	106	20	2	-	-

Data

➤ Models

- Climatology: 7 GCMs
- Historical: 5 GCMs

➤ Observations

- Best Track Database
 - National Hurricane Center
 - Joint Typhoon Warning Center

Tracking

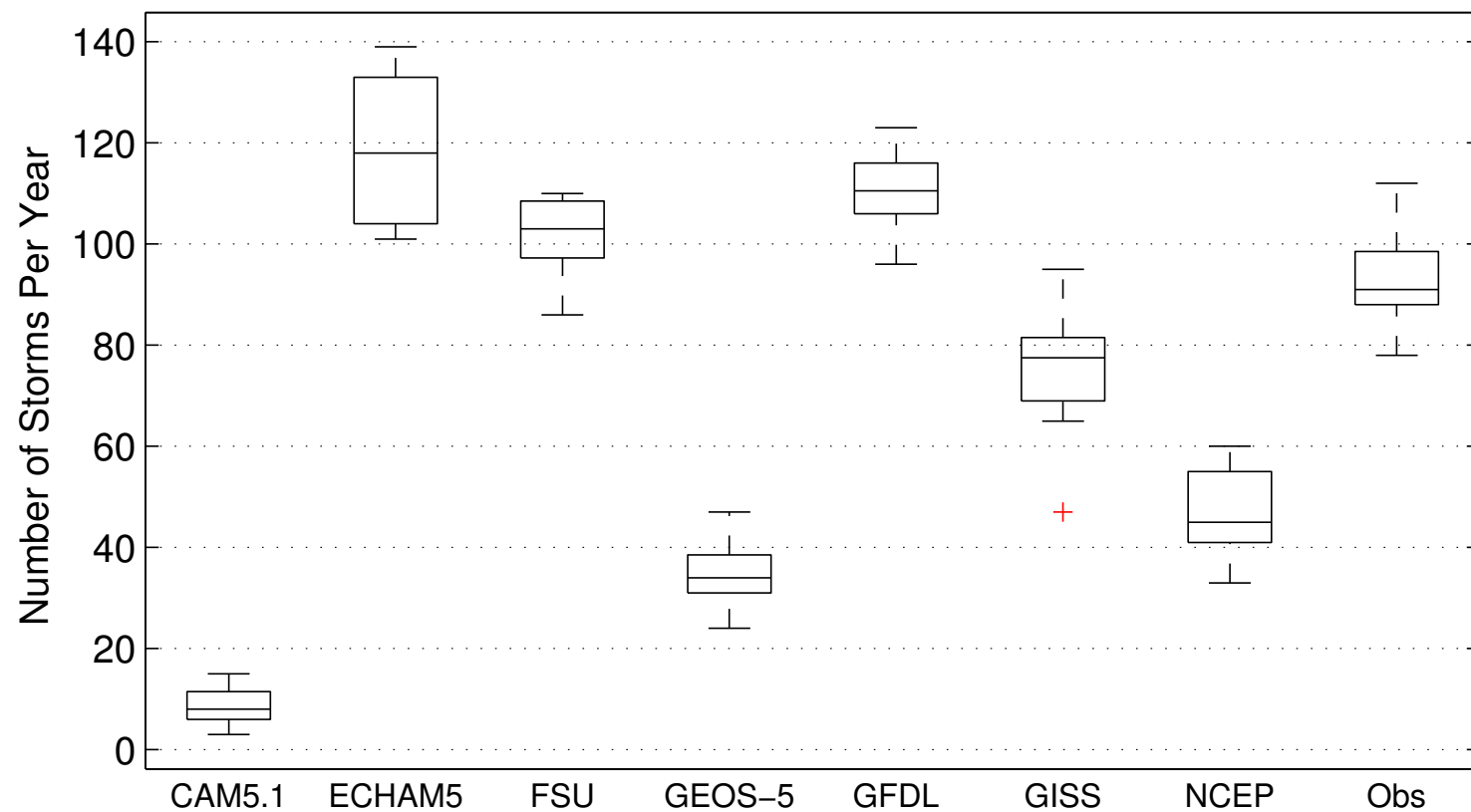
- Find storm locations
 - Vorticity / Wind Speed / Pressure > Threshold
 - Warm Core > Threshold
- Connect points
- Keep tracks that last longer than n days

Tracker

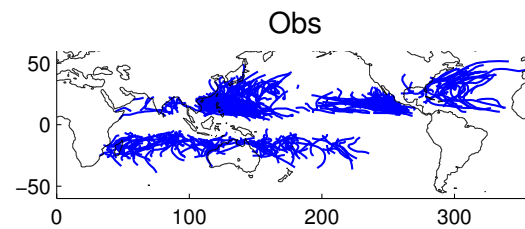
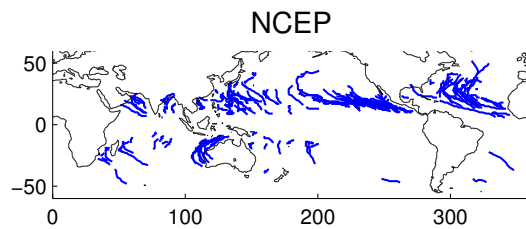
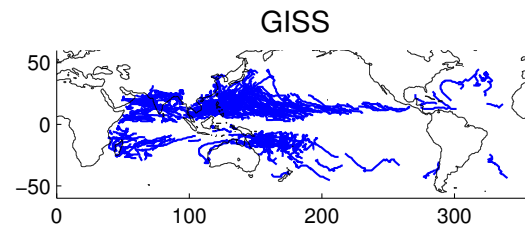
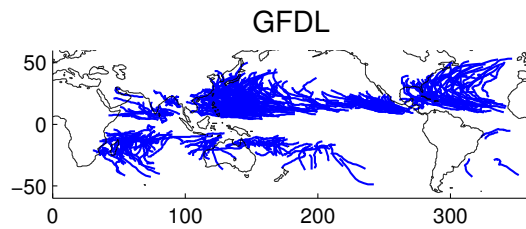
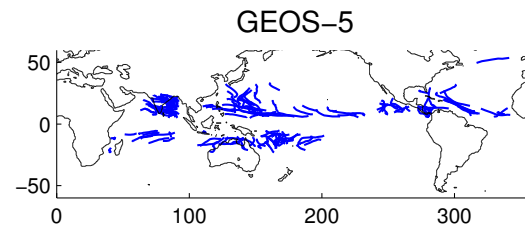
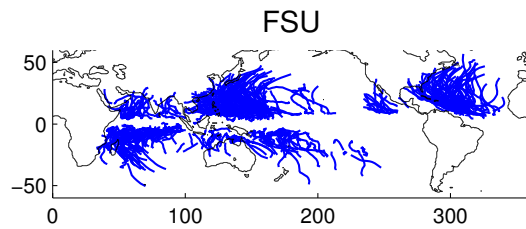
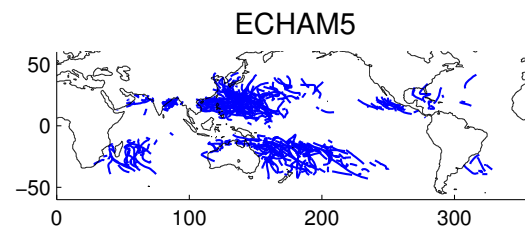
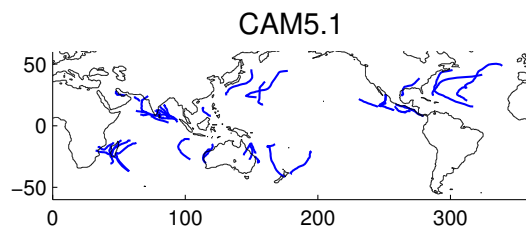
- We are using TC tracks provided by each GCM
- Number of TCs depends on the tracking scheme and thresholds
- Working towards using one unified tracker on all GCMs

Climatological SST Forcing

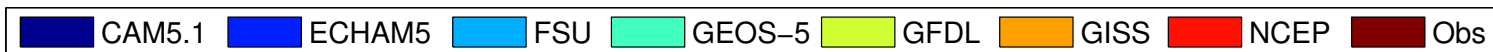
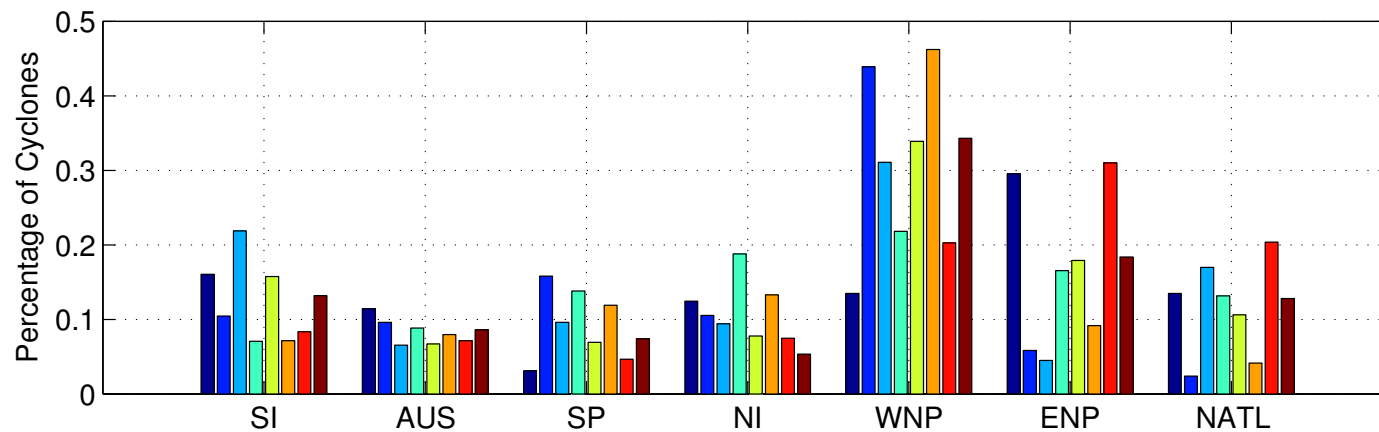
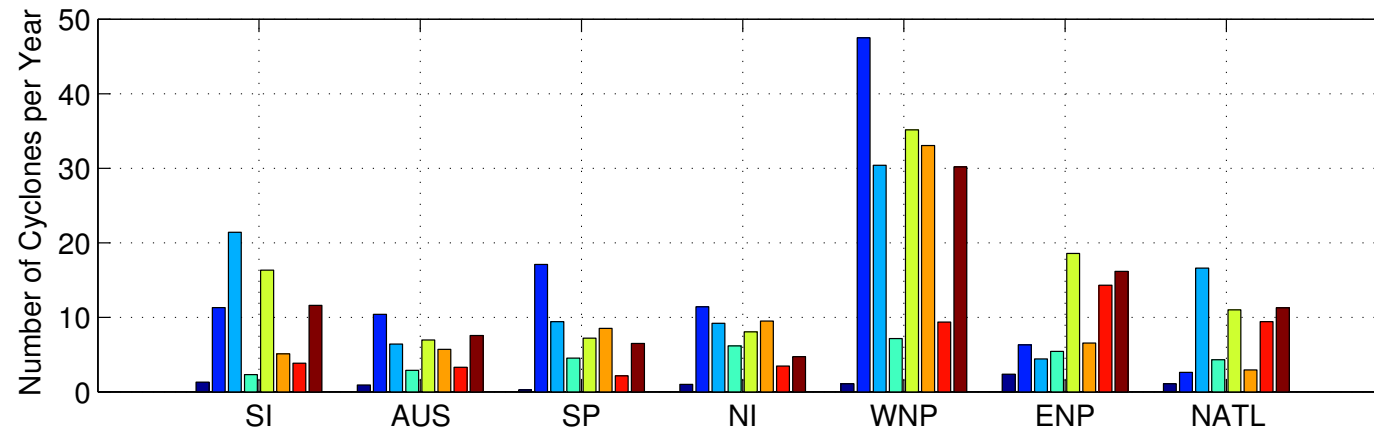
Number of TCs



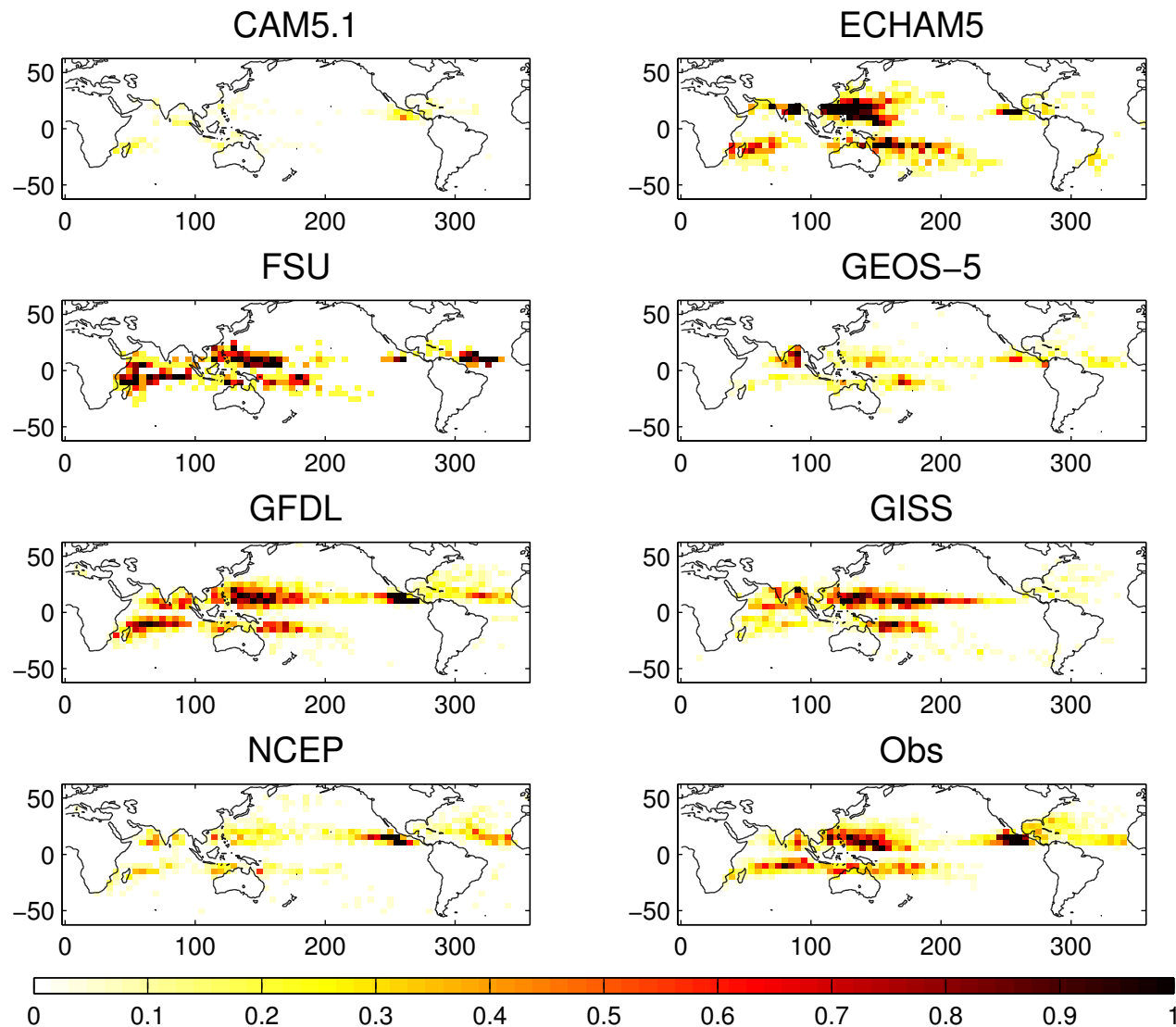
Tracks: 4 Years



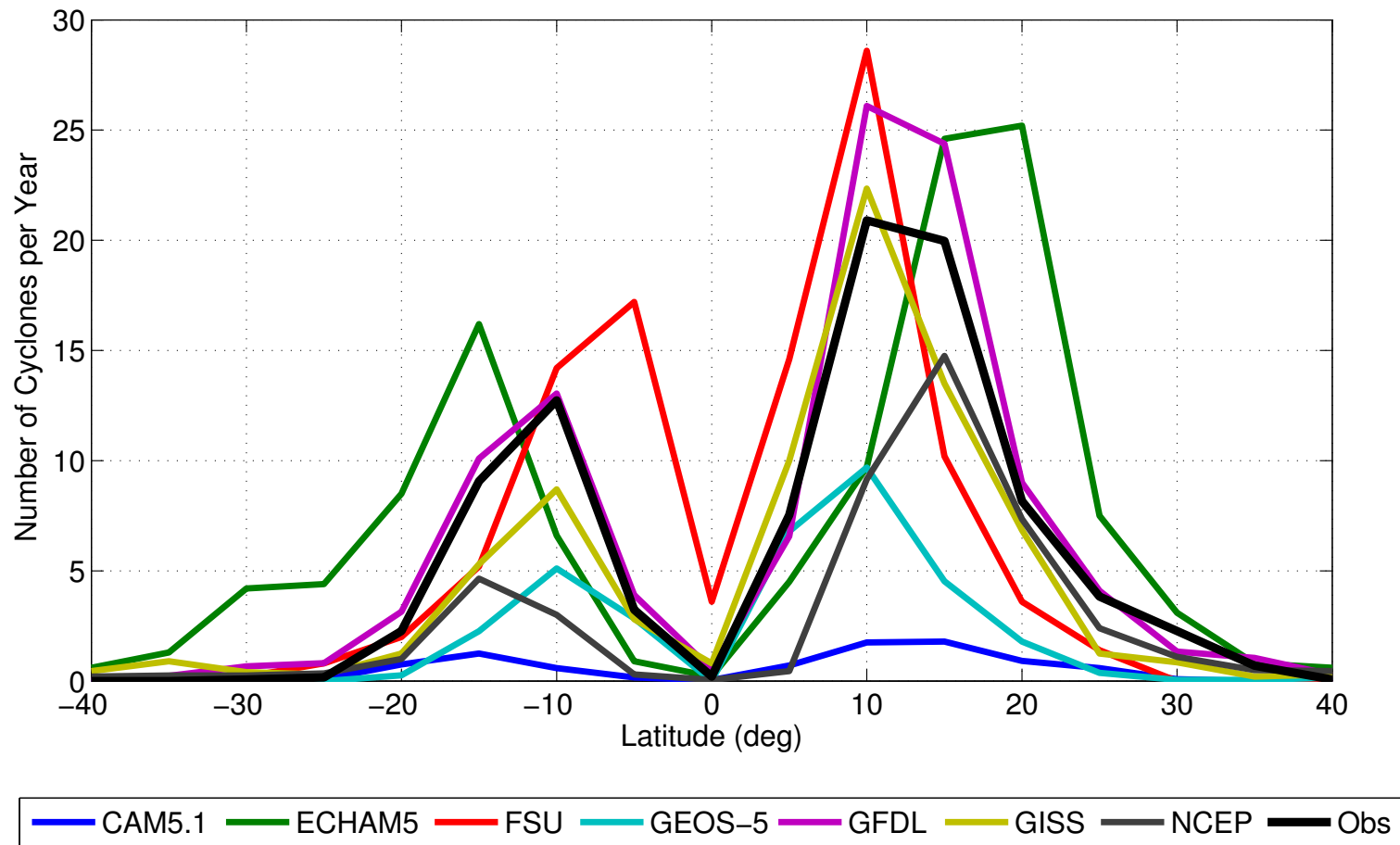
TCs per Basin



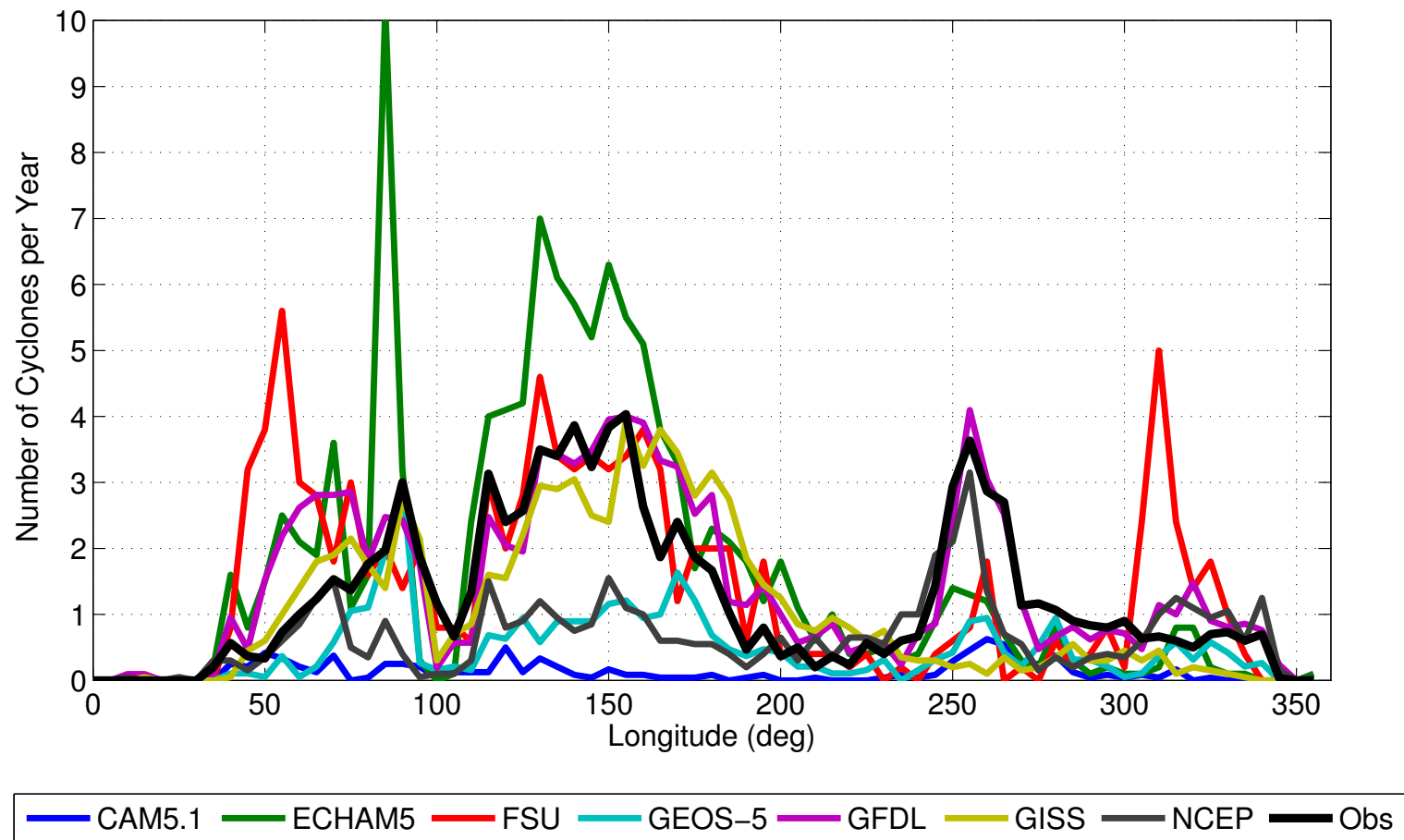
Genesis Density



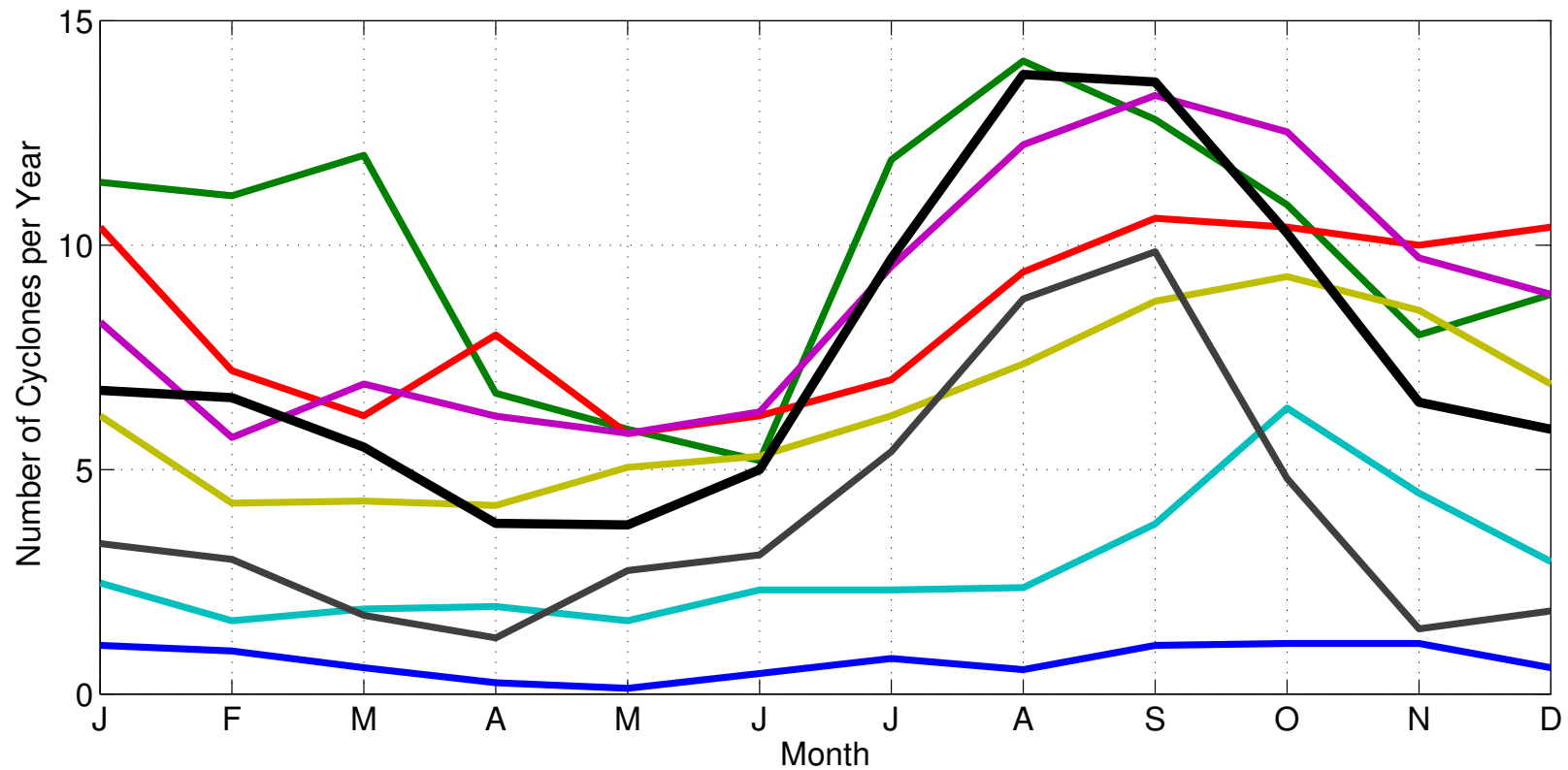
Genesis Density: Latitude



Genesis Density: Longitude

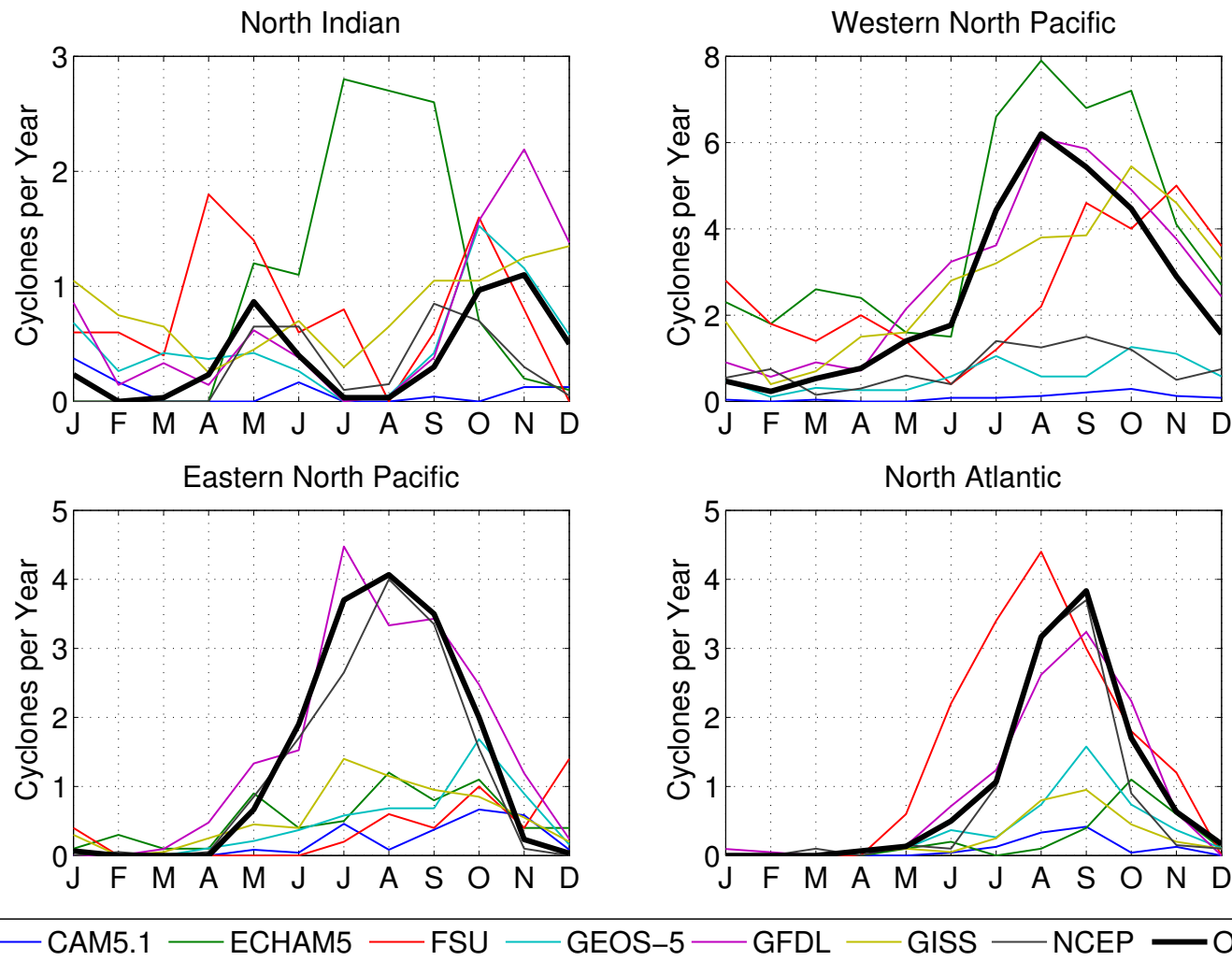


Seasonal Cycle

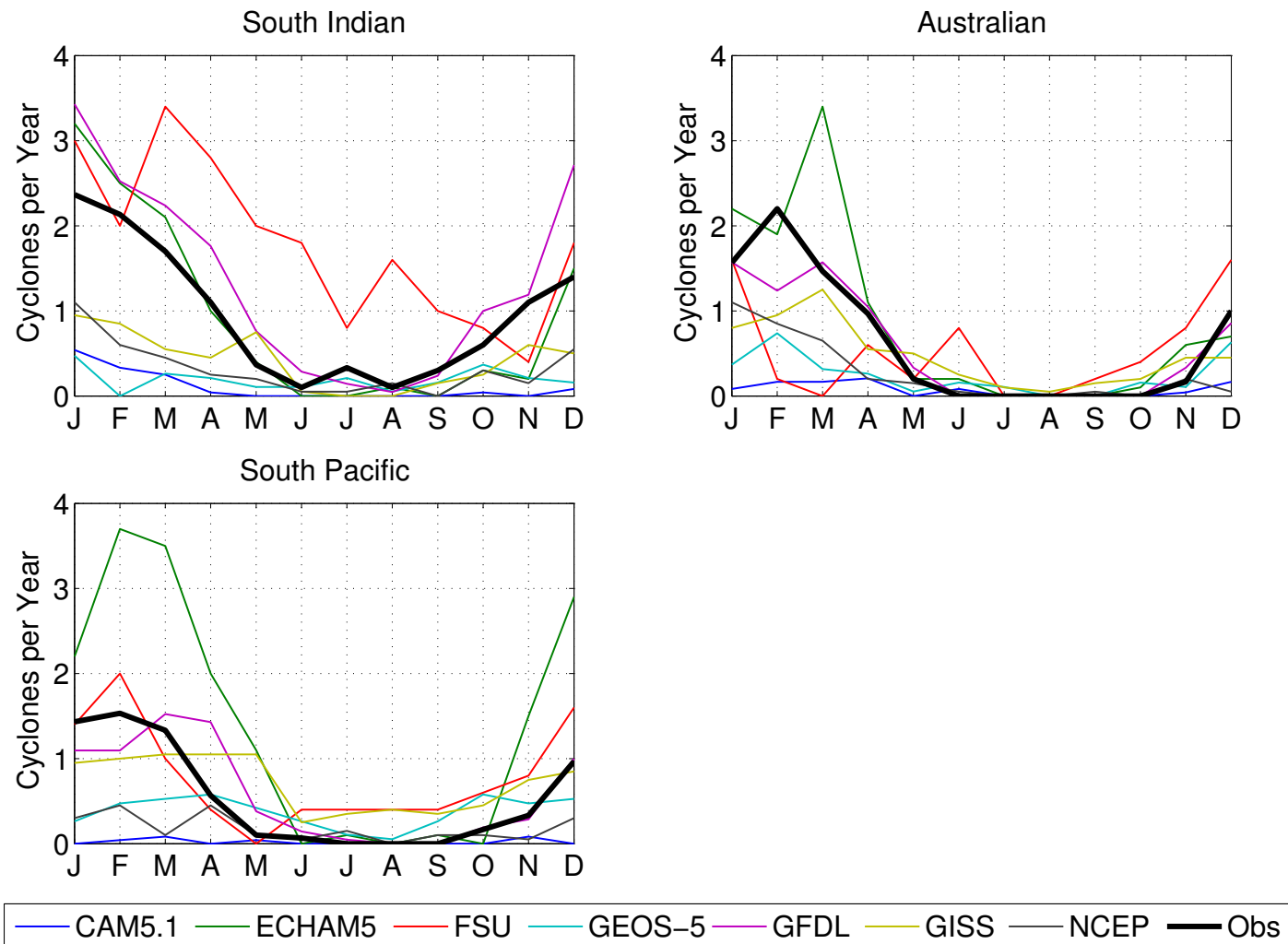


CAM5.1 ECHAM5 FSU GEOS-5 GFDL GISS NCEP Obs

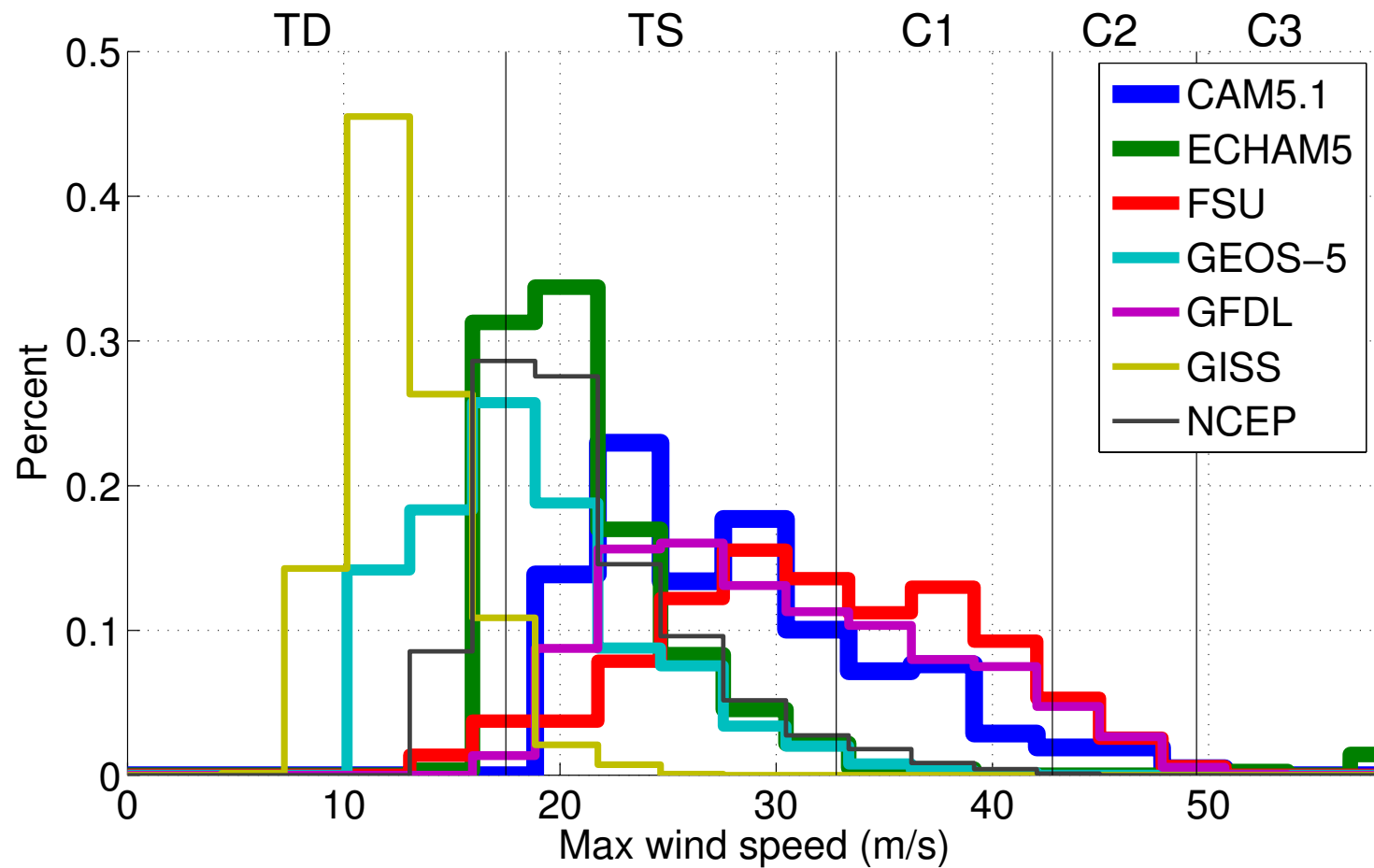
Seasonal Cycle



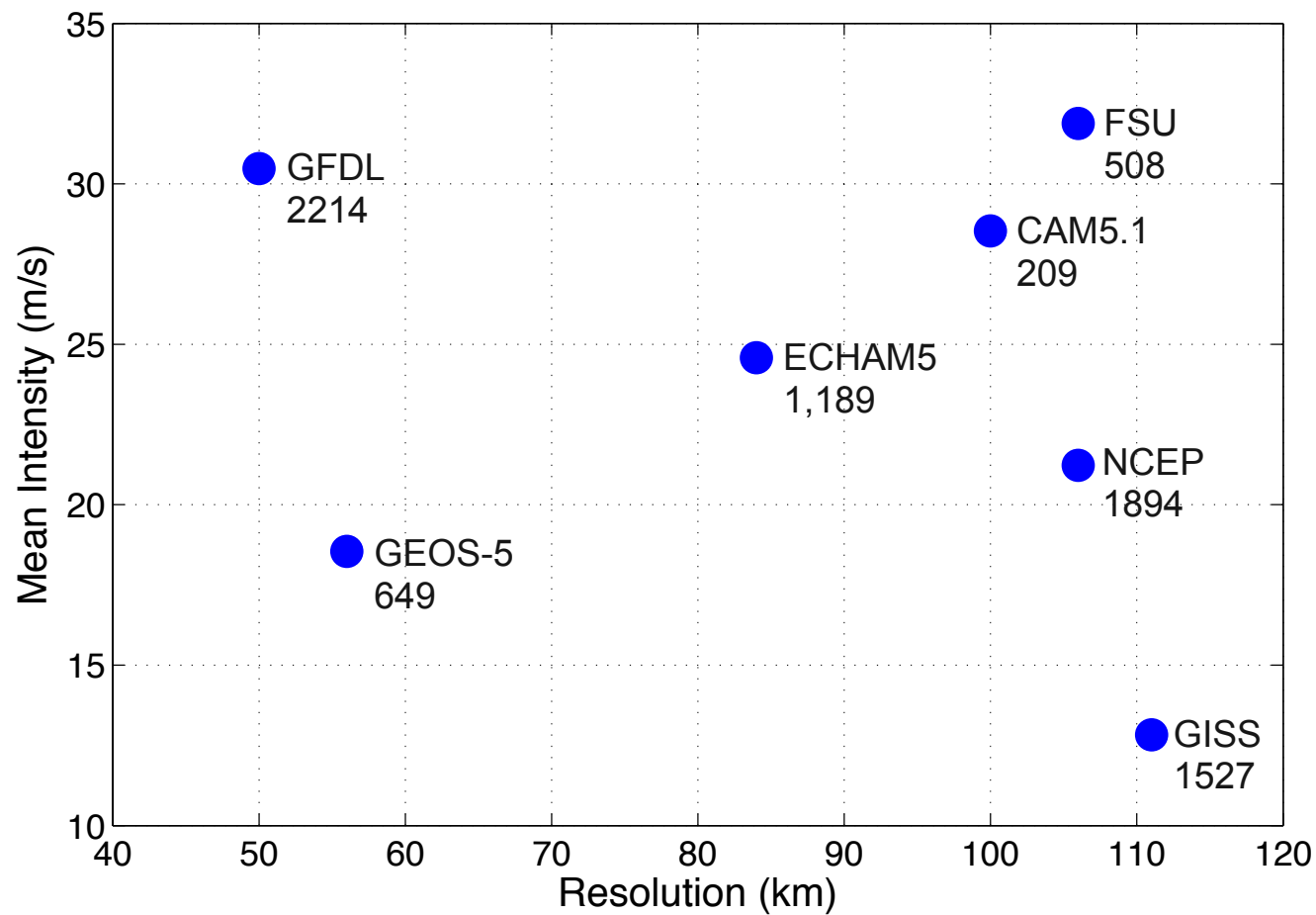
Seasonal Cycle



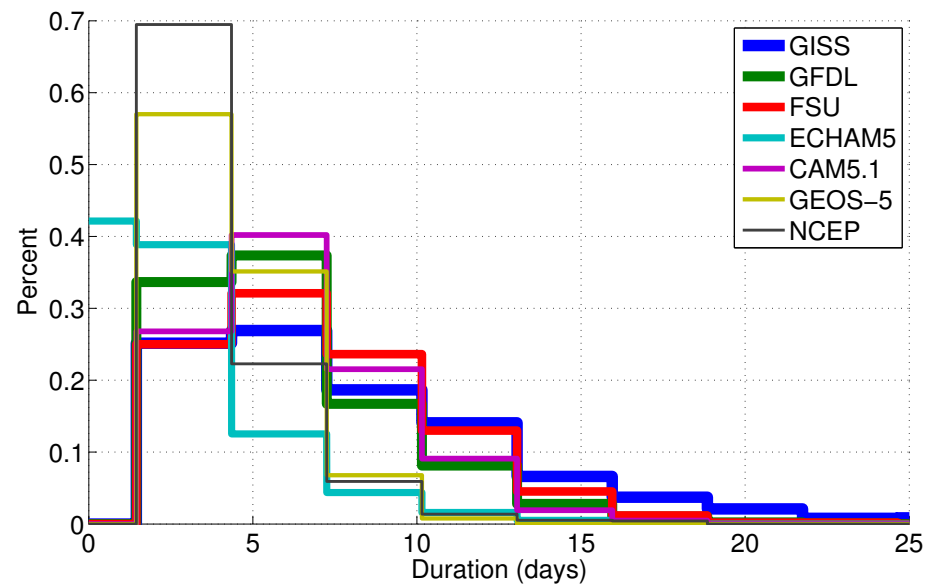
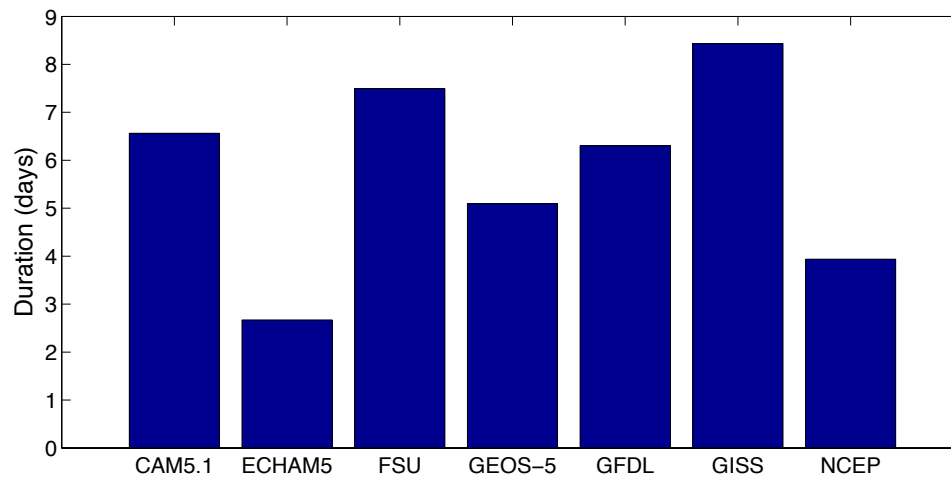
Maximum Intensity



Intensity

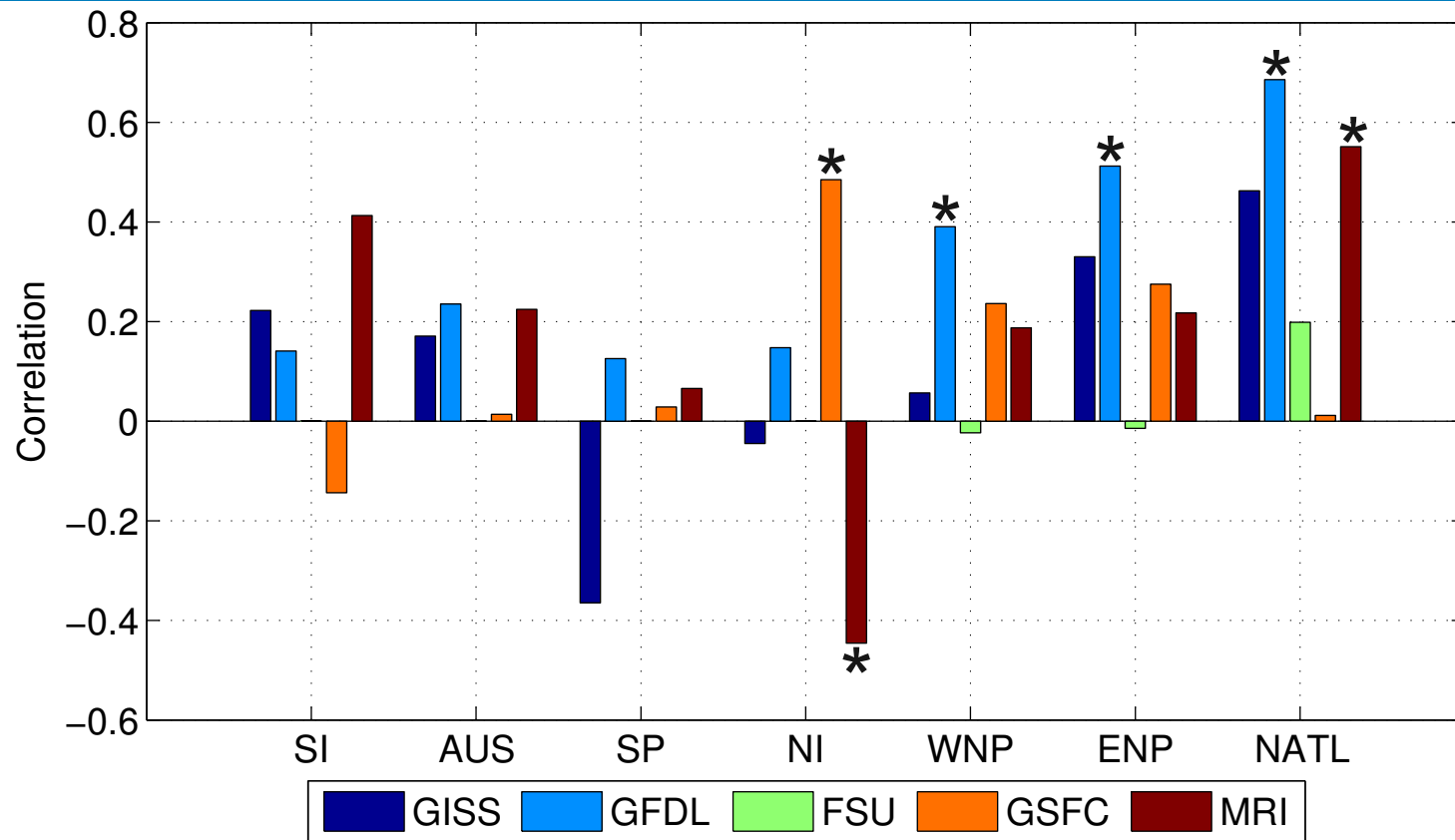


Track Duration



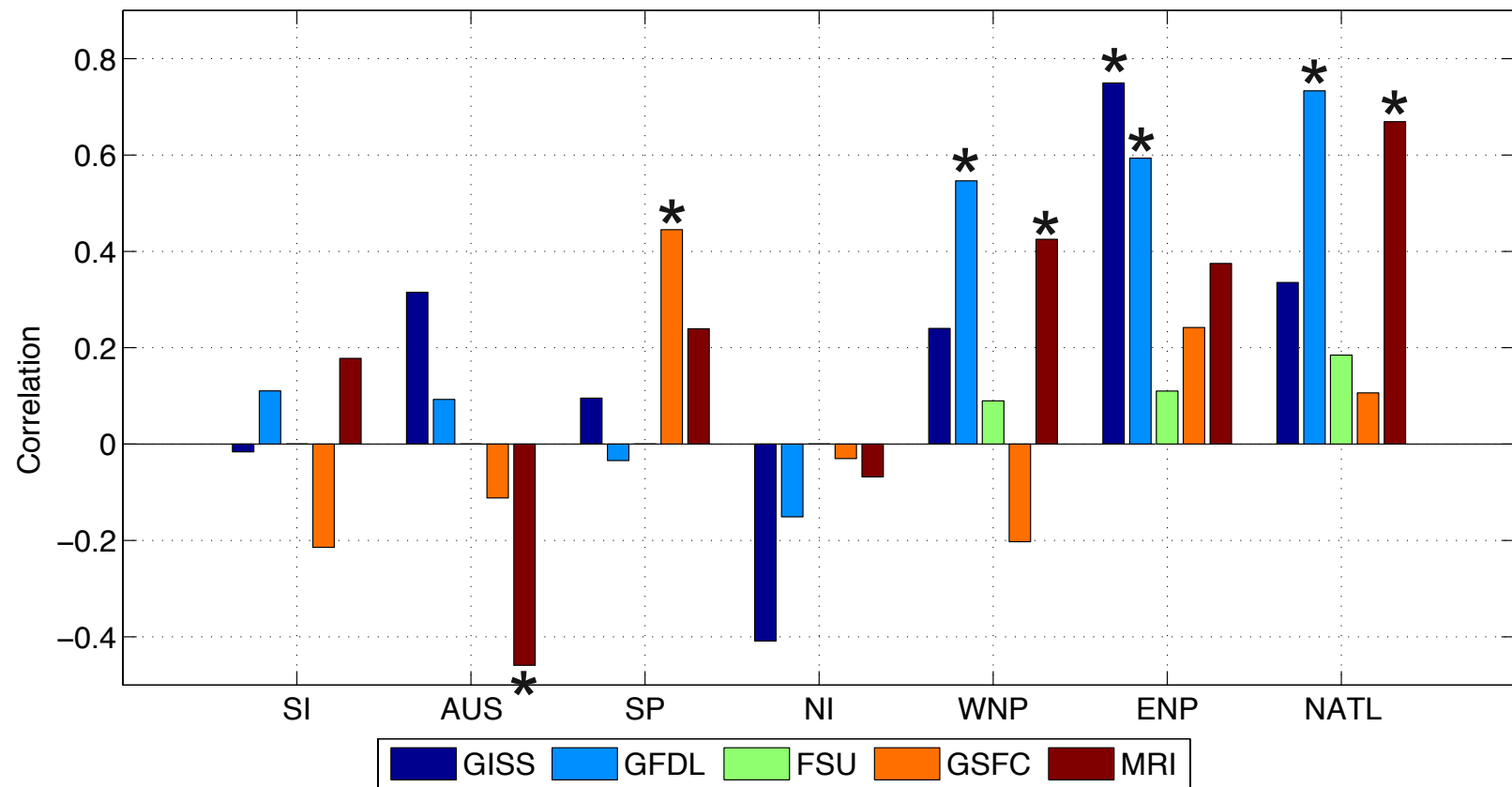
Historical SST Forcing

Yearly Correlation



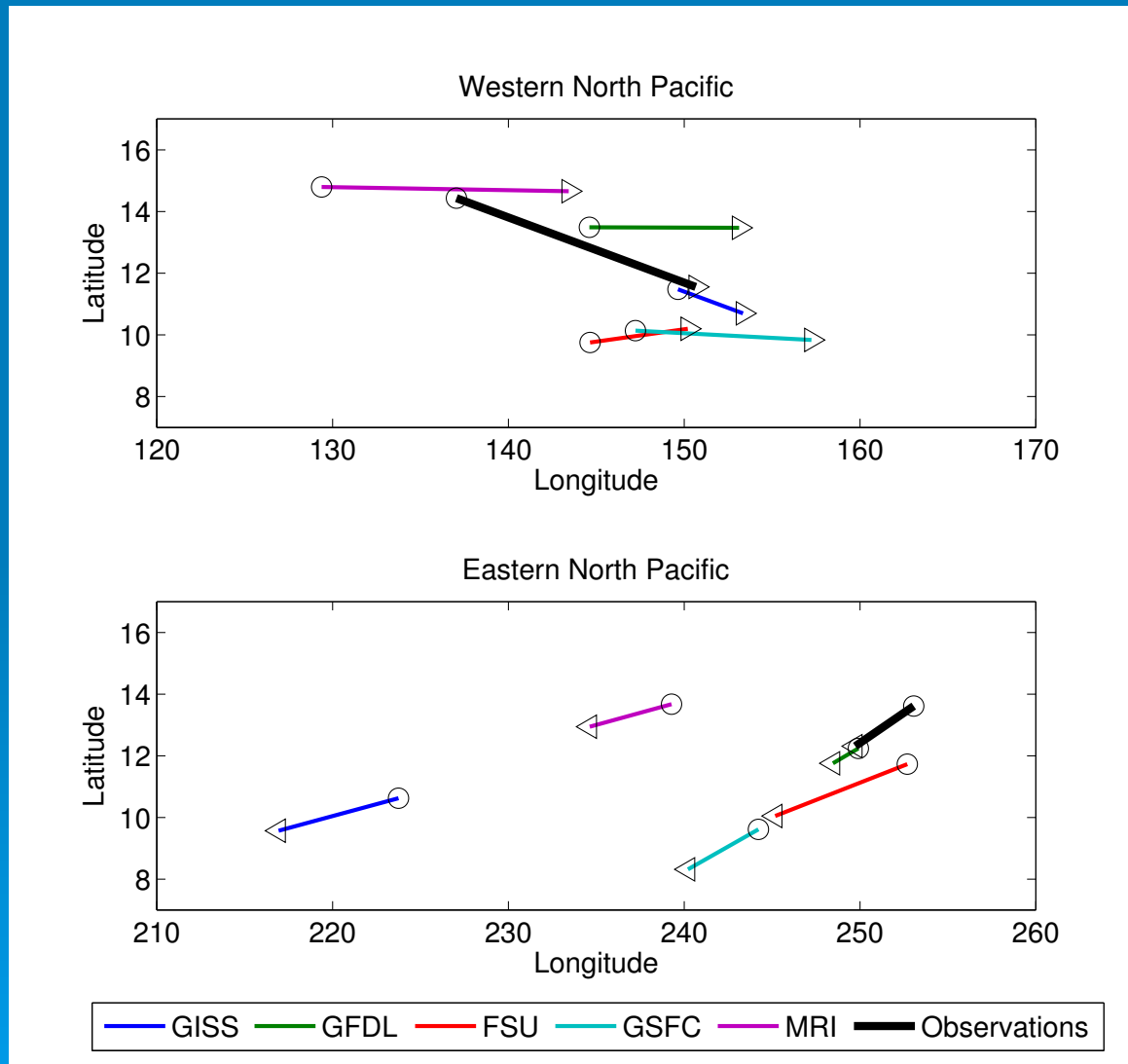
* Statistically Significant

Yearly ACE Correlation



* Statistically Significant

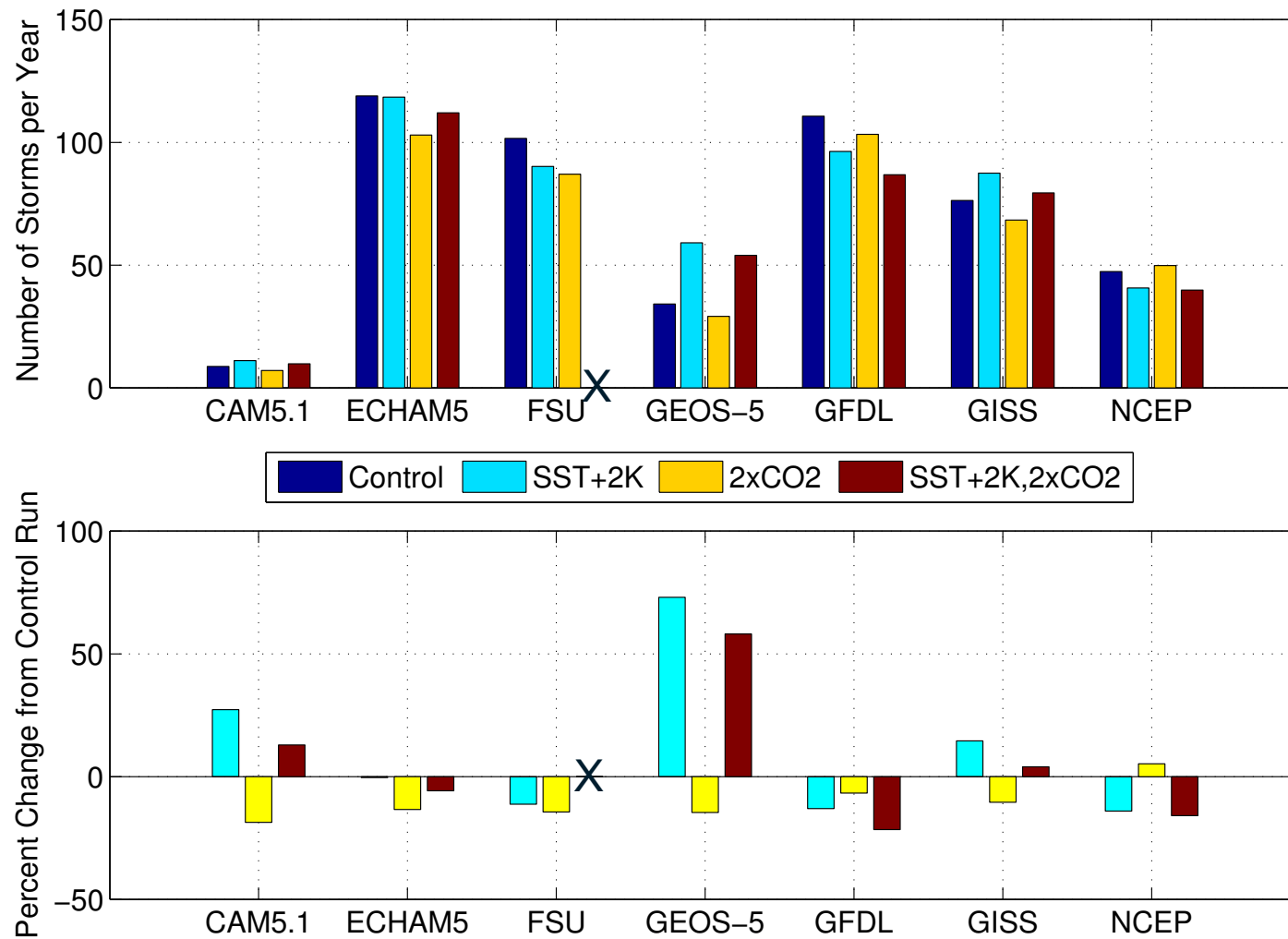
Average Formation Location



○ La Nina

▷ El Nino

Warming Runs



Summary

- Geographic distribution of TCs similar to observations
- Maximum intensity varies between models
- North Pacific TC shifts due to ENSO consistent with observations
- Need to unify tracking schemes to investigate TC frequency differences between models