US CliVar HWG
CAM5.1 simulations

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CAM

- Public release of Community Atmospheric Model
  - Version CAM5.1
  - Developed by DOE and NSF
  - Finite Volume dynamical core
  - Latitude-longitude mesh
  - Prescribed aerosols.

0.25° and 1° CAM5.1 status

- All 4 idealized configurations completed
  - Climatological SST , 330ppm CO^2
    - 1° (27 years); 0.25° (17 years)
  - Climatological SST plus 2°, 330ppm CO^2
    - 1° (24 years); 0.25° (16 years)
  - Climatological SST , 660ppm CO^2
    - 1° (24 years); 0.25° (14 years)
  - Climatological SST plus 2°, 660ppm CO^2
    - 1° (24 years); 0.25° (16 years)
- AMIP-style
  - 1° (50 member ensemble; 1959-2008)
  - 0.25° (1 run; 1979-2005)
- 400TB, 20M Cray X1E processor hours.

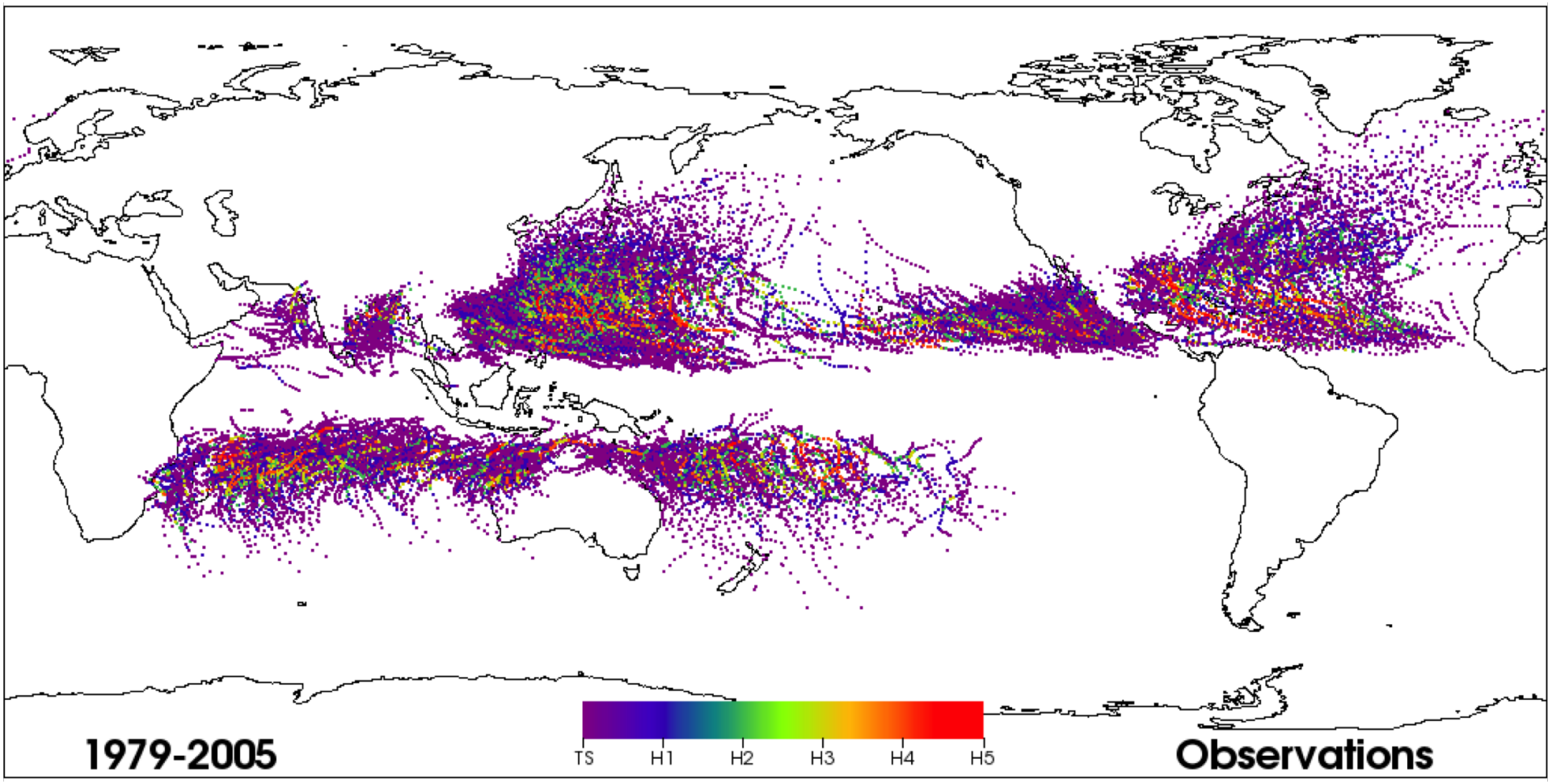
1979-2005 Global average / year

- Used the GFDL tracking algorithm and default parameters from Knutson et al. 2007.
  - Parallel and scalable to 150K processors…

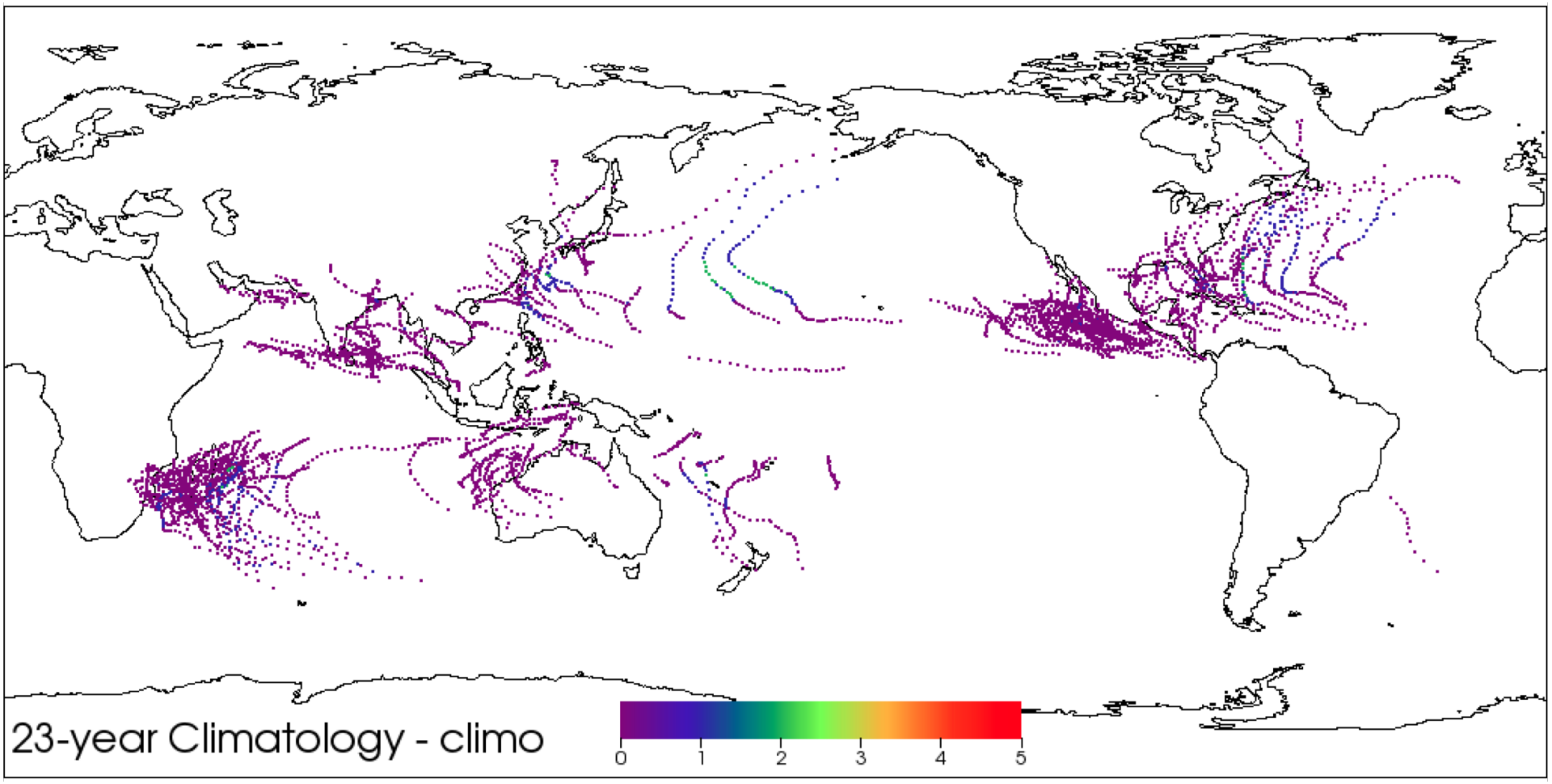
- total TC **(>35knots)**
  - observations **87±8**
  - 0.25° cam5.1 **84±9**
  - 1.0° cam5.1 **8±3**
  - 2.0° cam5.1 **0**
  - T341 cam4 eulerian **24±3**

- total hurricanes **(>64knots)**
  - Observations **49±7**
  - 0.25° cam5.1 **52**
    - cat1 **21**
    - cat2 **5**
    - cat3 **12**
    - cat4 **7**
    - cat5 **1.5**
  - 1.0° cam5.1 1.7
    - cat1 **1.5**
    - cat2 **0.2**

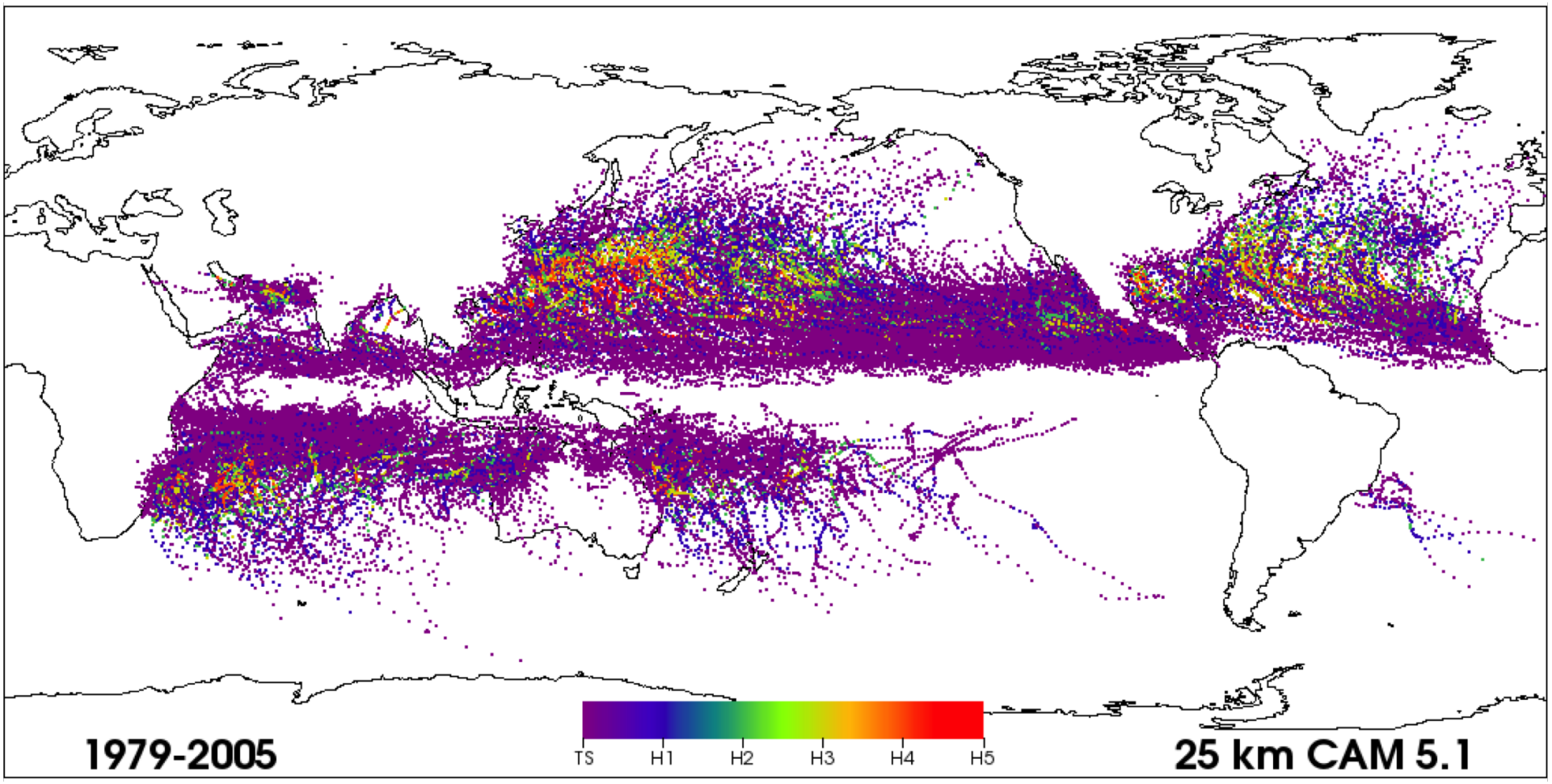
Observed (Emanuel) storm tracks



1º CAM5.1 storm tracks



0.25° CAM5.1 storm tracks



Tropical Storm

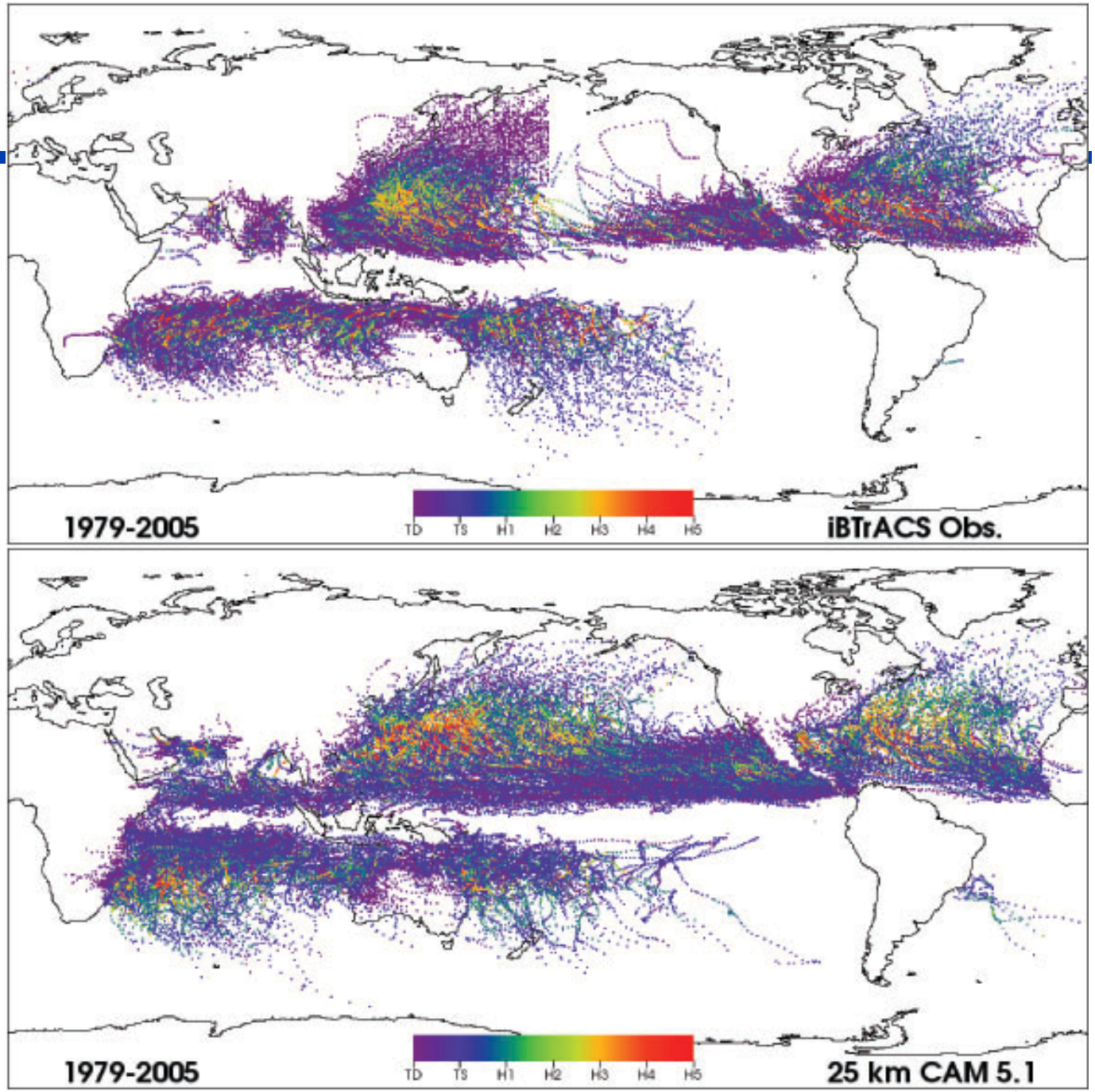
Cat1

Cat2

Cat3

Cat4

Cat5



Figures by Prabhat

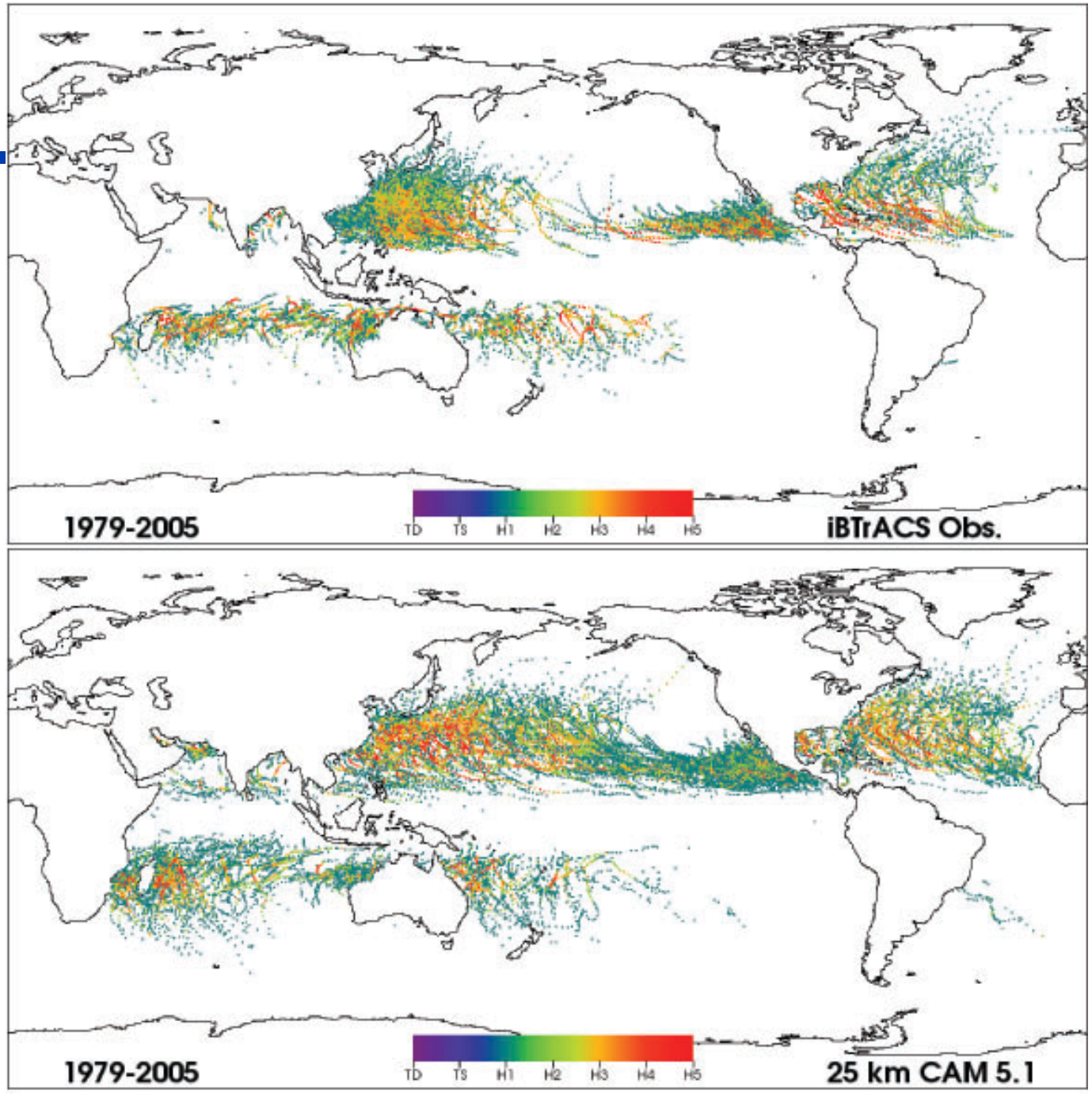
Cat1

Cat2

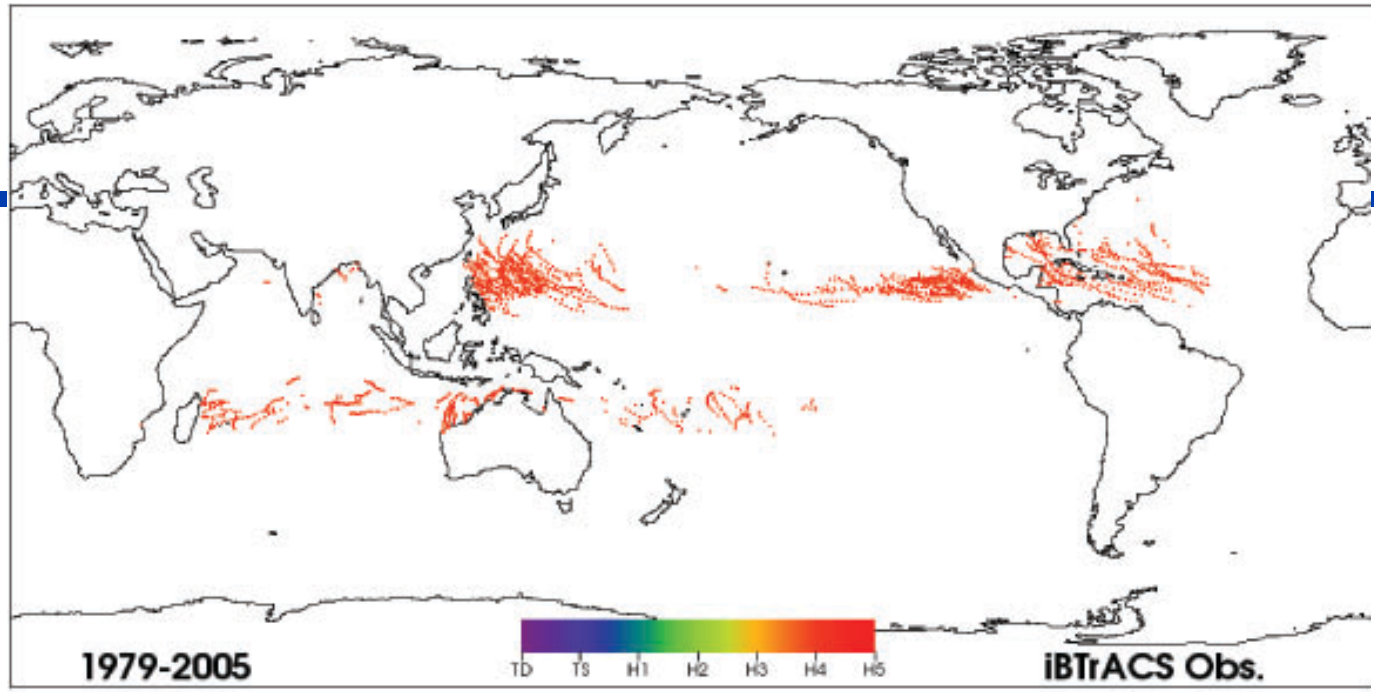
Cat3

Cat4

Cat5

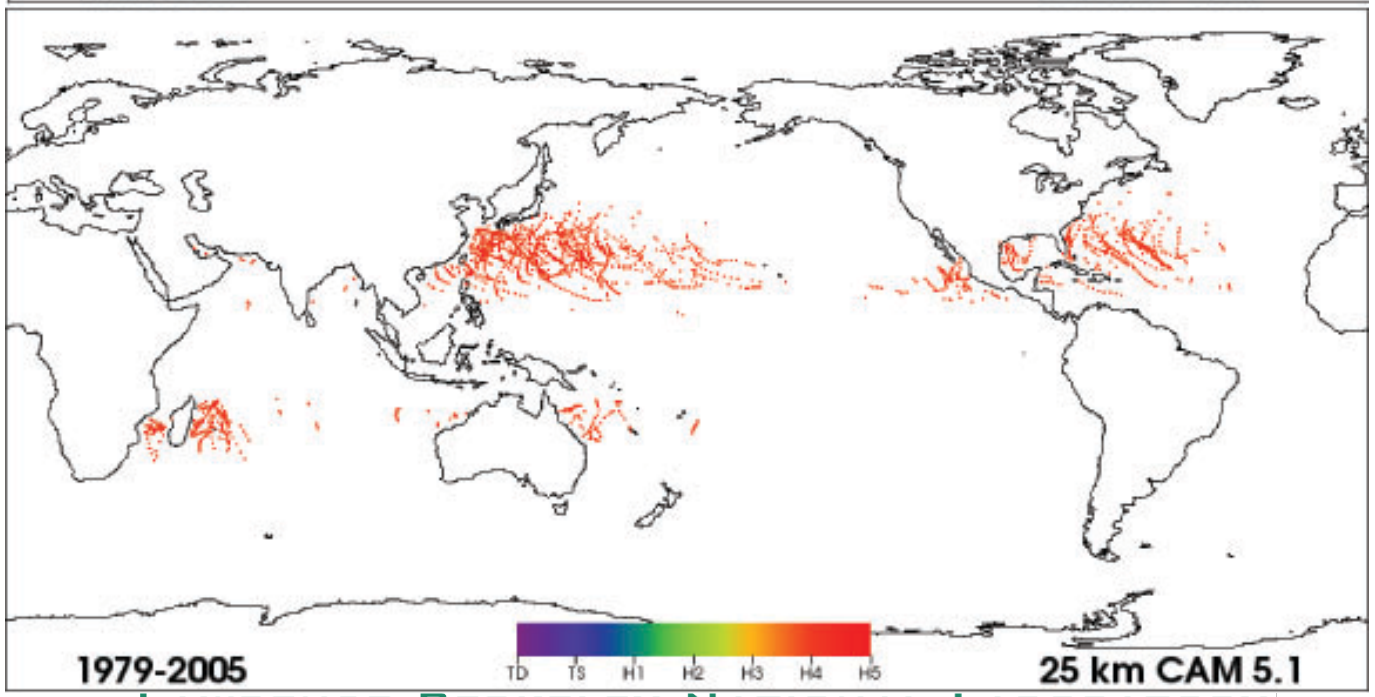


Figures by Prabhat



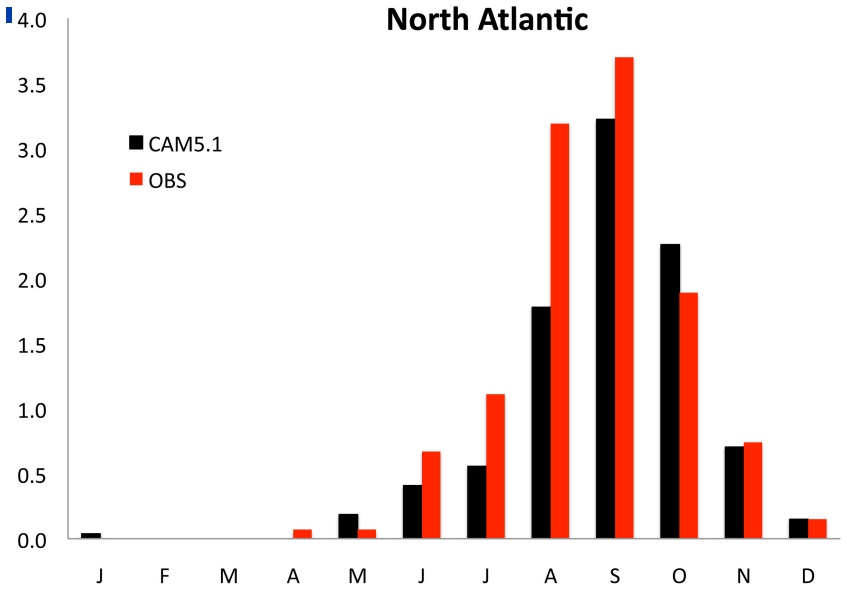
Cat4

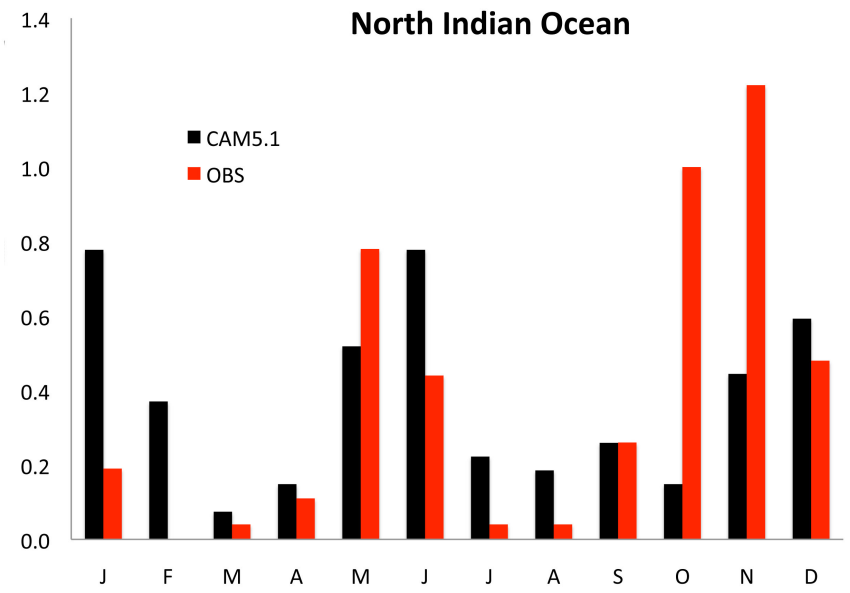
Cat5

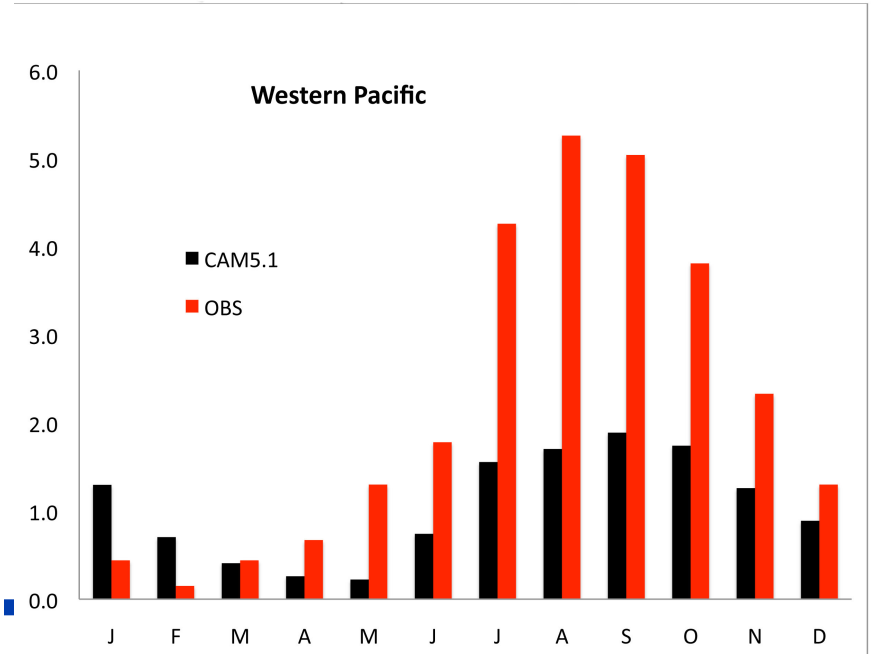


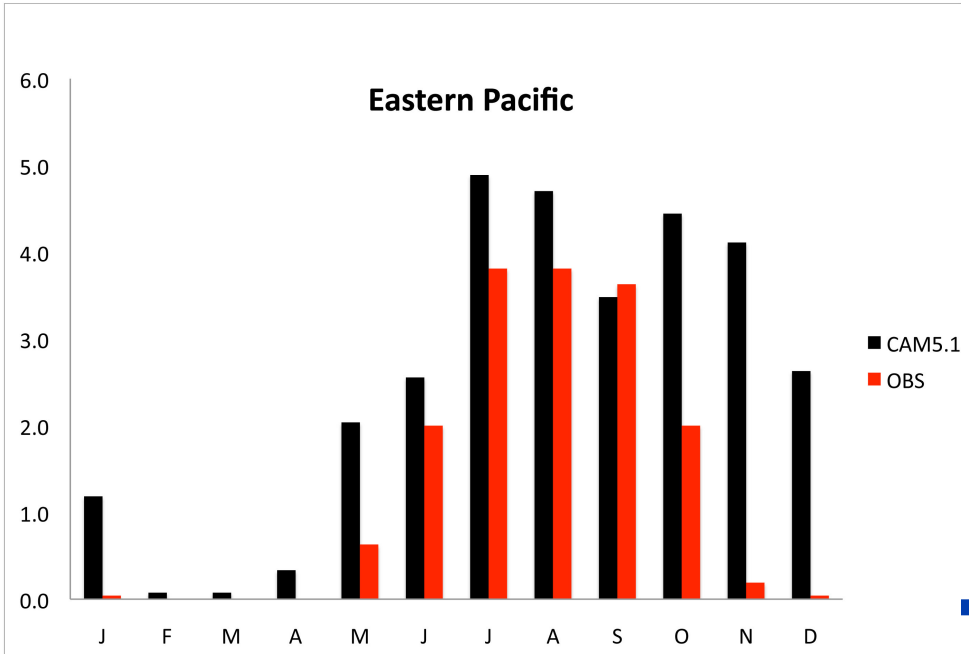
Figures by Prabhat

TC Seasonal cycle









1º CAM5.1 US CliVar HWG results

	climo	2xCO2	SSTplus2	SSTplus2_ 2xCO2
TC/year	8.5	7.1	11.0	9.8
σ	3.3	2.1	4.3	3.3

- Is Climo different than 2XC02?
  - Yes at the 96% level
- Is Climo different than SSTplus2?
  - Yes at the 98% level
- Is SSTplus2 different than SSTplus2_2XC02?
  - Yes at the 85% level
- Is Climo different than SSTplus2_2XC02?
  - Yes at the 91% level

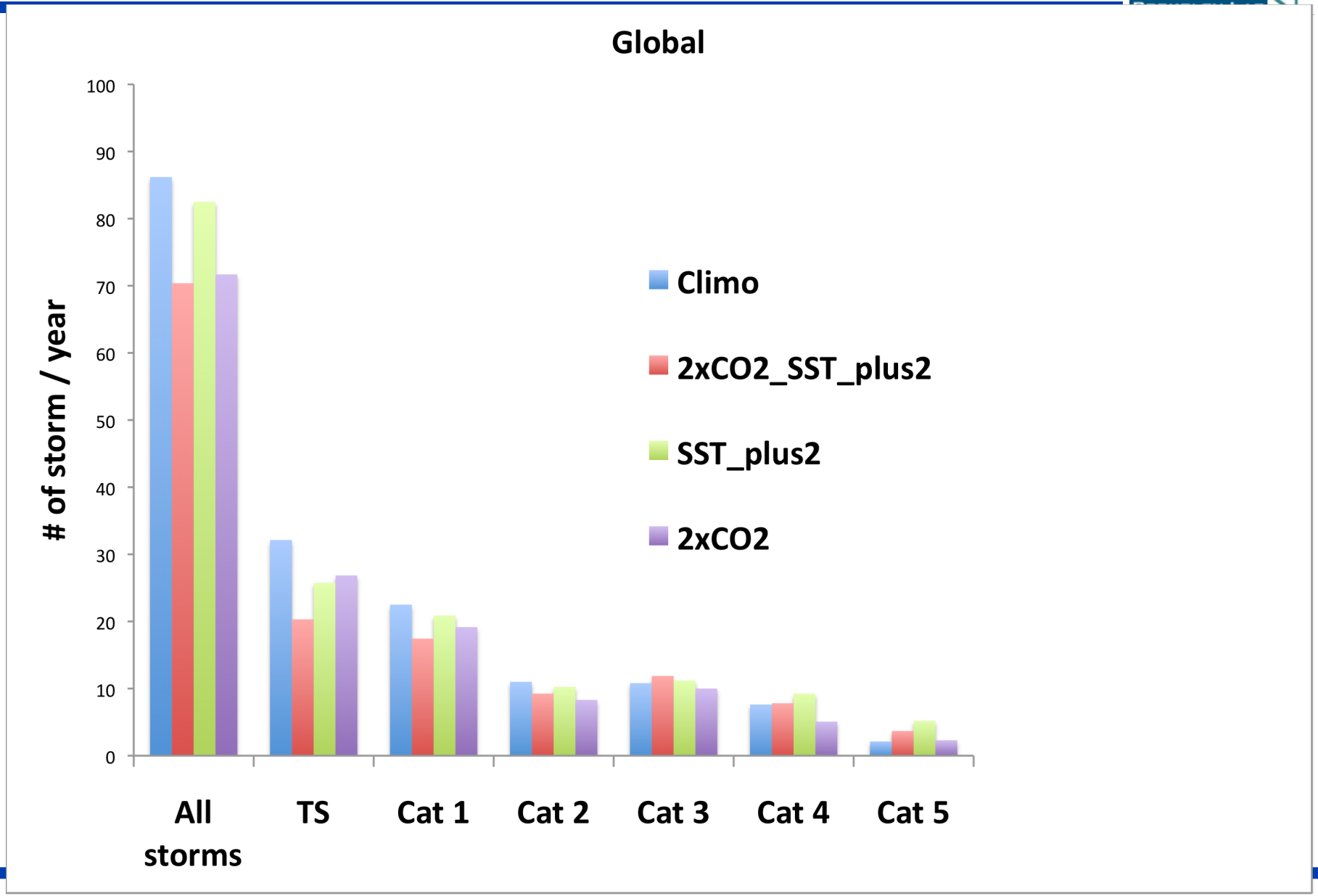
Expectations from 1º CAM5.1

- A challenge to the conventional wisdom

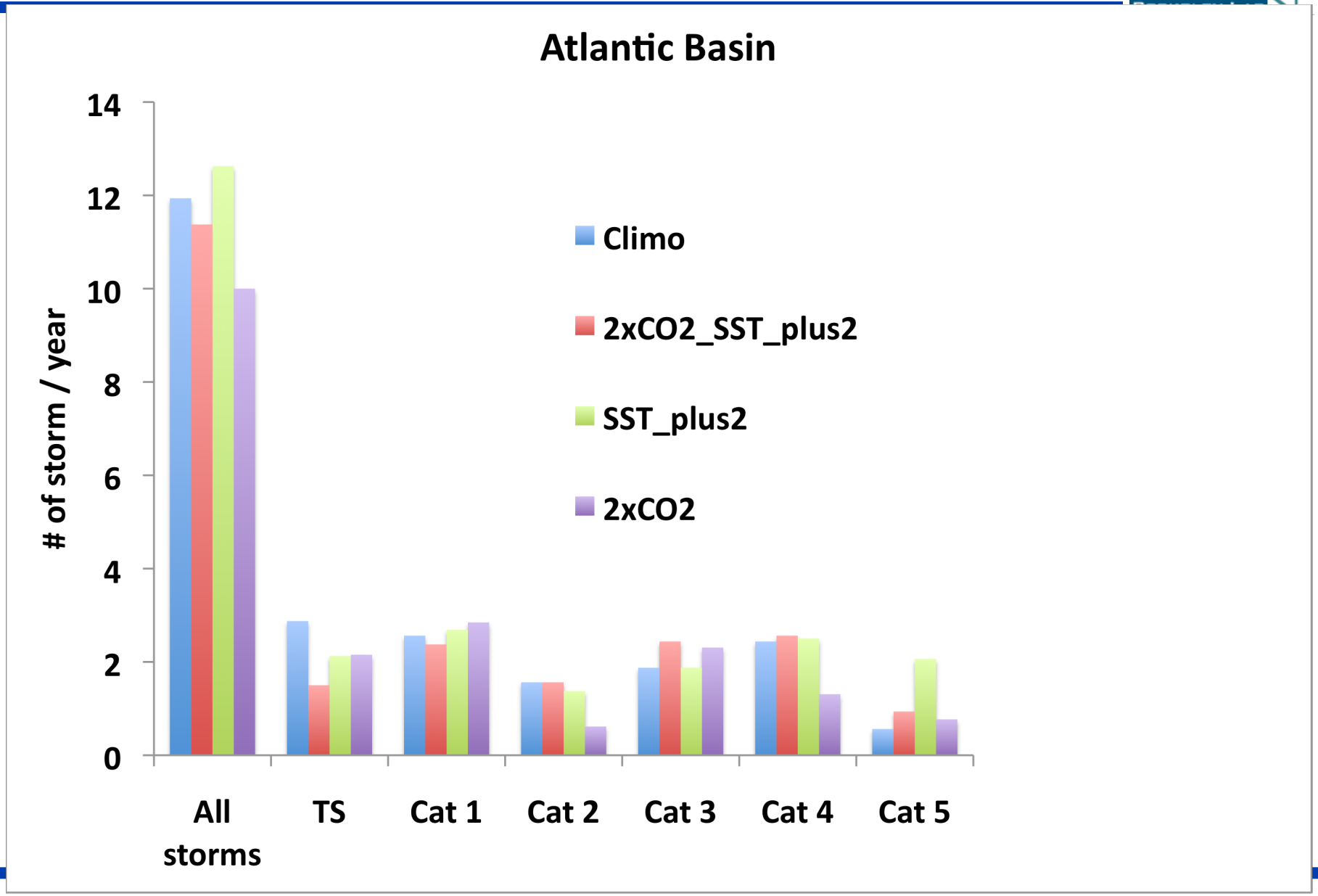
- Total #TC/year:
- Decrease from 2xCO2 does not offset the increase from 2C SST increase.

- Implicit in this expectation is that an SST increase causes more storms.

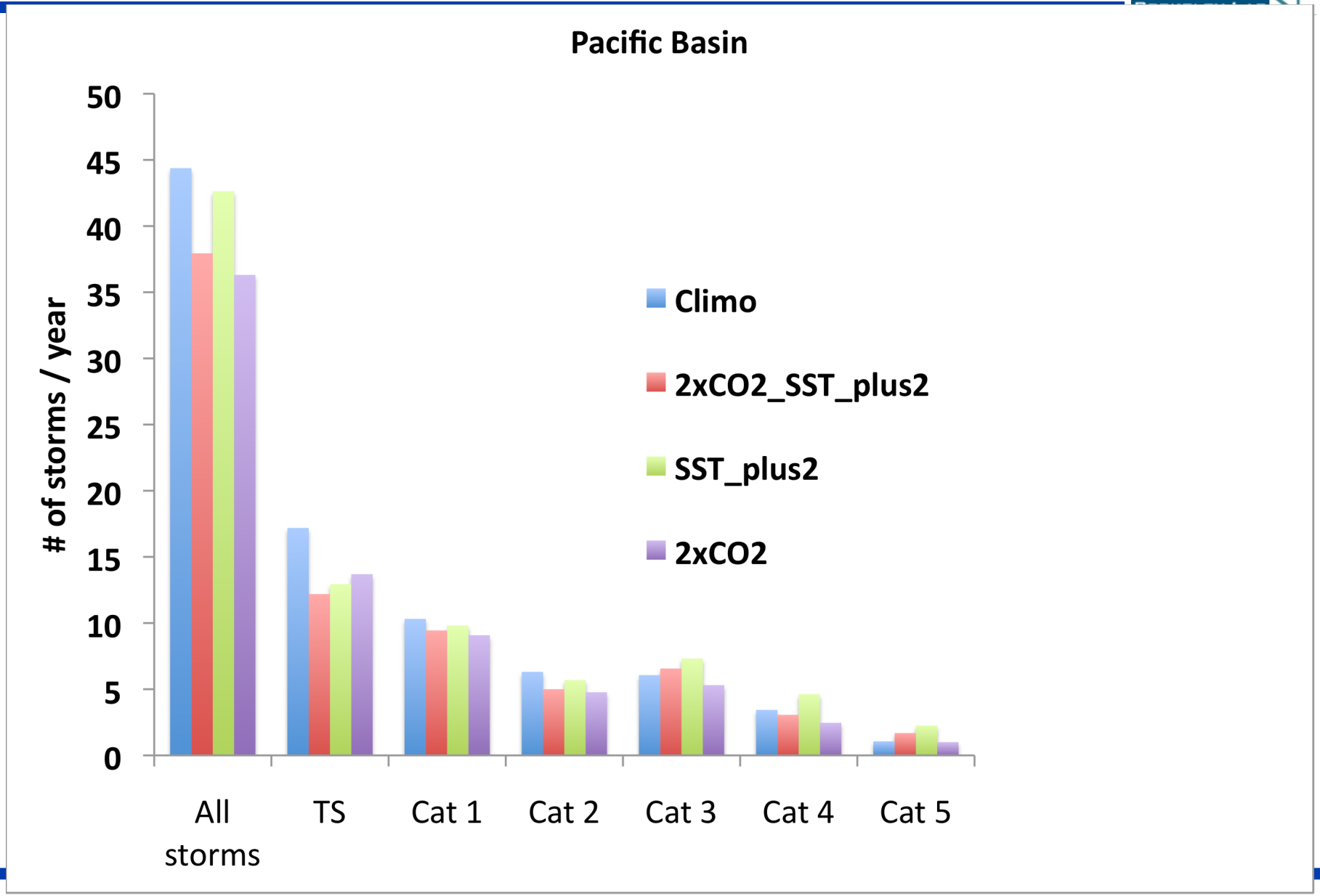
0.25° CAM5.1 US CliVar TCWG results



0.25° CAM5.1 US CliVar TCWG results

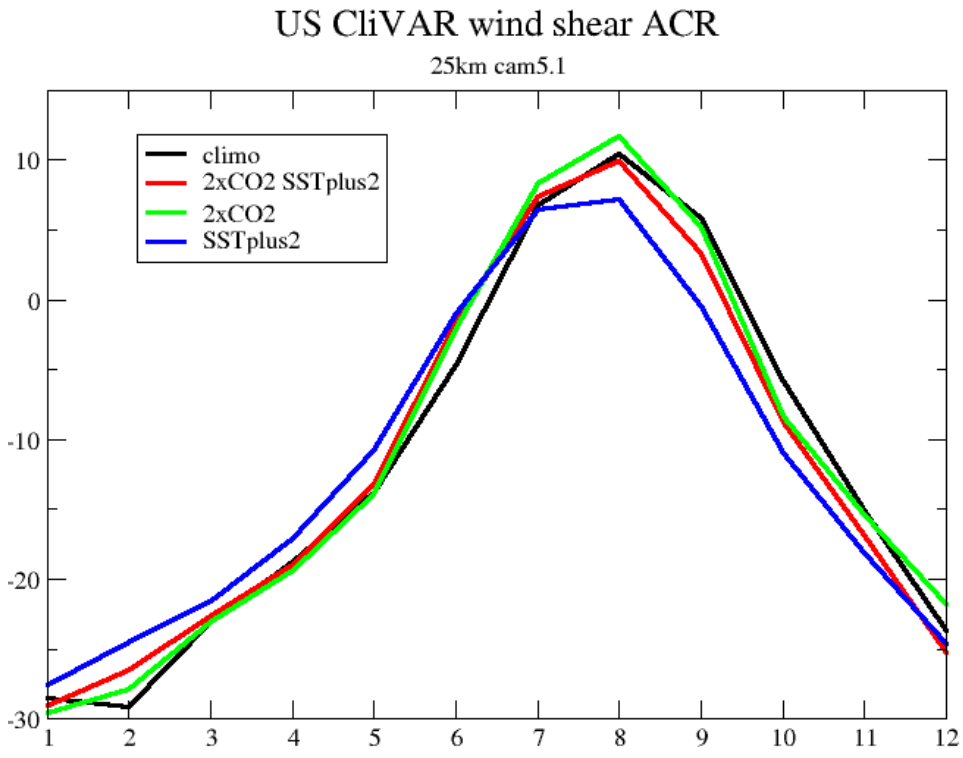


0.25° CAM5.1 US CliVar TCWG results

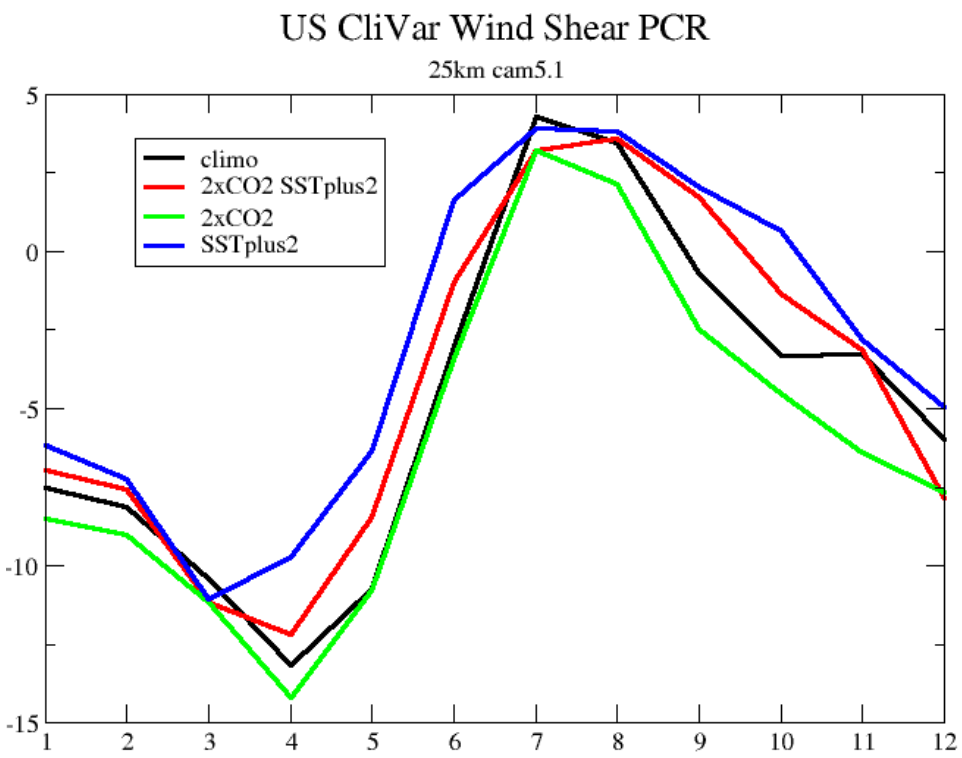


Cyclogenesis region wind shear

6-18N 300-340W



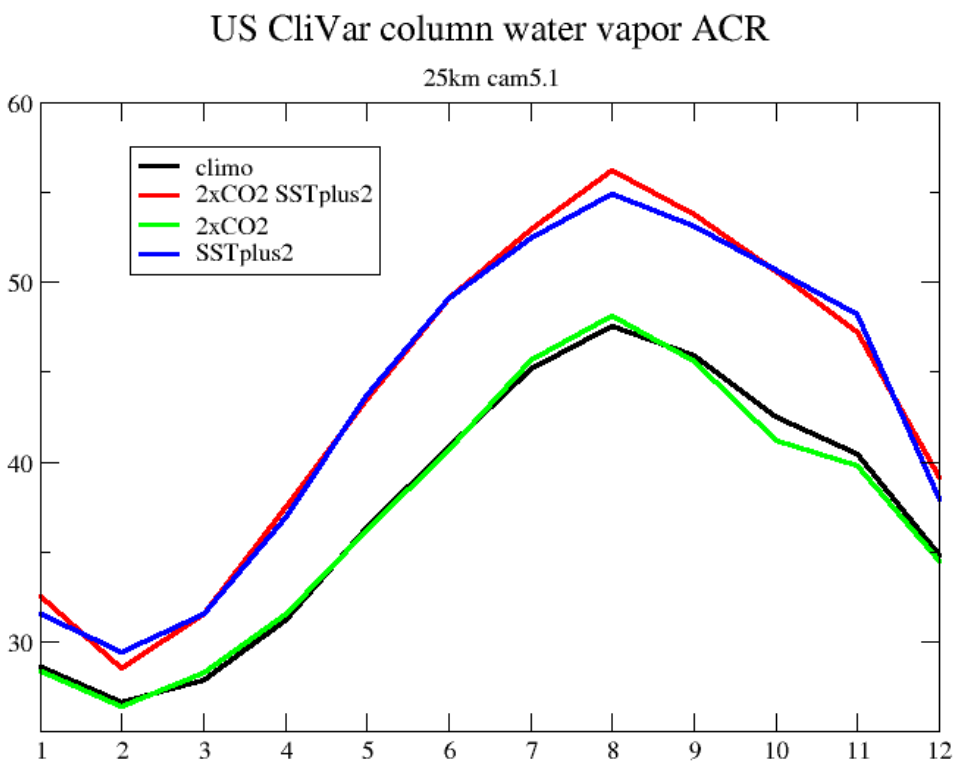
5–15N 180–130E



- Not a lot of change
- And the change does not explain the change in TC frequency

Cyclogenesis region water vapor

6-18N 300-340W



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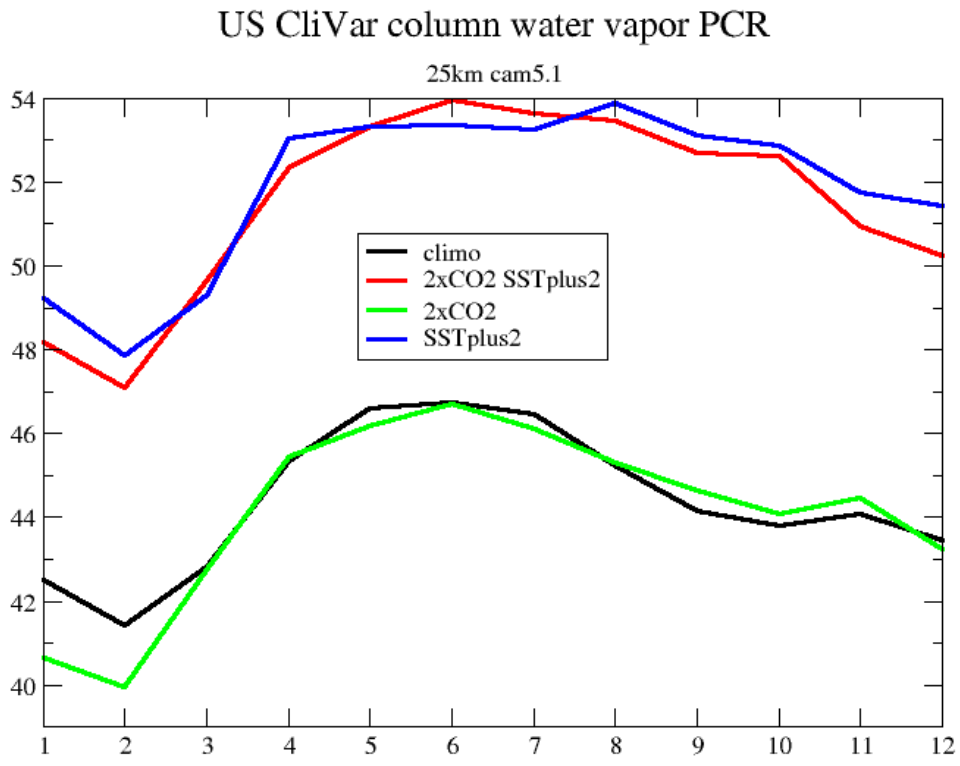
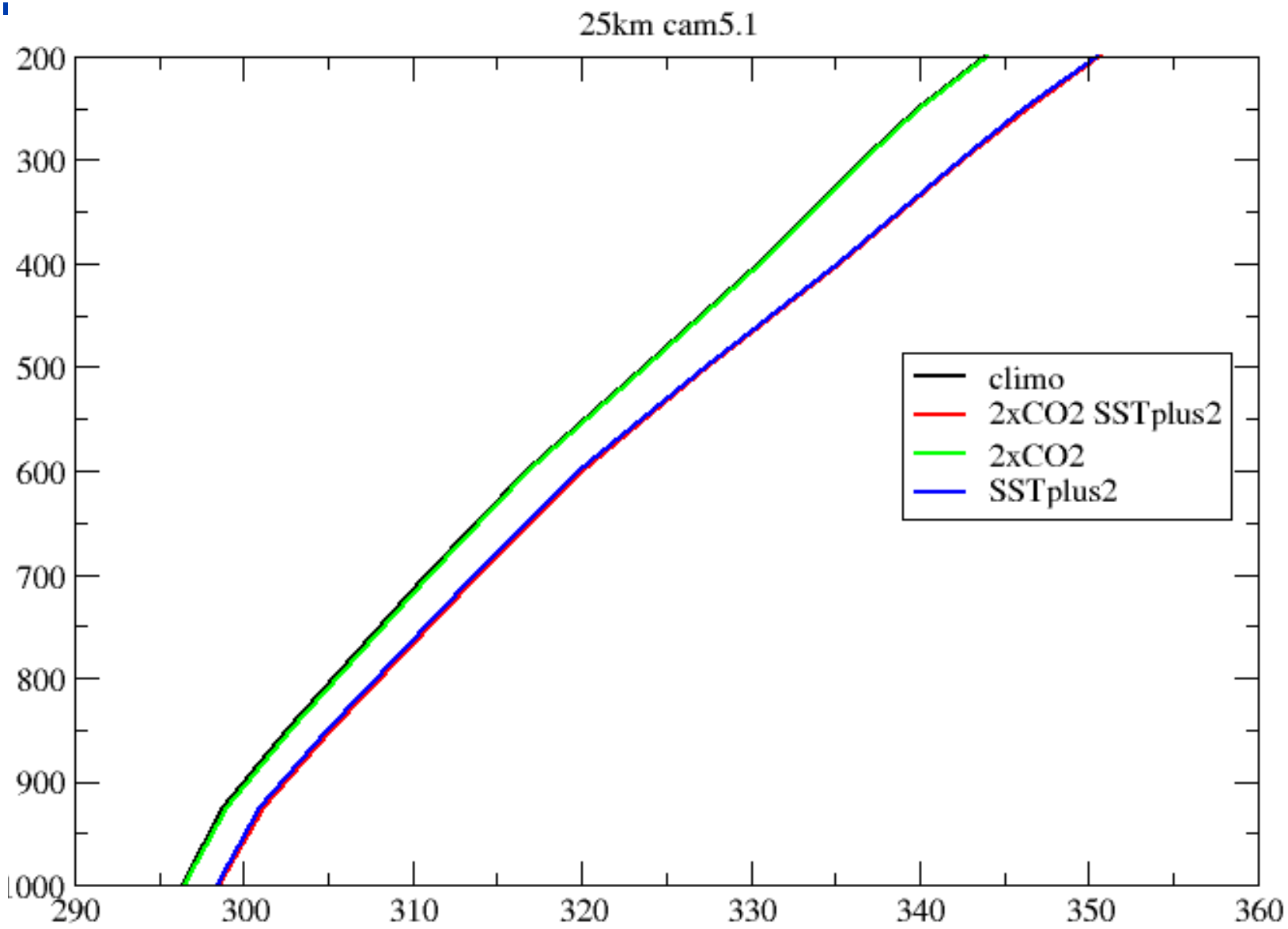


30s-30N

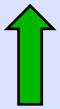
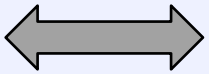
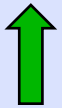
US CliVar tropical potential temperature



0.25° summary of # TC/year

- 2xCO2 vs climo
  - Global and Pacific reduction in all categories
  - Atlantic reduction in total number.
- 2xCO2_SSTplus2 vs . SSTplus2
  - Global, Pacific, Atlantic reduction in total number
  - Global and Pacific reduction in low and high categories
- SSTplus2 vs climo
  - Global and Pacific reduction in total number (!)
  - Global, Pacific, Atlantic reduction in low categories;increase in cat 5
- 2xCO2_SSTplus2 vs 2xCO2
  - Little change in global number
  - Global reduction in low categories; increase in cat 5
- 2xCO2_SSTplus2 vs climo
  - Global, Pacific, Atlantic reduction in total number
  - Global, Pacific, Atlantic increase in cat 5

0.25° vs 1° CAM5.1

	SSTplus2_2xCO2 vs climo	2xCO2 vs climo	2xCO2_SSTplus2 vs SSTplus2	SSTplus2 vs climo	2xCO2_SSTplus2 vs 2xCO2
1°					
0.25° all					
0.25° Cat 5					

- Low resolution response in total # of TC
  - –does not predict high resolution response in total.
  - –does predict high resolution cat 5 response.
- Likely a consequence of the tracking algorithm.

CAM5.1 US CliVar HWG summary

- (fv)CAM5.1 supports the common wisdom.
  - –Fewer number of tropical cyclones
  - –More intense tropical cyclones

- Still searching for definitive causes.

- Paper for JClim special issue planned…
- All data is available now and is unrestricted.
  - –ESFG (http://esg01.nersc.gov/esgf-web-fe/)
  - –Or contact me

Thank You

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