

Tropical Cyclone Activity and its Effect on Global Averages of Total Precipitable Water

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“The world’s great Atlantic hurricanes are apocalyptic machines that move across water, feed off water, push water from ocean to shore and out of giant lakes, and make water a weapon of death.”³

-Eliot Kleinberg

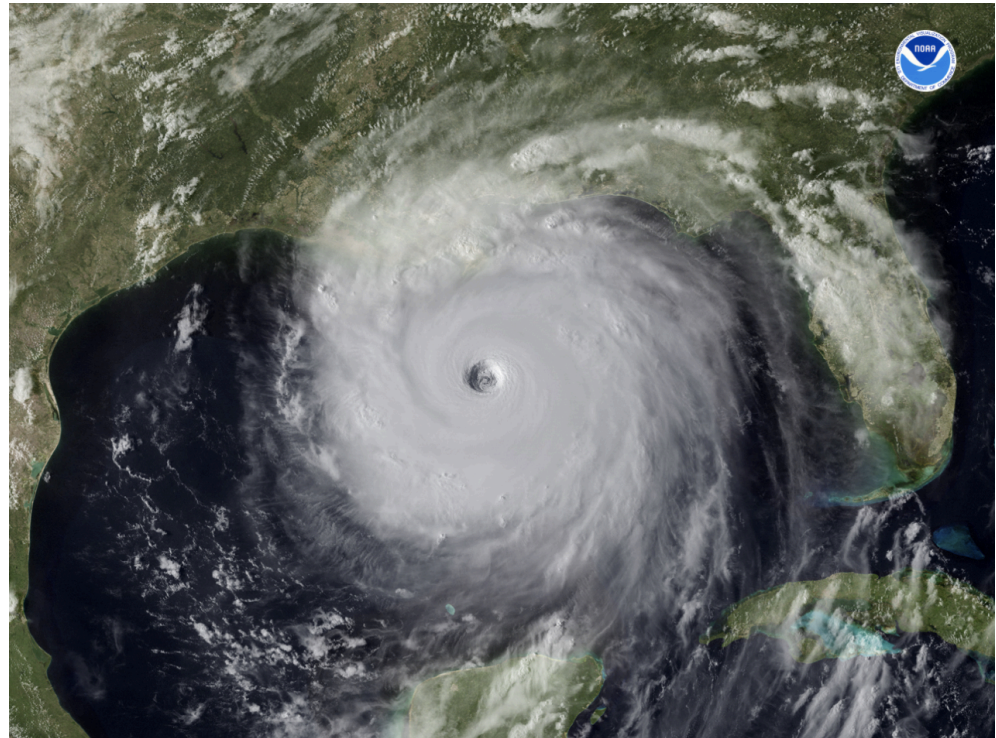


Image of Hurricane Katrina 2005

Special Sensor Microwave/Imager (SSM/I)

5



Products:

1. Total water vapor in column
2. Total cloud liquid water in column
3. Near-surface scalar wind speed
4. Precipitation

The “New” NVAP Dataset

My Main
Focus



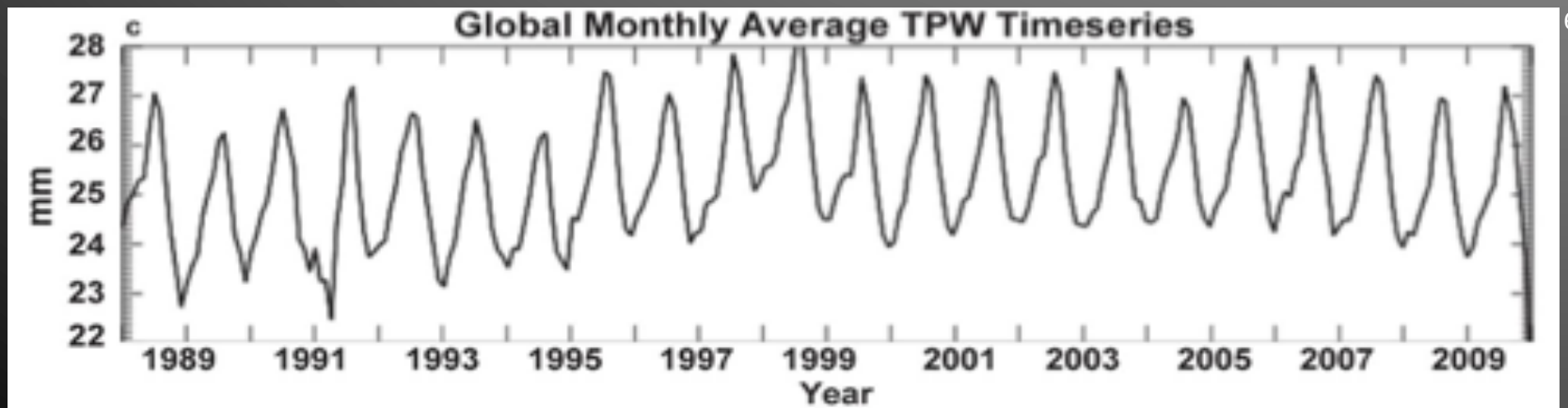
NVAP-M
Ocean
(1988–2009)

NVAP-M
Climate
(1988–2009)

NVAP-M
Weather
(1988–2009)

All known biases from old NVAP dataset were removed, making for a much more reliable dataset.

Current analysis of NVAP-M



Seasonal and interannual variability of TPW from NVAPM-Climate

Currently, global average of TPW over land and ocean is 25.37 mm

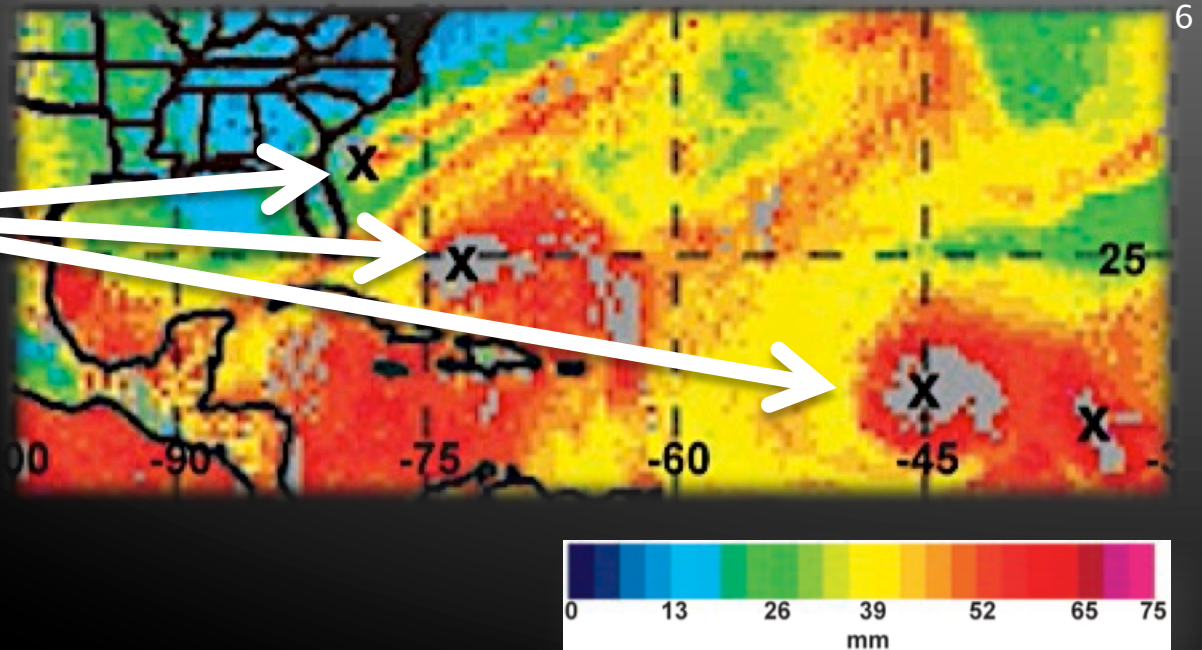
Global average of TPW over ocean only is 30.69 mm

Wait a second...

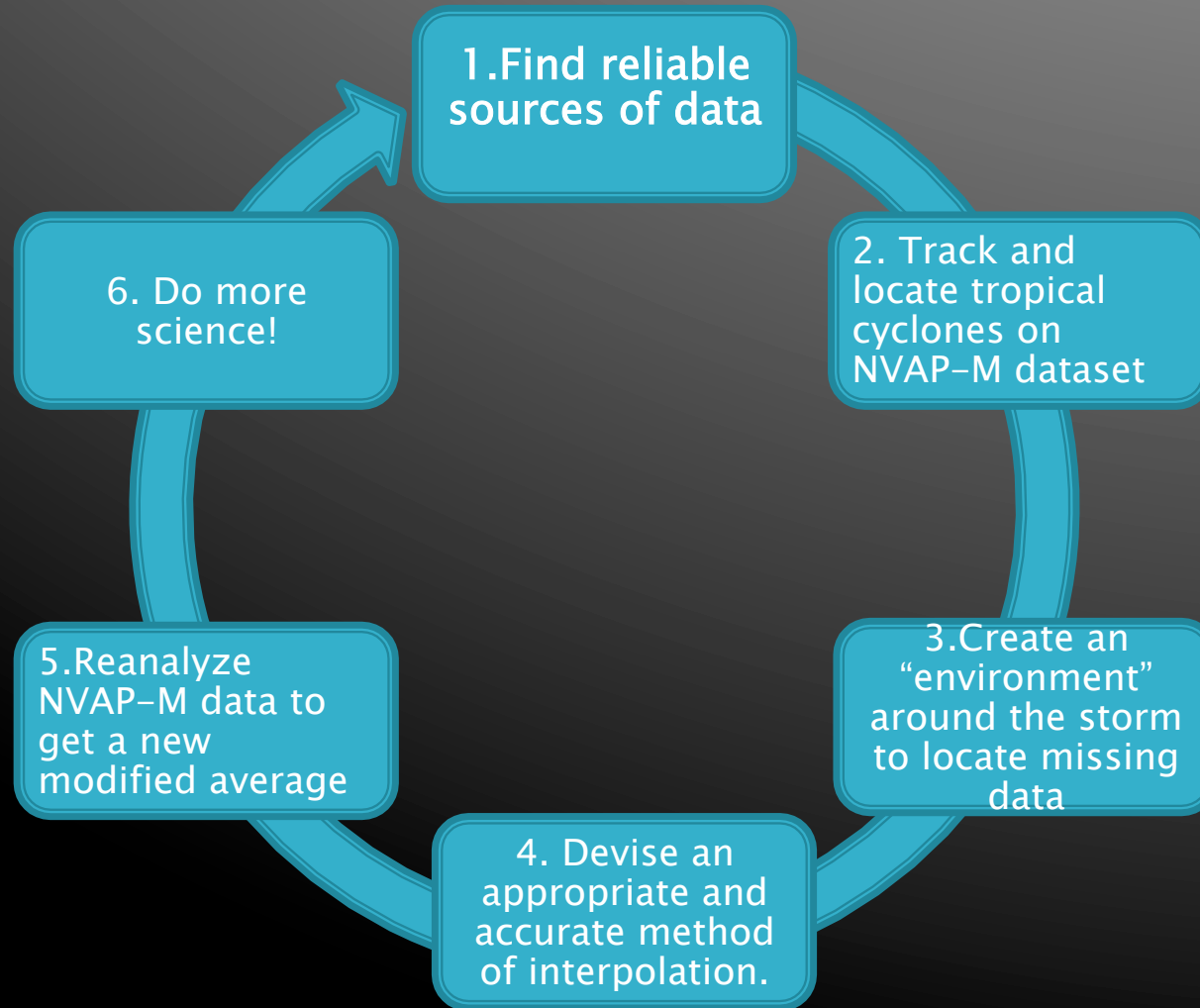
How would sampling TC's affect the global TPW average?

Tropical Cyclones in Atlantic with missing values

A lot of high TPW values are missing and not considered in the global average.



My Methodology





My Methodology

Tracking and locating tropical cyclones



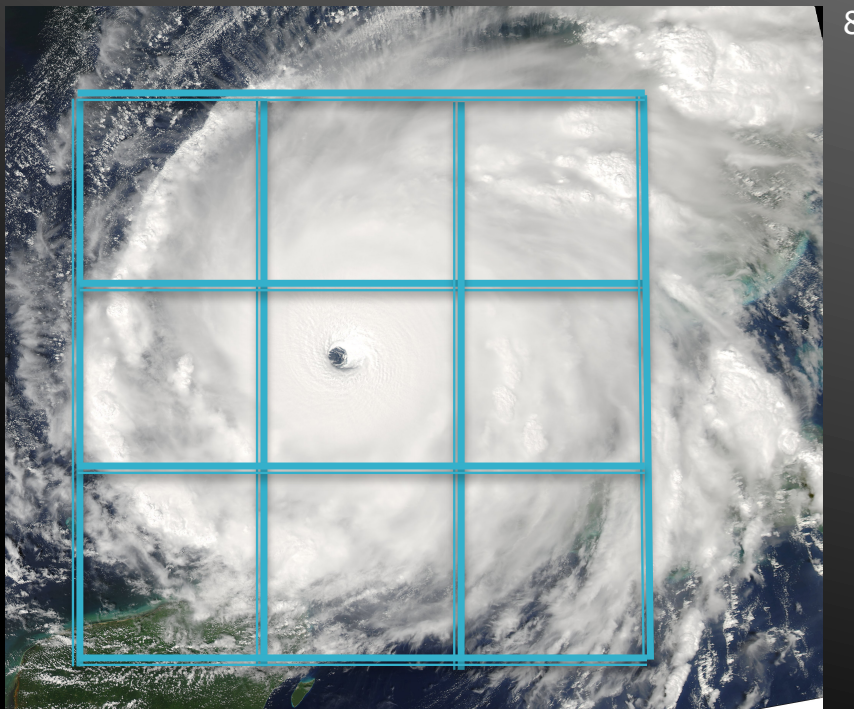
This is done via the Extended Best Track Dataset⁸

- An extension of the HURDAT dataset provided by the National Hurricane Center (NHC)
- Adds additional parameters to help better describe storm structure
- Created here locally by Mark DeMaria at CIRA

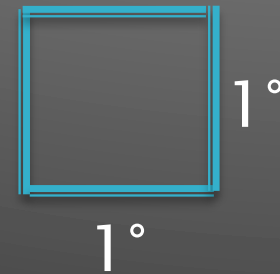


My Methodology

Creating the environment



Not to scale



Environments Considered

1. 3x3 grid \approx 60000 km²
2. 5x5 grid \approx 166000 km²
3. 7x7 grid \approx 326000 km²



My Methodology



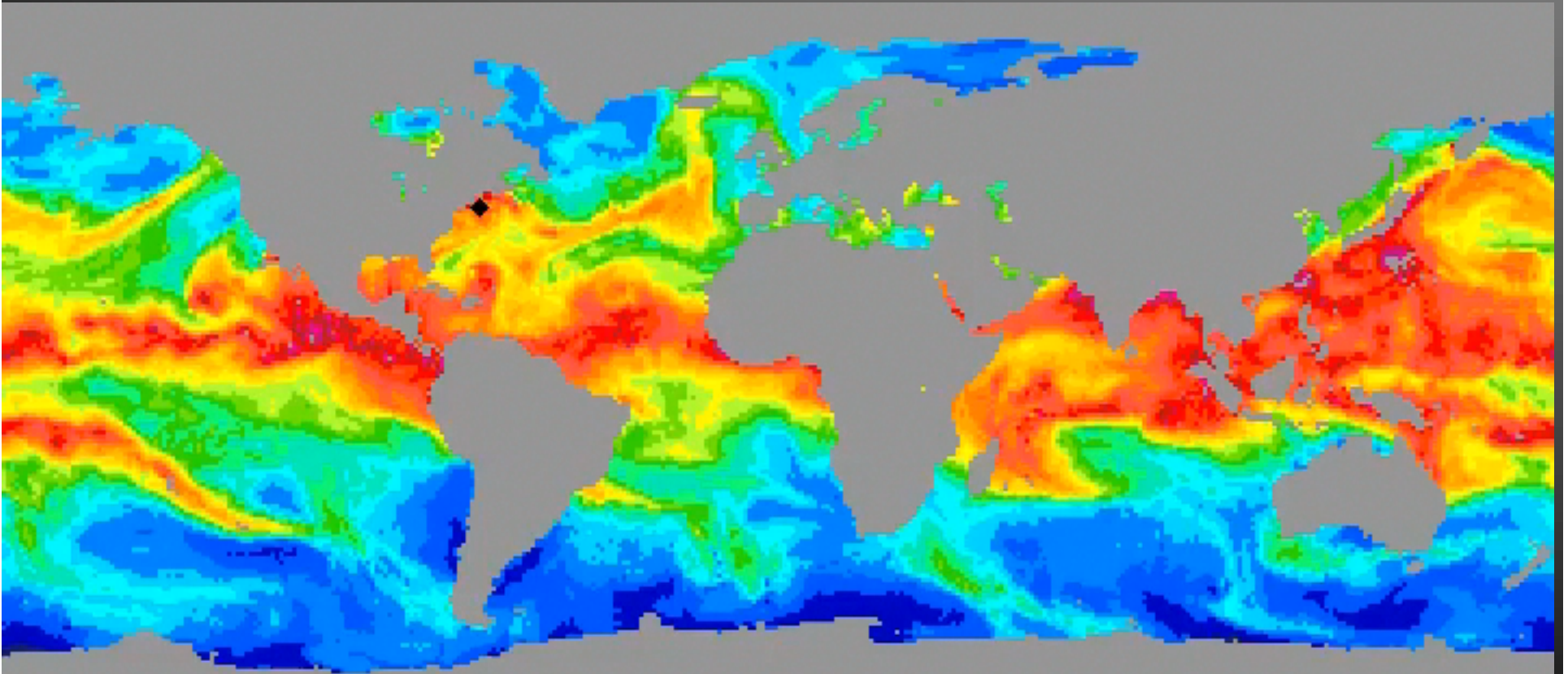
Methods of Interpolation

Method 1: Missing data within environment would be replaced by **TPW value** = 70 mm

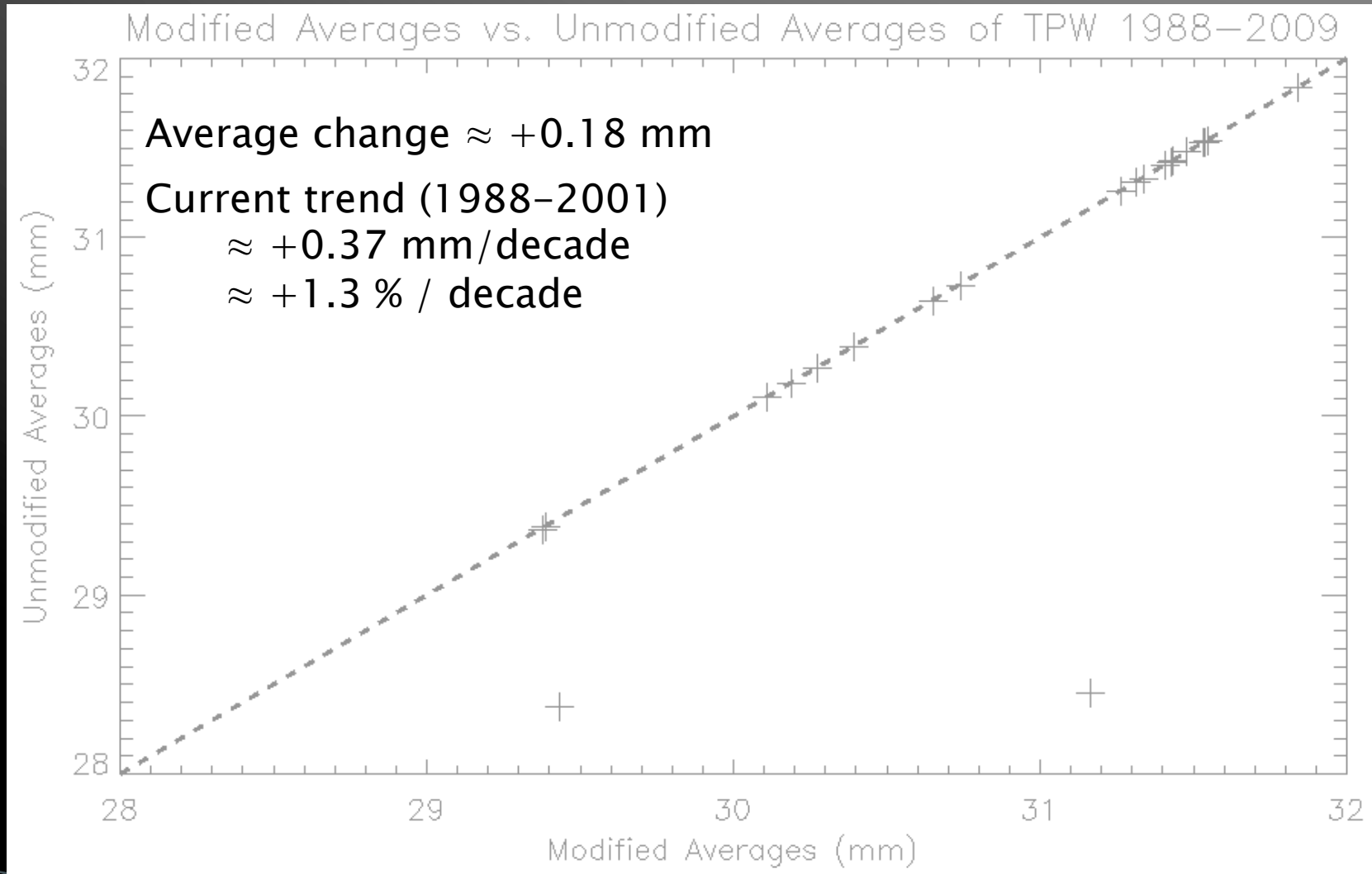
Method 2: Locate maximum value in environment, then 120% of max value = **TPW value**

Method 3: Average TPW value in environment then, environmental average = **TPW value**

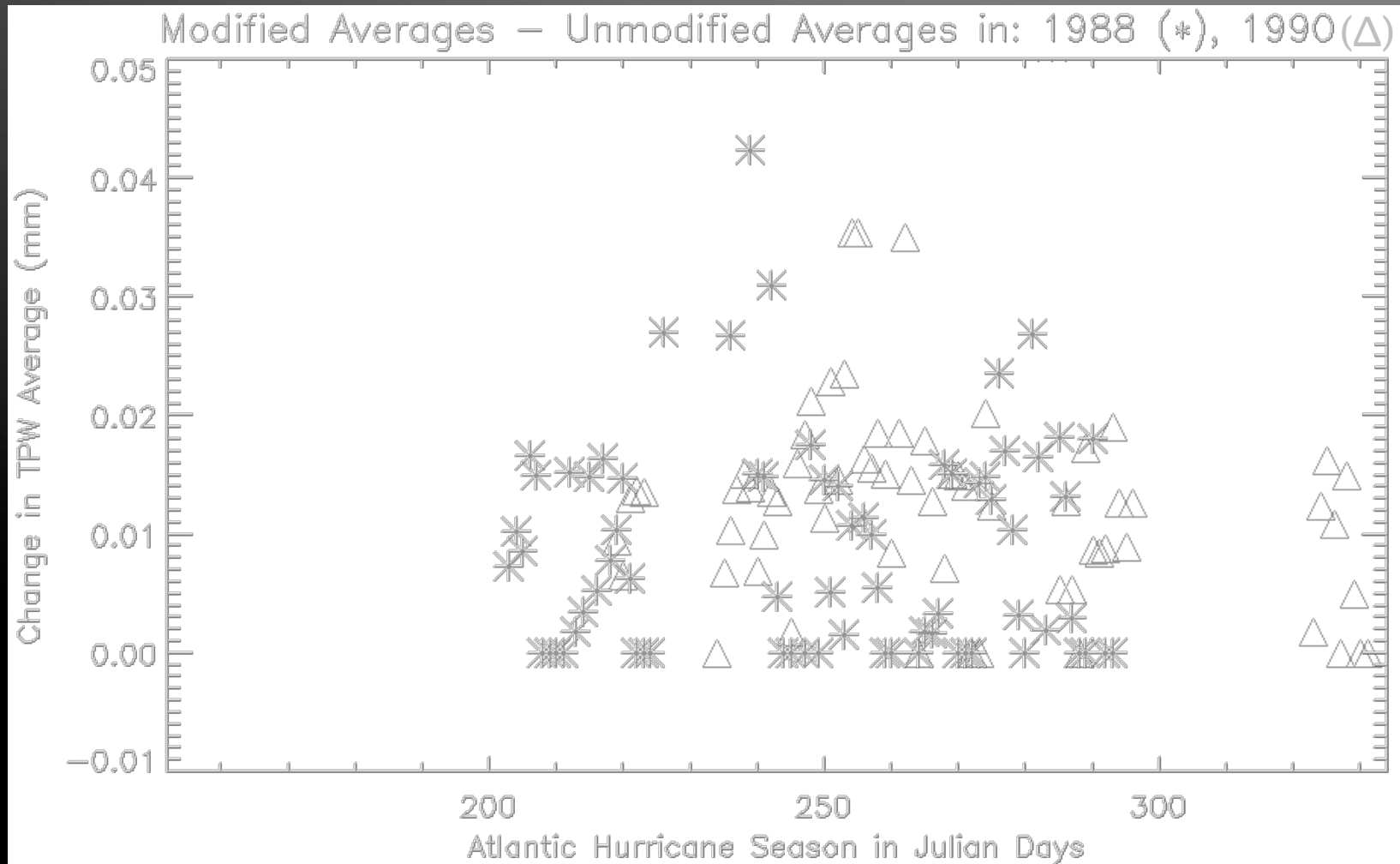
Putting all the pieces together



Modified Averages vs. Unmodified Averages



Modified Averages – Unmodified Averages



Conclusions

Not considering TC's is a bias when determining the global average of TPW.

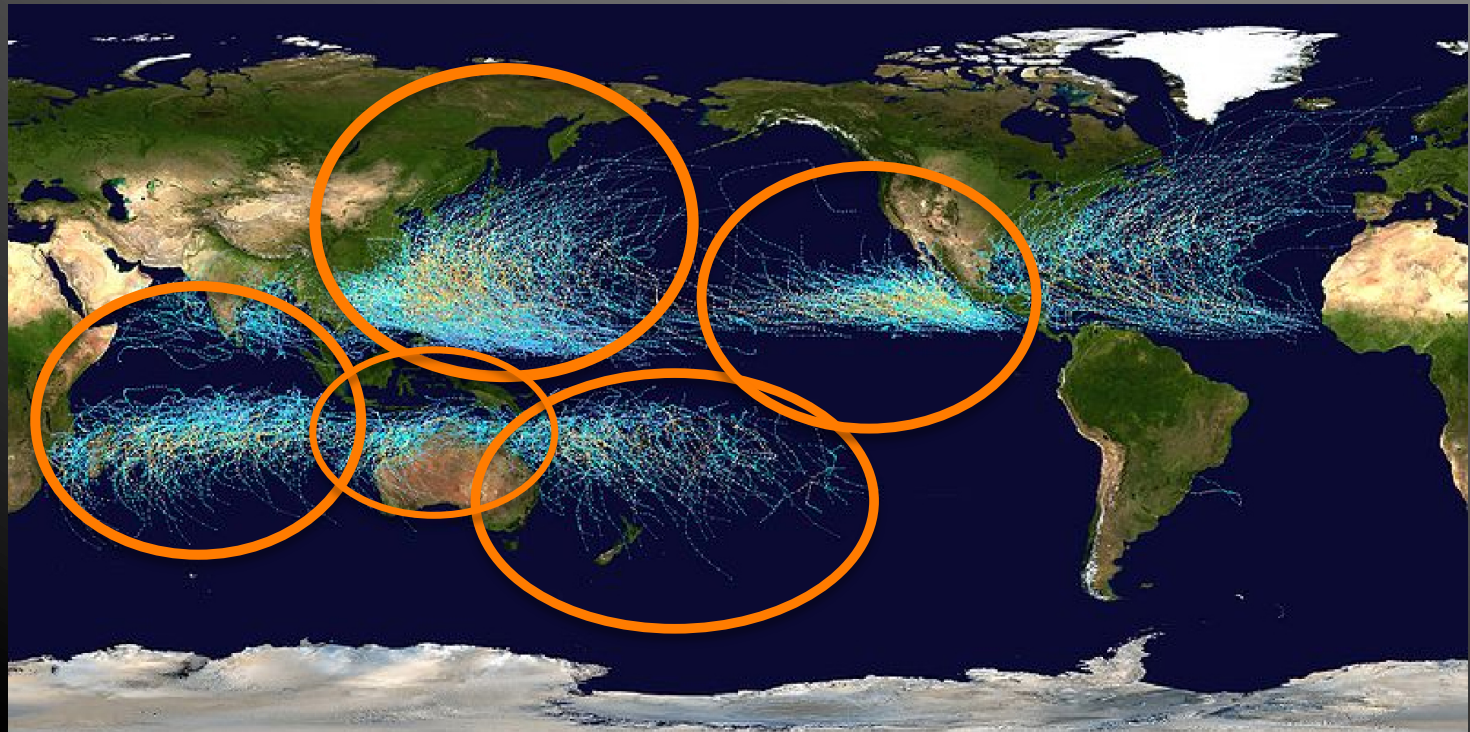
Sampling TC's do increase global TPW averages by approximately 0.18 mm.

Only the Atlantic was considered!

There is still plenty of work that can and will be done.

Future Work

Tracks of all tropical cyclones during the 1985–2005



Consider all TC basins

The Atlantic basin contributes $\approx 11.4\%$ of Earth's TC activity¹⁰


Future Work

Implement a new, more accurate method of interpolation



Model a typical, moist tropical (MT) sounding to attain a more appropriate TPW interpolation value.

Hurricane dropsondes would prove extremely useful.



One possible reference to develop an accurate model

Recent publication by Jason P. Dunion at NOAA/HRD titled: *Rewriting the Climatology of the Tropical North Atlantic and Caribbean Sea Atmosphere*¹¹

Acknowledgements



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Thank you

References

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