

On the Changing Characteristics of Atlantic Hurricanes

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Summary:

Atlantic Changes and Relationship to SST

Variability vs Trend

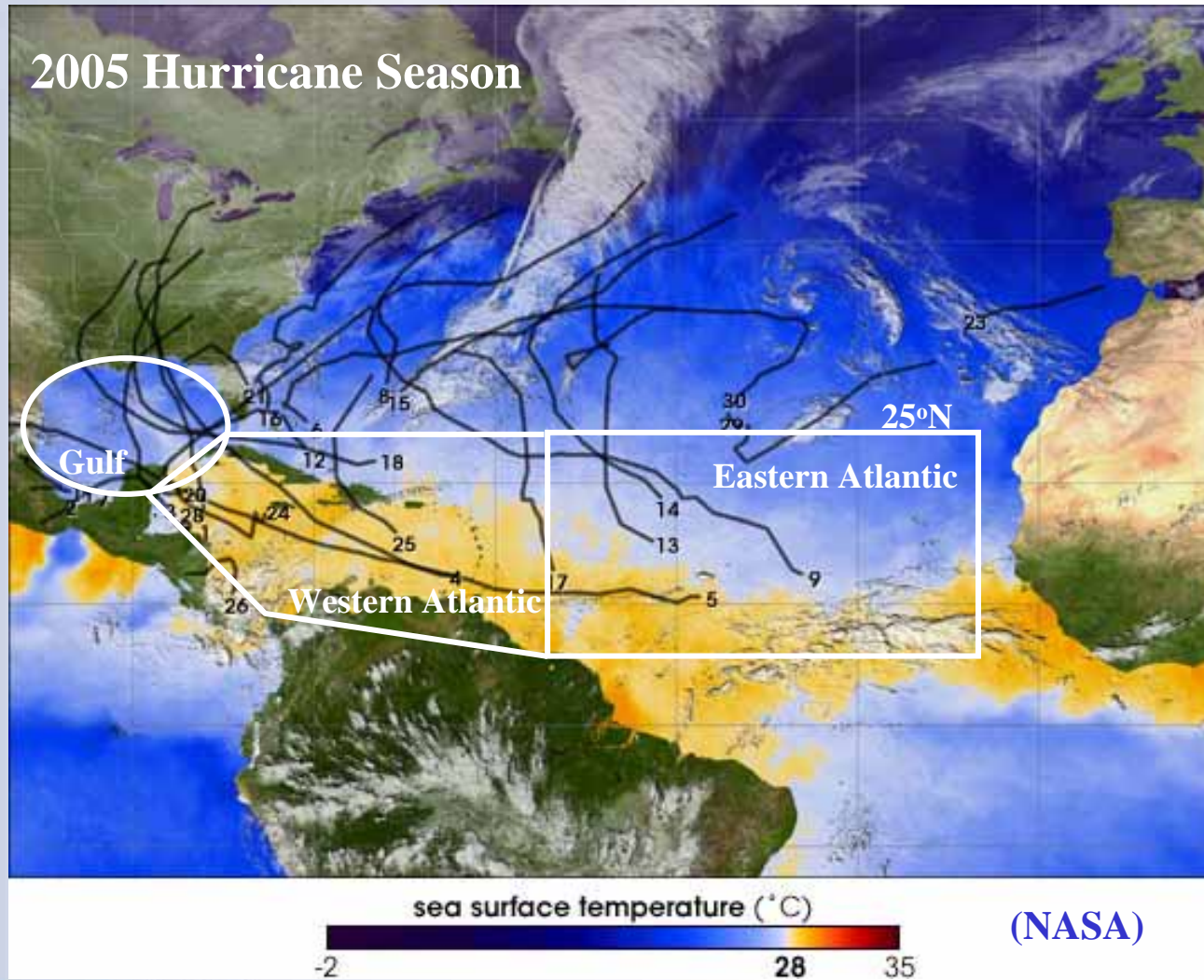


Much of this work is from Holland and Webster (2006, submitted)



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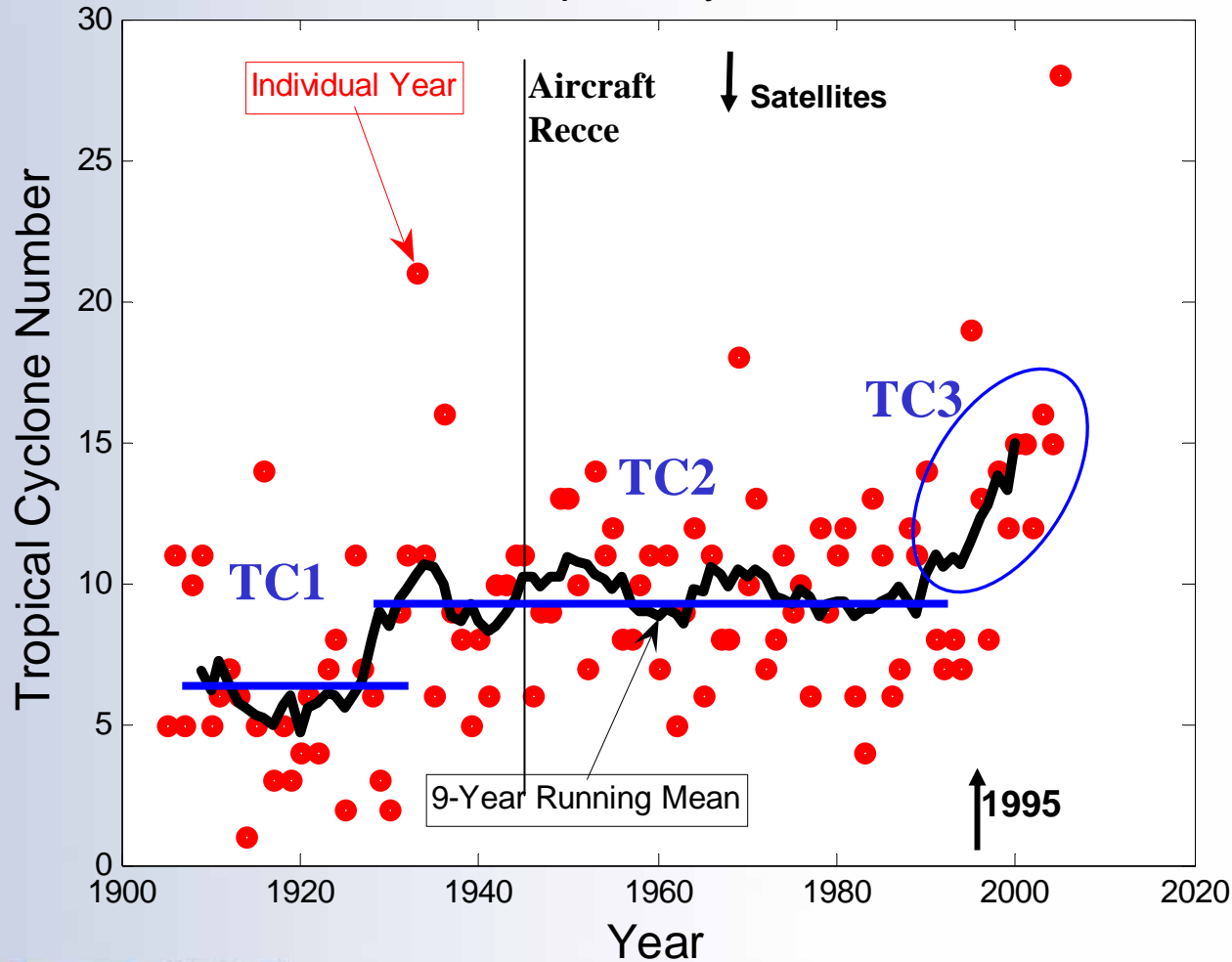
Regions



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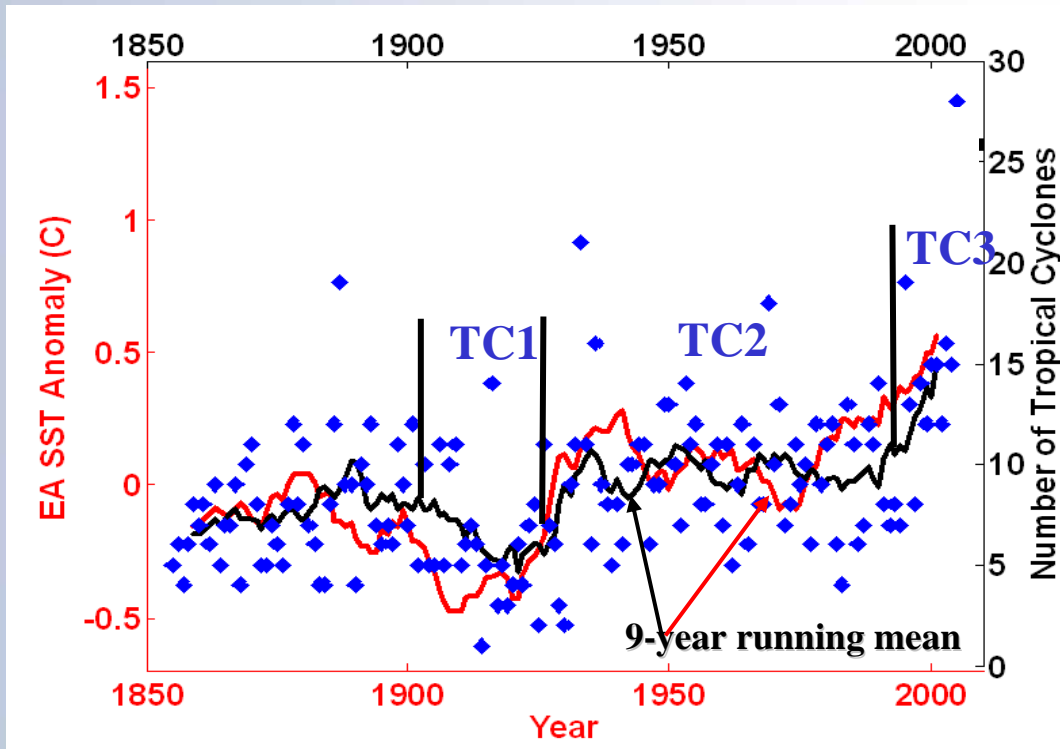
Atlantic Tropical Cyclone Trend

North Atlantic Tropical Cyclones 1905-2005



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TC Number-SST Relationship

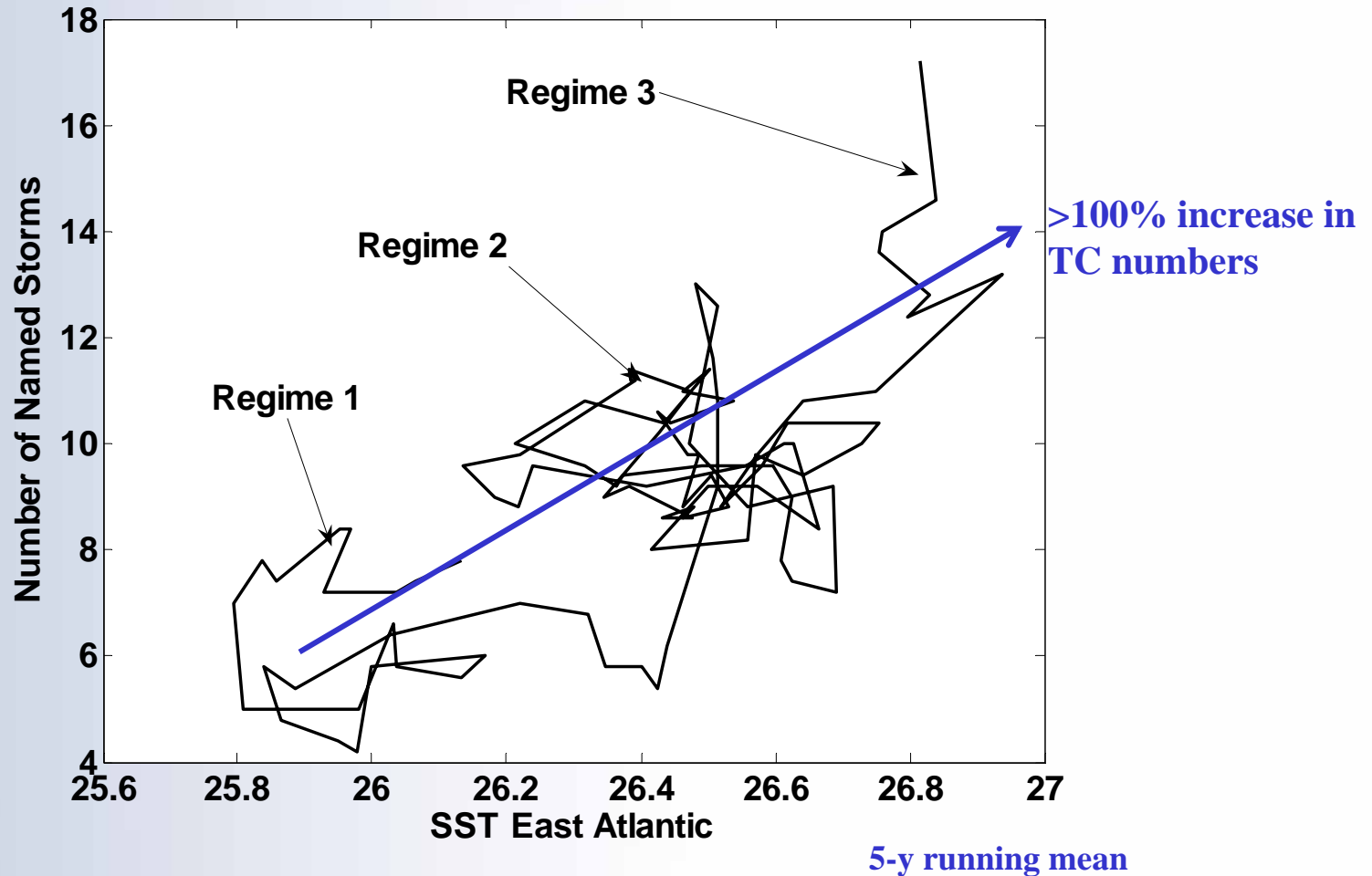


Changes between TC climate regimes are accompanied by similar changes in eastern Atlantic SSTs;

SST leads cyclone changes and explains >60% of the variance in TC numbers (due entirely to regime changes).

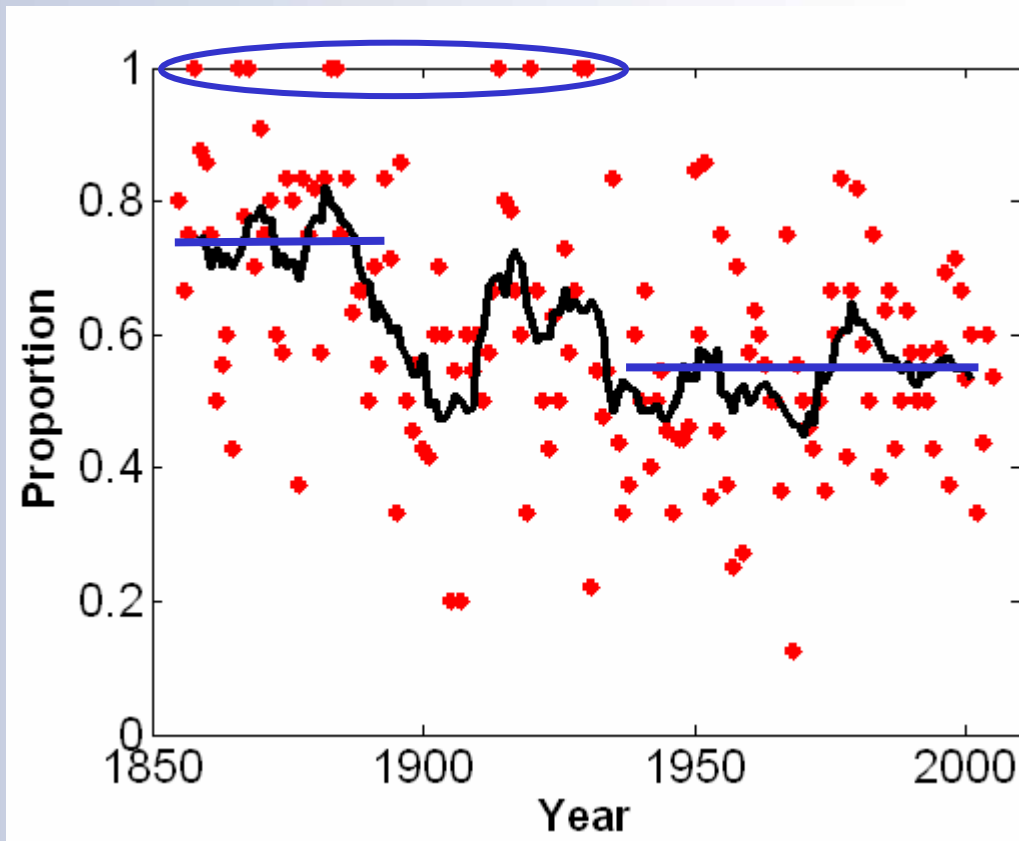


TC Climate Regimes



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Hurricane Proportions

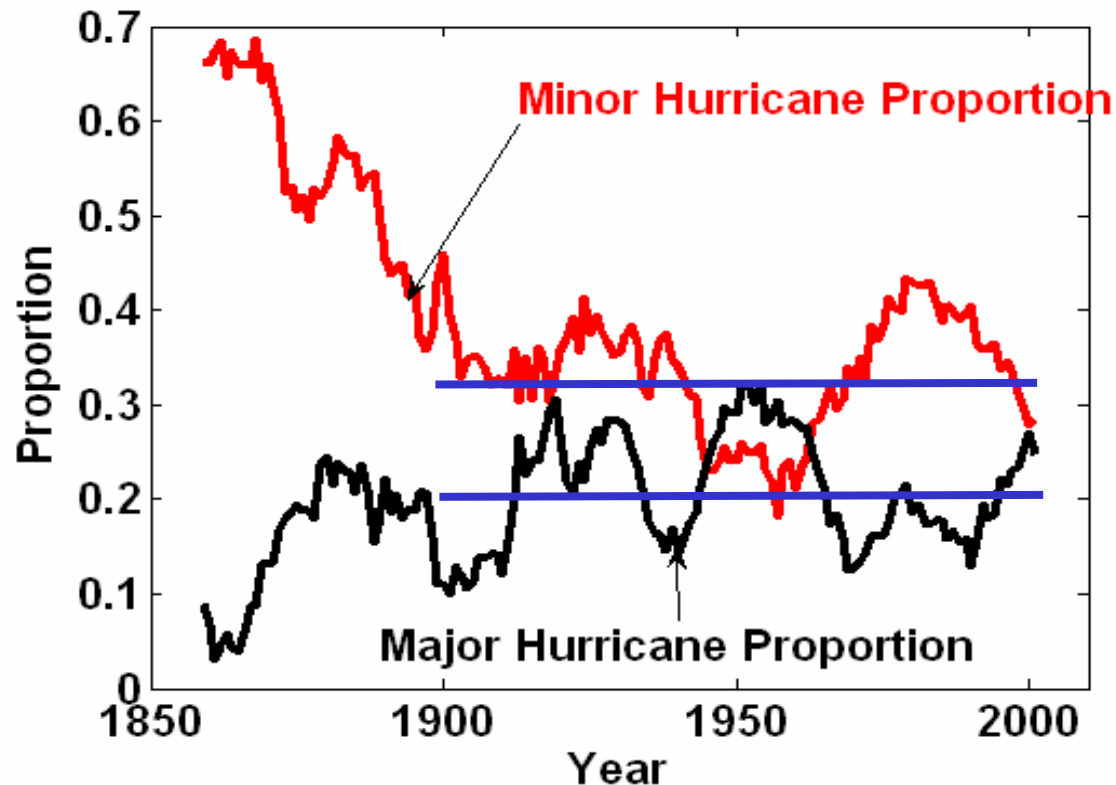


Since 1900 and esp. since 1945 hurricane proportions have been remarkably steady with only a few % variation; High hurricane proportion prior to 1900 and occasional year with only hurricanes up to 1940 are indicative of a tendency to miss weaker systems in earlier years.



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Major Hurricane Variation



Period before 1900 dominated by data issues;

No evidence of any trend since 1900;

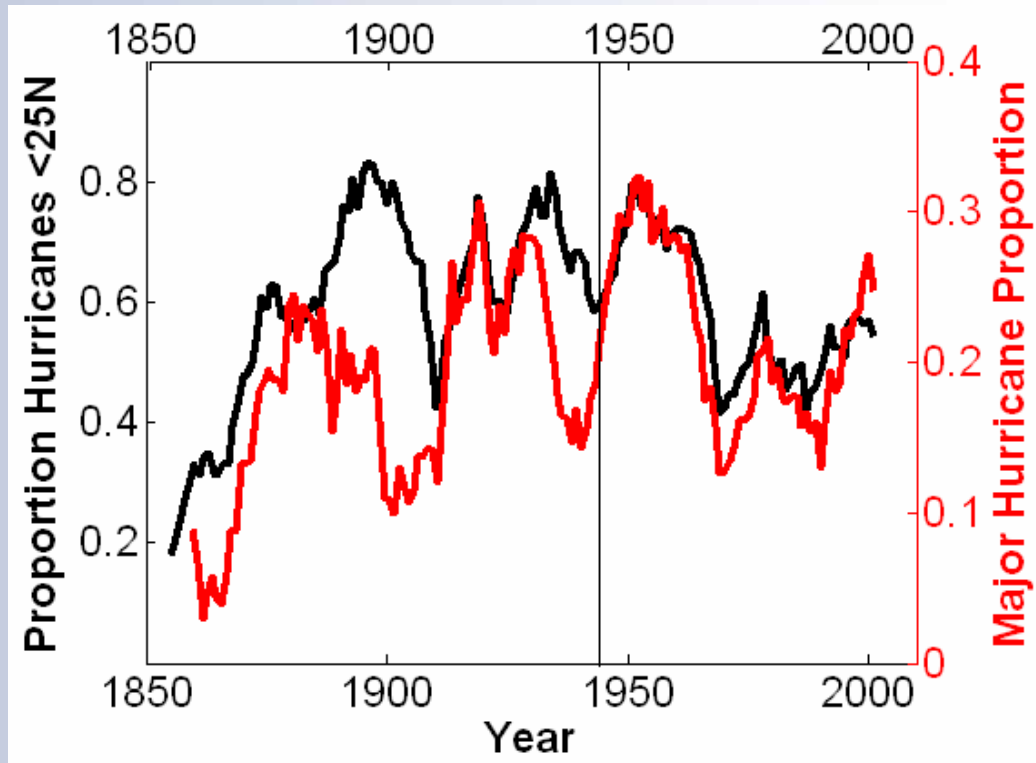
Remarkable, out of phase oscillation in major and minor hurricanes with multi-decadal period.

Independent of Hurricane or Tropical Cyclone Variation



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Major Hurricanes are Related to Equatorial Developments



Eastern Atlantic SST has no relationship with major hurricane proportion;

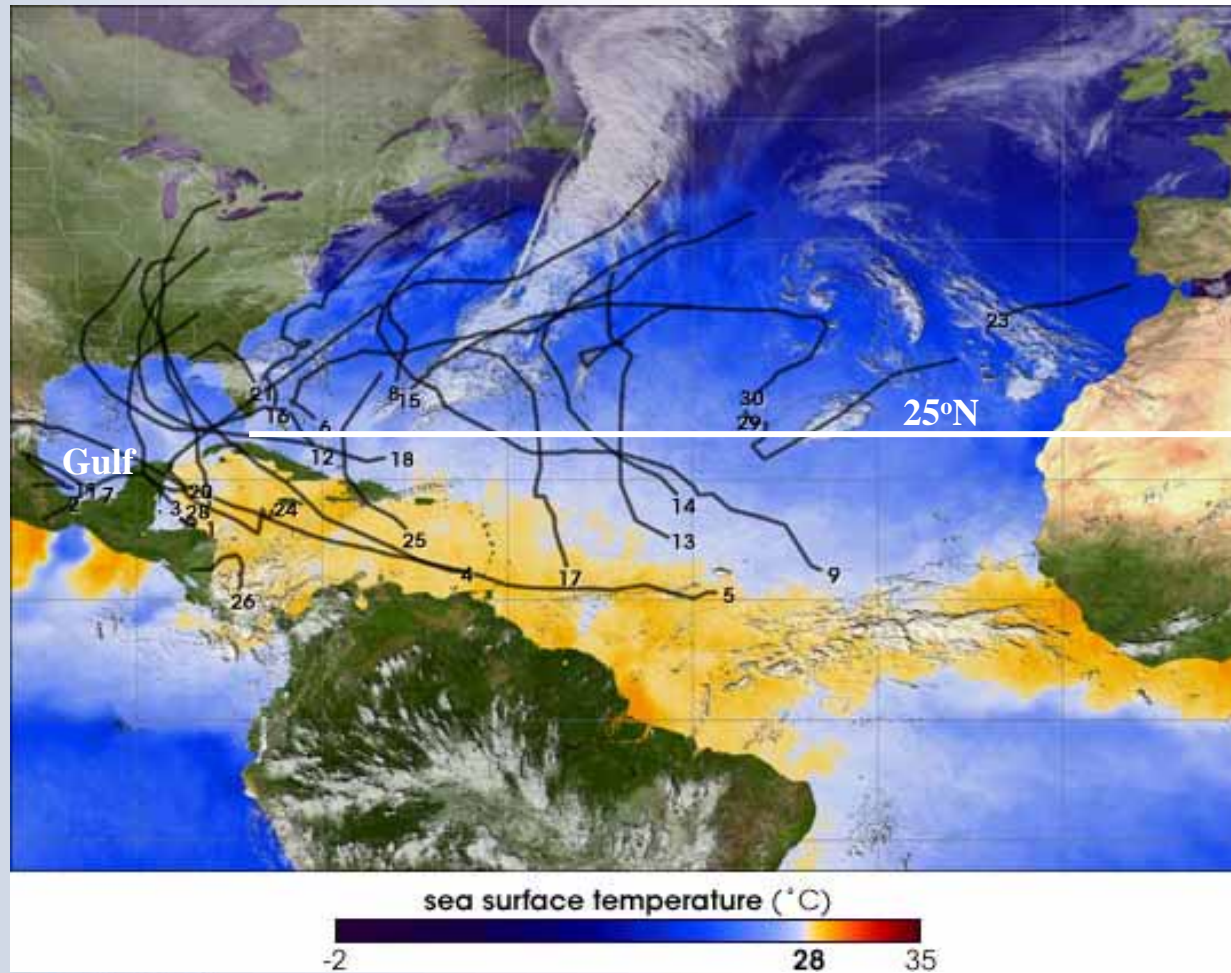
Gulf of Mexico SST explains 64% of variation in major hurricane proportions since 1945;

The proportion of hurricanes forming <25°N explains over 80% of the variation in major hurricane proportion since 1945.



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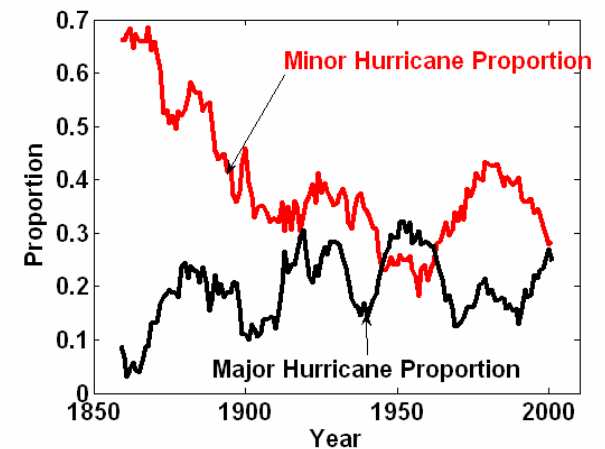
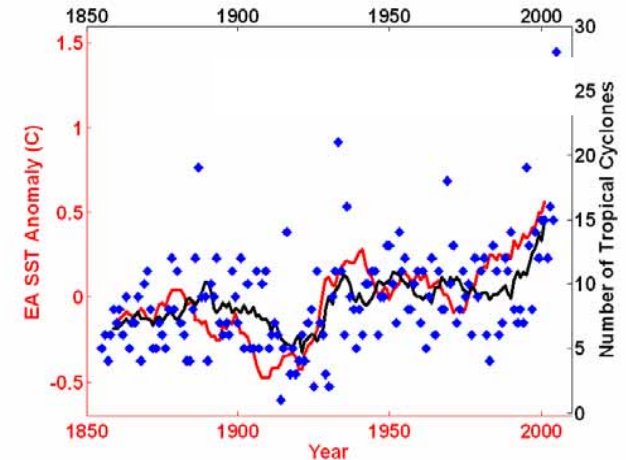
Increases arise from Equatorial Developments



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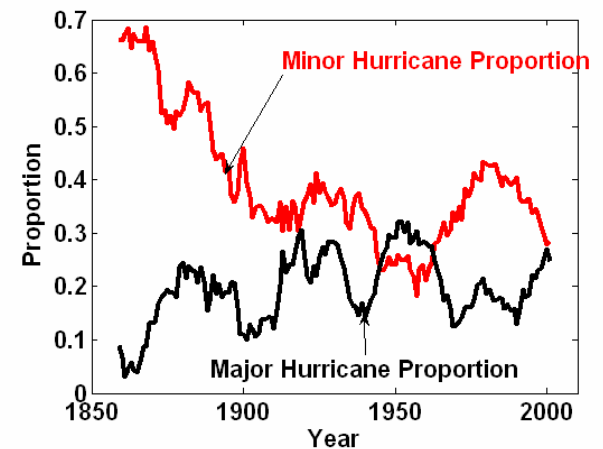
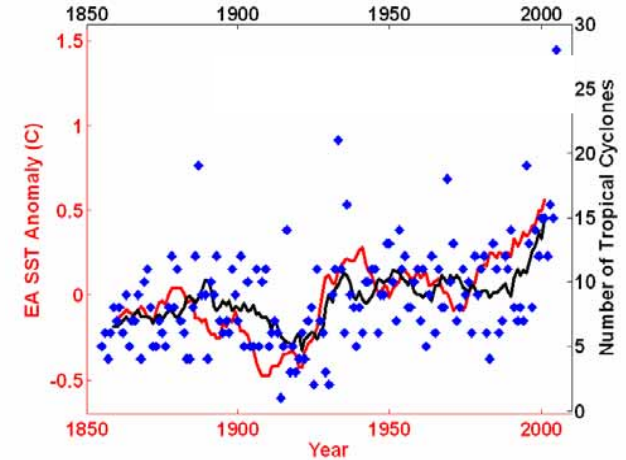
Summary

- Since 1905 we have seen a marked increasing trend in tropical cyclone and hurricane numbers associated with eastern North Atlantic SSTs;
- Major hurricane proportions show no trend since 1905, but have a marked, multi-decadal oscillation with peaks associated with equatorial developments;



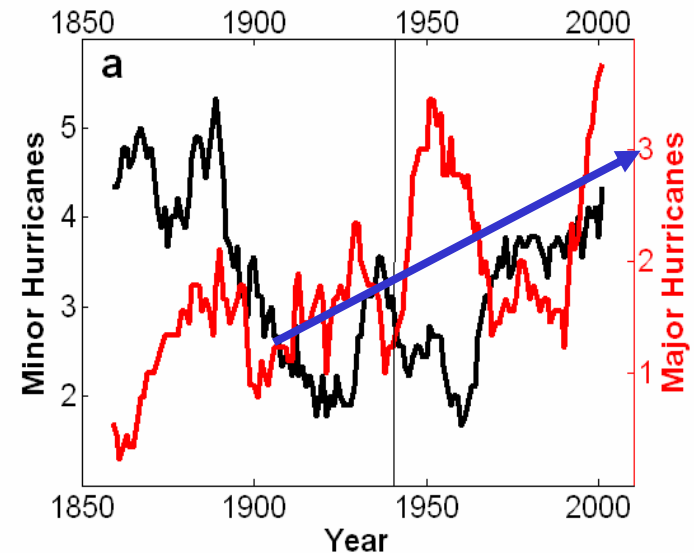
Summary ctd.

- The 1950-64 period of enhanced activity was due entirely to major hurricane fluctuations;
- The period since 1995 has seen the first confluence of a high in major hurricane proportion and in TC activity;



Summary ctd.

- While there is no trend in the *proportion* of major hurricanes there is a distinct trend in the *number* of major hurricanes.



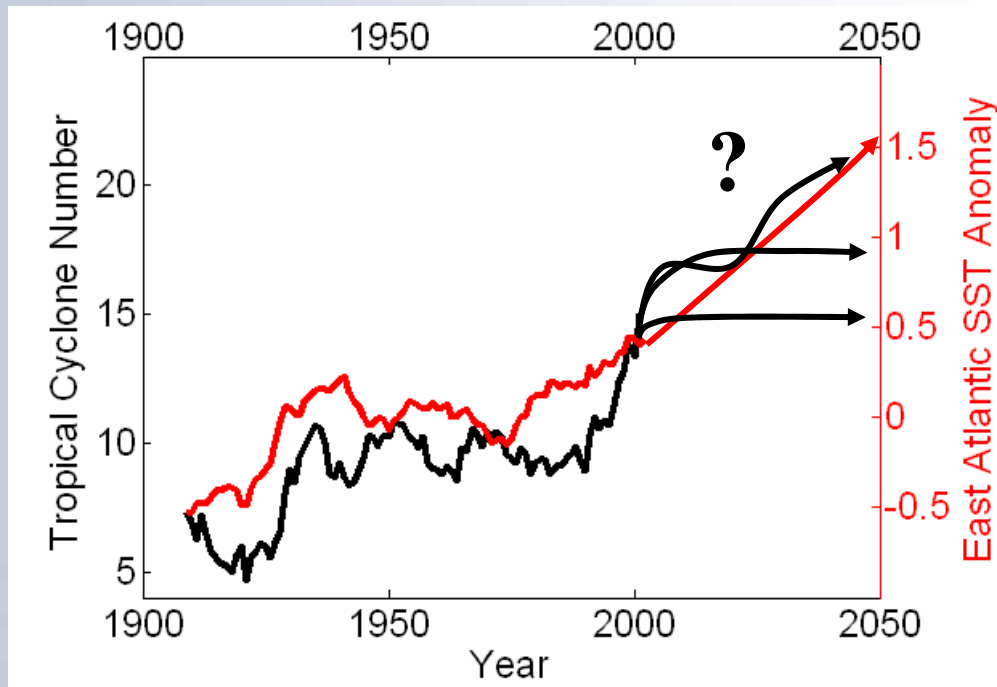
The strong relationship between increases in storm and hurricane numbers and increases in SSTs leads to the inescapable conclusion that the majority of current hurricane activity is a direct result of greenhouse warming.



“The future comes apace”

William Shakespeare

Given SSTs are expected to continue to rise, what will happen to Atlantic tropical cyclone numbers?



- **The current upward transition has not yet stabilized;**
- **There is no rational reason to expect a decrease;**
- **There are limitations on the number that can exist or develop at any one time;**
- **An average of over 20 per year is not impossible (currently running at 15 per year).**



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