On Tropical-Cyclones

A Statistical Analysis in a Warming Environment

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Objectives

- Analysis of the influence of the SST on tropical-cyclones intensity.
  - Replicate the results obtained by Corral et al. in [1].
  - Update these results with revised data.
- Analysis regarding the influence of the SST, or lack thereof, on the intensity and duration of tropical-cyclones.

Tropical-cyclones tracks

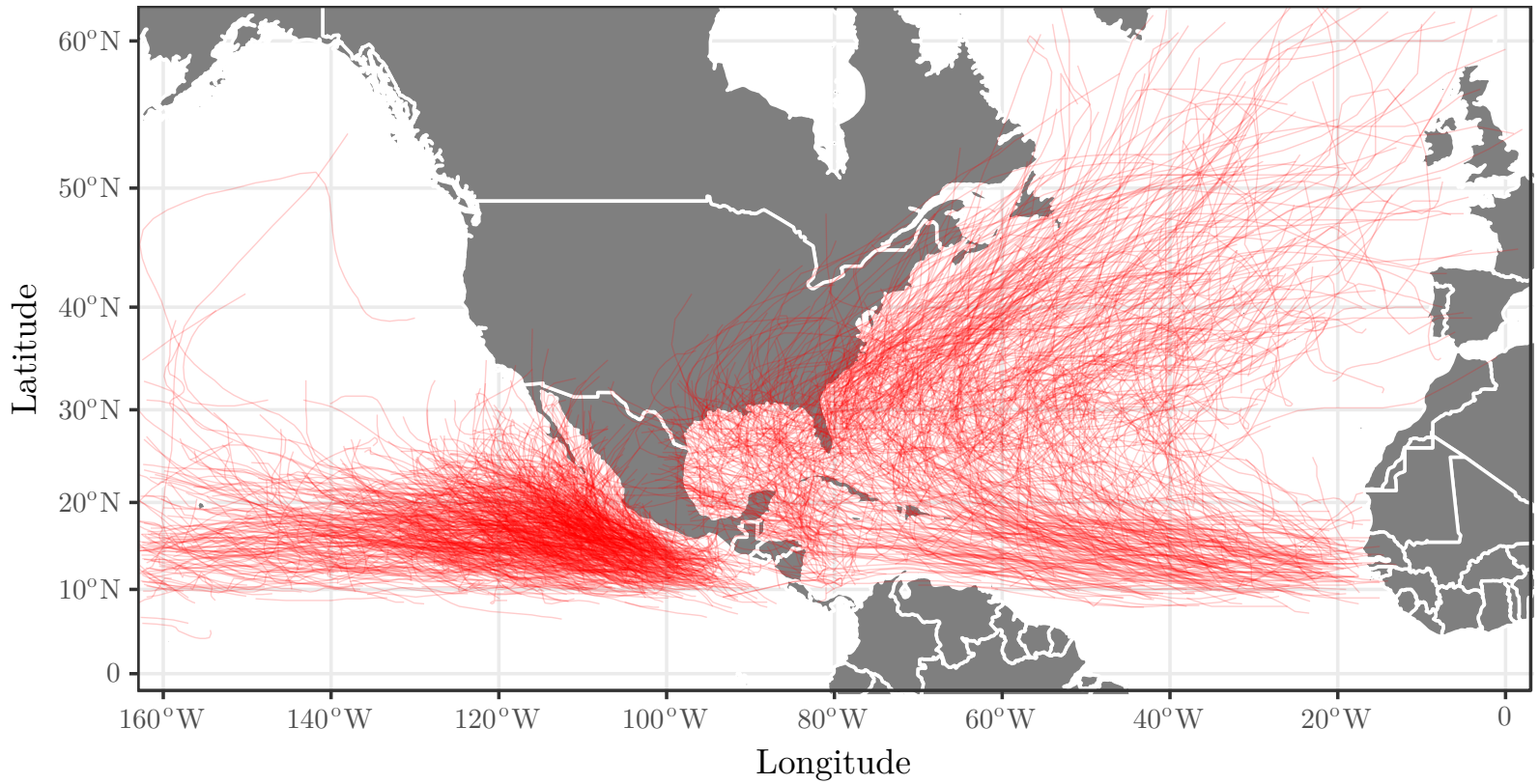
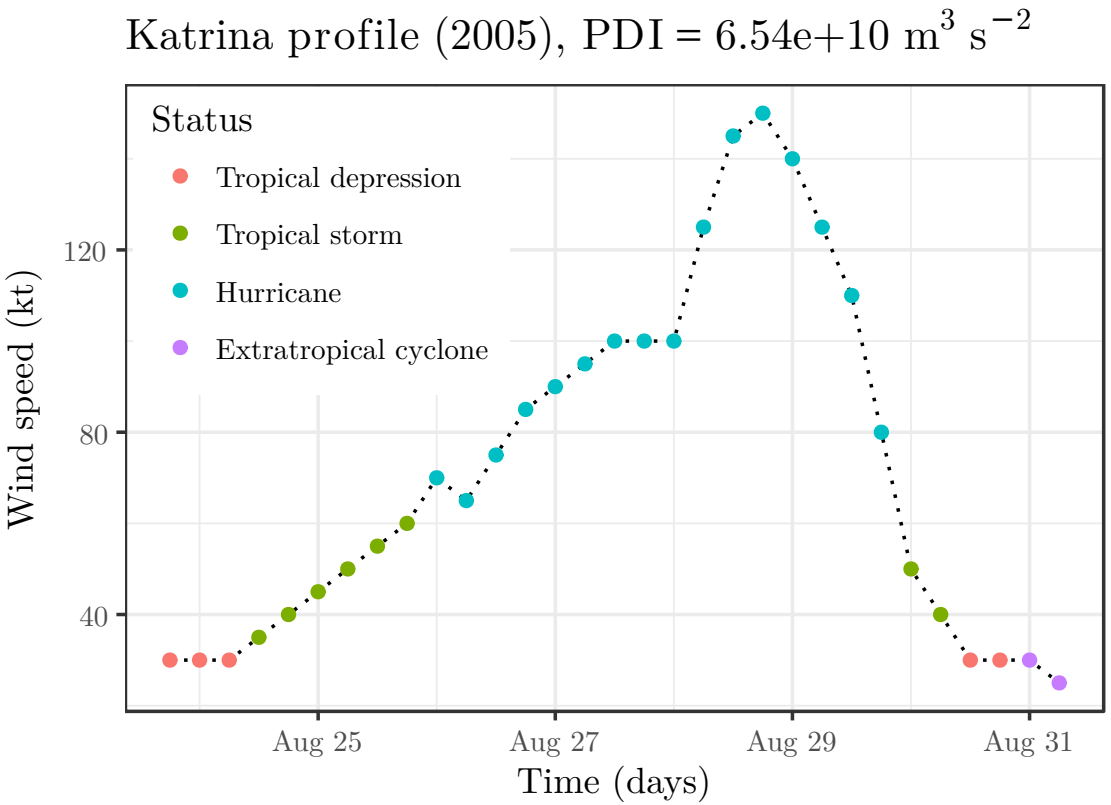


Figure: Tropical-cyclones tracks for the Northeast Pacific (E. Pac.) & North Atlantic (N. Atl.) Oceans

Individual storm intensity



$$PDI = \sum_t v_t^3 \Delta t \quad (1)$$

Figure: Katrina surface wind speed profile

D(PDI) distribution

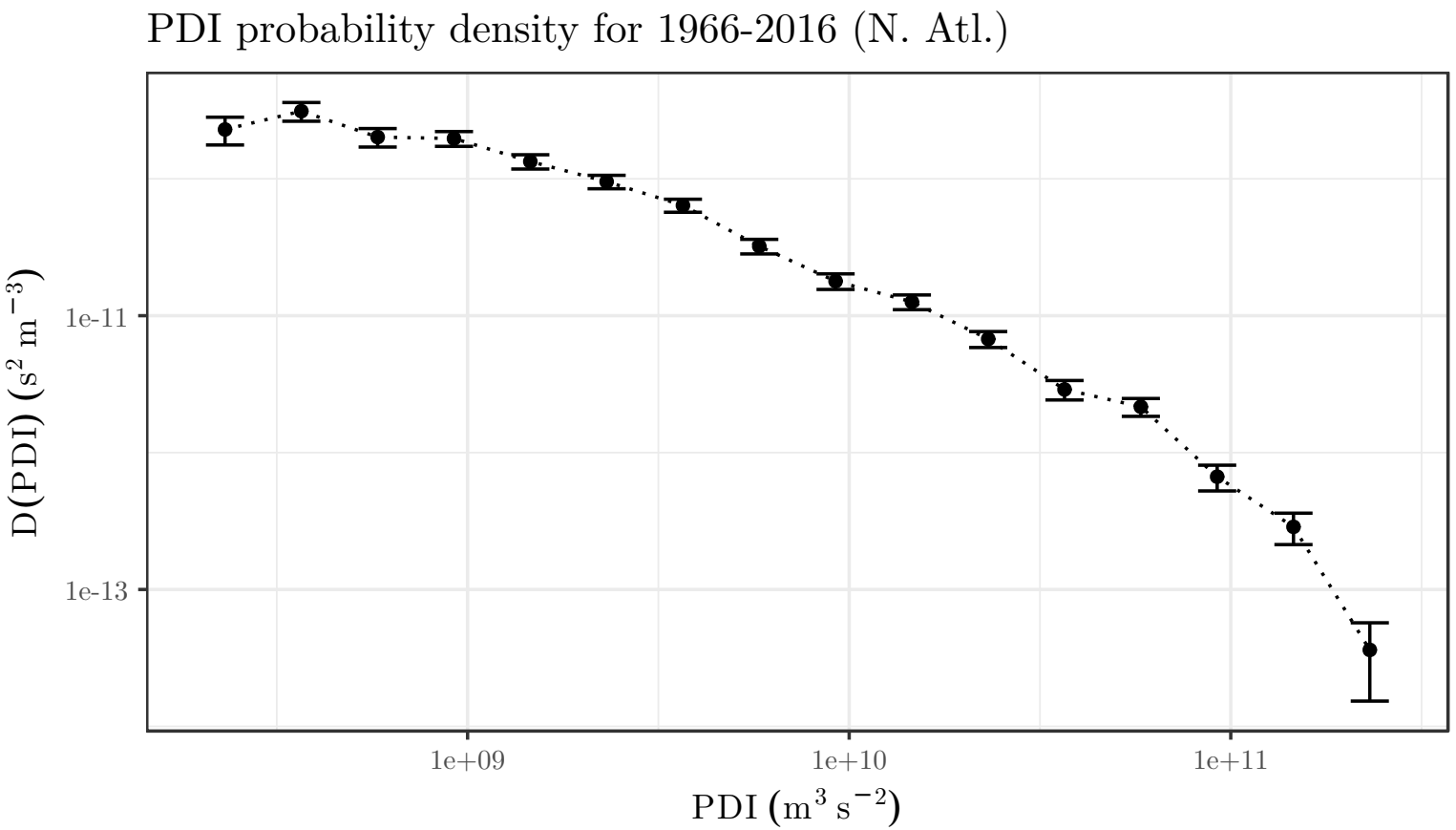


Figure: $D(PDI)$ distribution for the North Atlantic Ocean

Analyses

- **Separation by SST**
  Higher SSTs and increased water vapour $\rightarrow$ high-SST years should have a longer tail.
- PDI correlations

Separation by SST

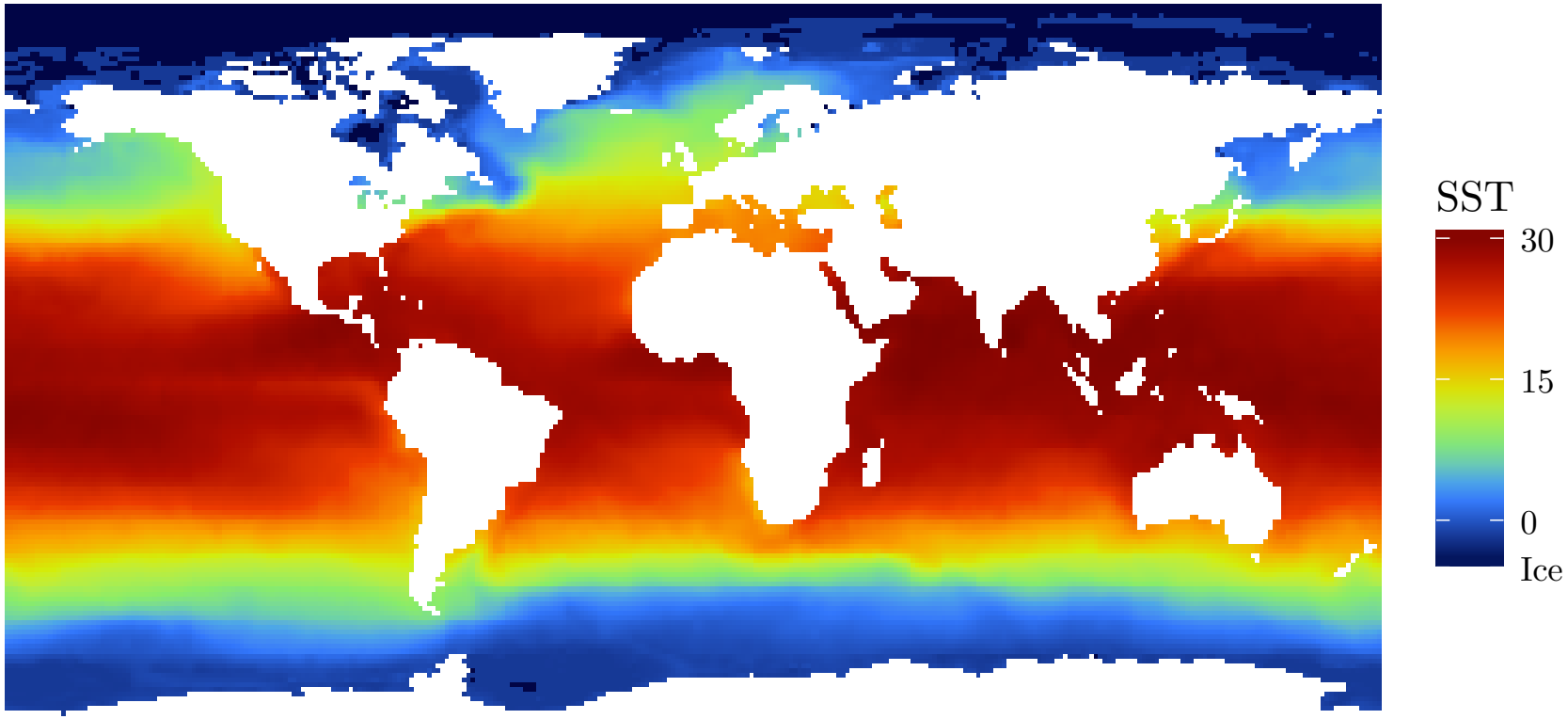


Figure: Global SST (in °C) map from May 2017

Separation by SST

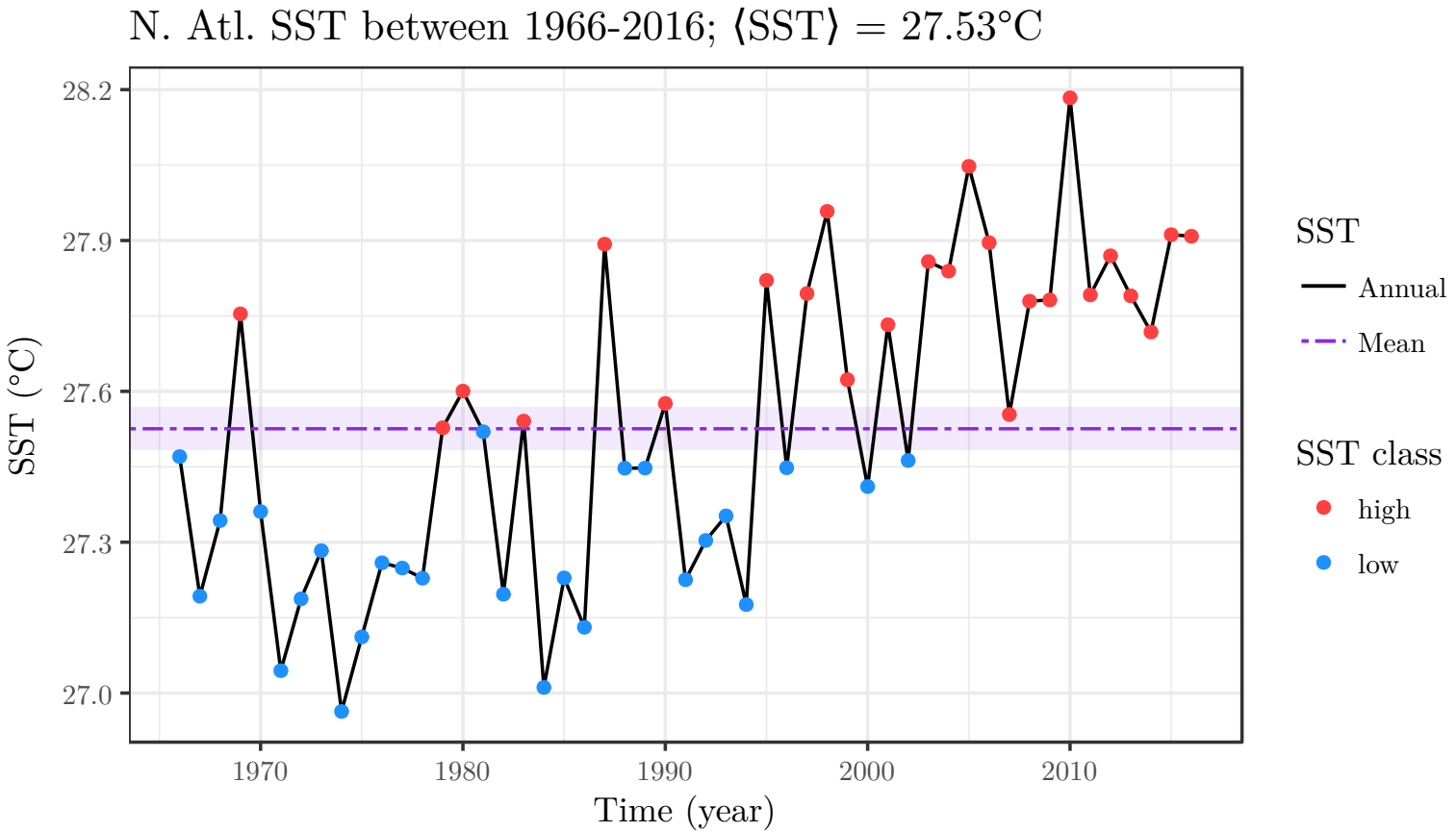


Figure: SST analysis for the North Atlantic Ocean

Results

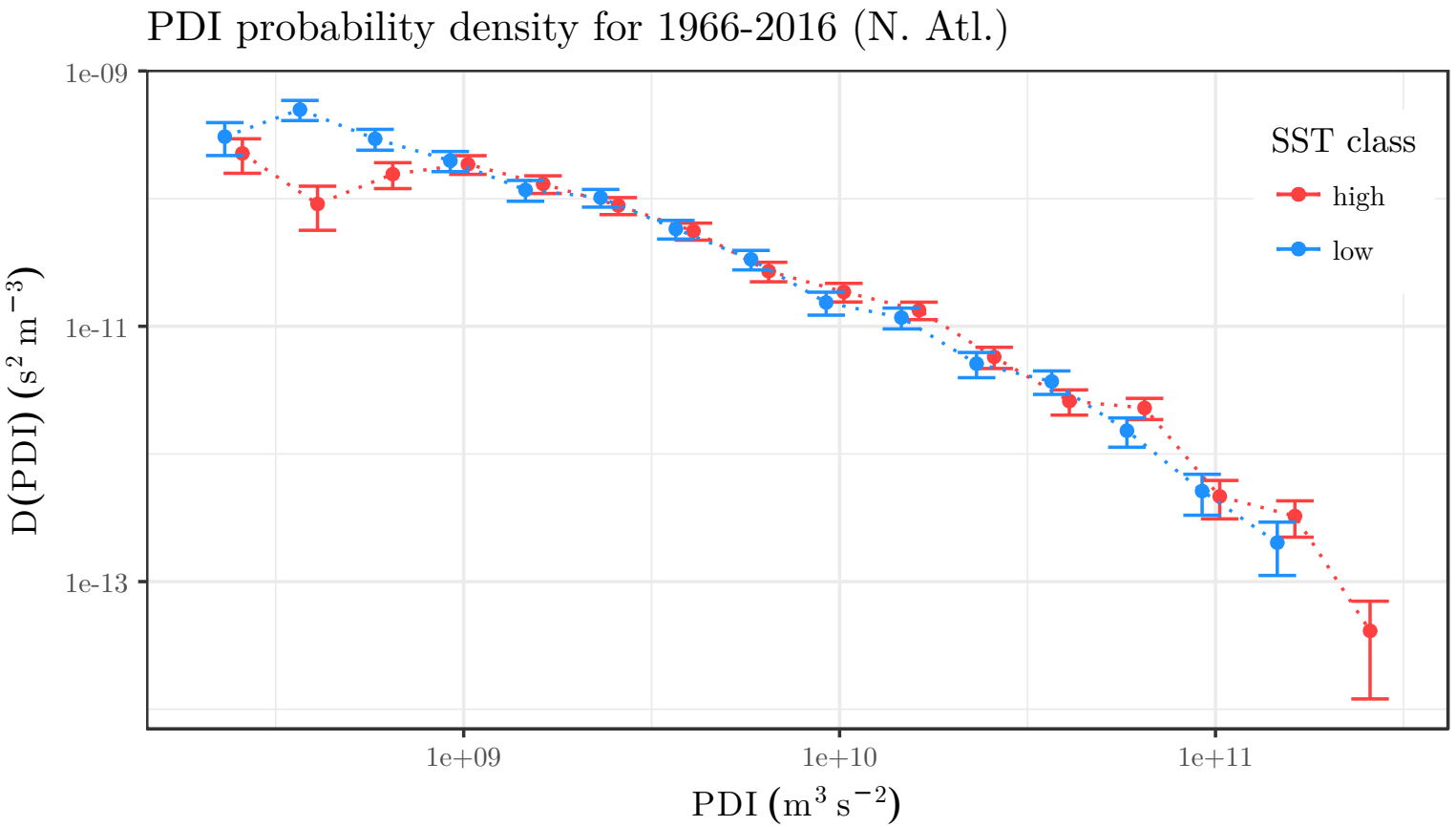


Figure: $D(PDI)$ distributions calculated separately for years with high or low SST for the North Atlantic Ocean

Analyses

- Separation by SST
- **PDI correlations**
  Why do high-SST years have more energetic tropical-cyclones? Once cyclones are activated, they should behave the same regardless of the SST.

PDI correlations

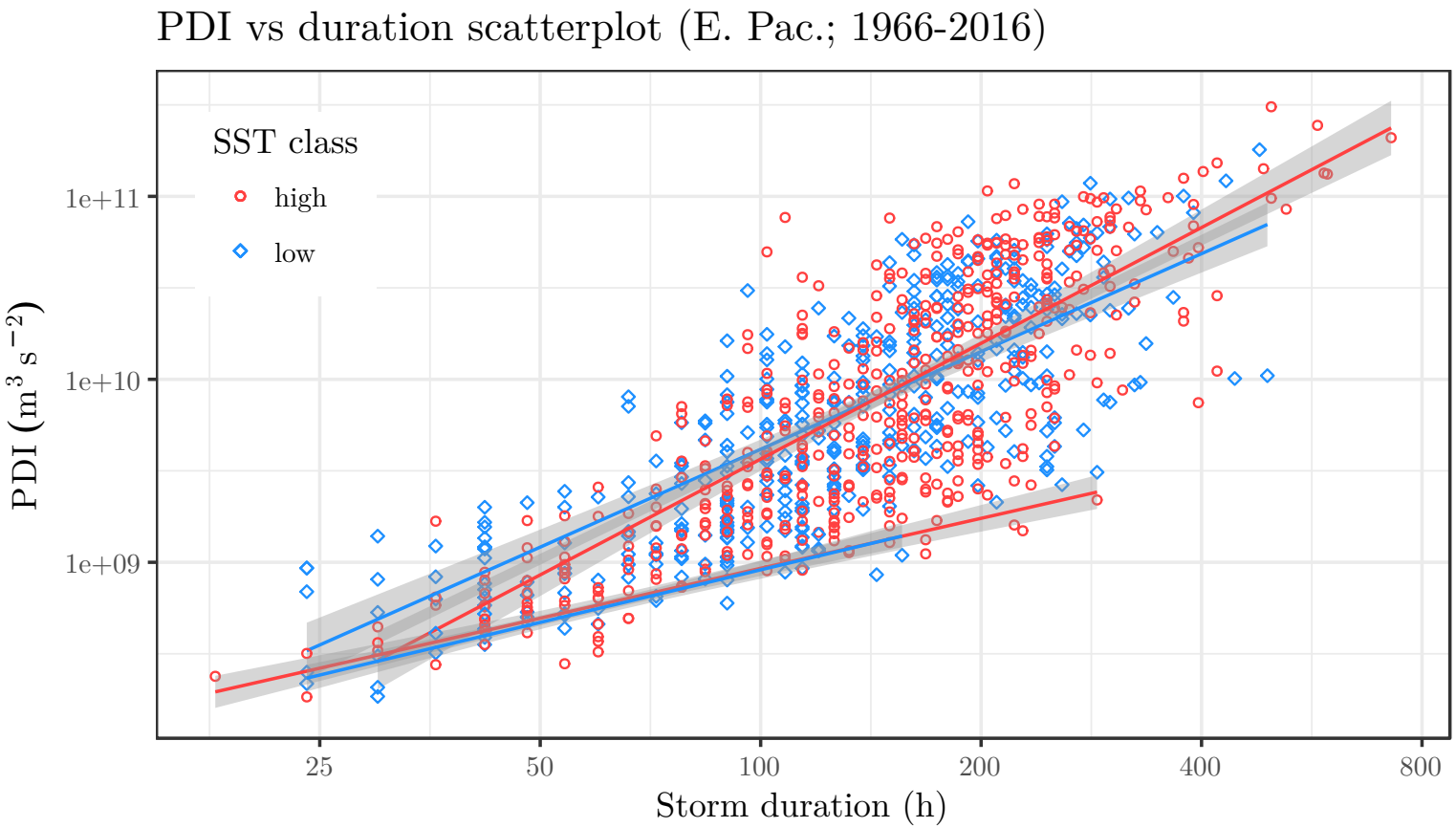


Figure: PDI vs duration analysis for non-developing and developing systems for the Northeast Pacific Ocean

Conclusions

- Corroboration of global warming.
- An example of its severe consequences.

+ Comprehensive study of all basins.
+ Individual SST tracking per storm (ICOADS).
+ Multivariate statistics for the correlation analyses.

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References

- Á. Corral, A. Ossó and J. E. Llebot. Scaling of tropical-cyclone dissipation. *Nature Physics*, 6(9):693–696, 2010.
- P. J. Webster et al. Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science (New York, N.Y.)*, 309(5742):1844–6, 2005.
- K. A. Emanuel. Tropical Cyclones. *Annual Review of Earth and Planetary Sciences*, 31(1):75–104, 2003.