Controlling Mechanisms Of Extreme Precipitation Events

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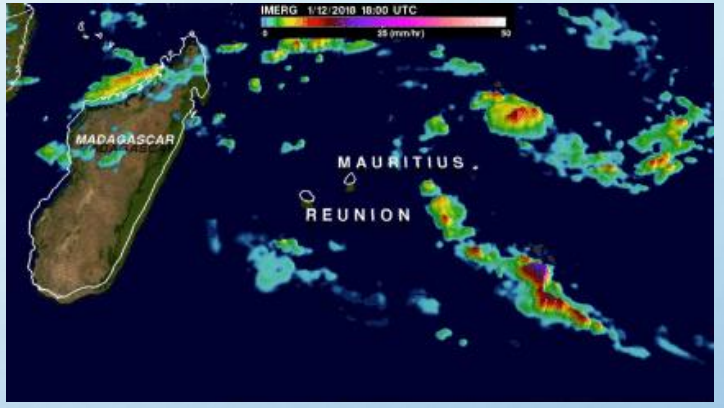
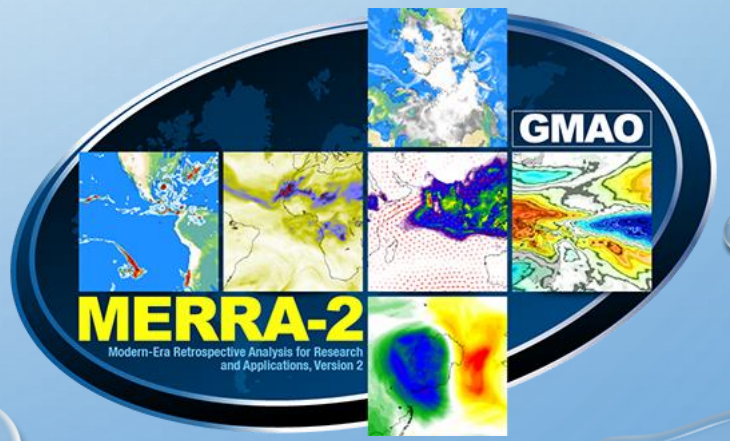
Background

- Extreme Precipitation Events (EPEs):
  - Hazards: major flooding, erosion, landslides
  - As climate changes: more intense and frequent
- IMERG: database of EPEs over CONUS[2]
  - Global Precipitation Measurement satellites
- MERRA-2: many meteorological variables[3]
  - Observational data and model simulations

IMERG Rainfall Data[1]

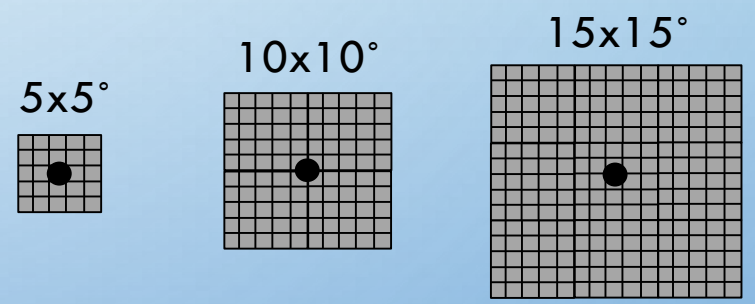


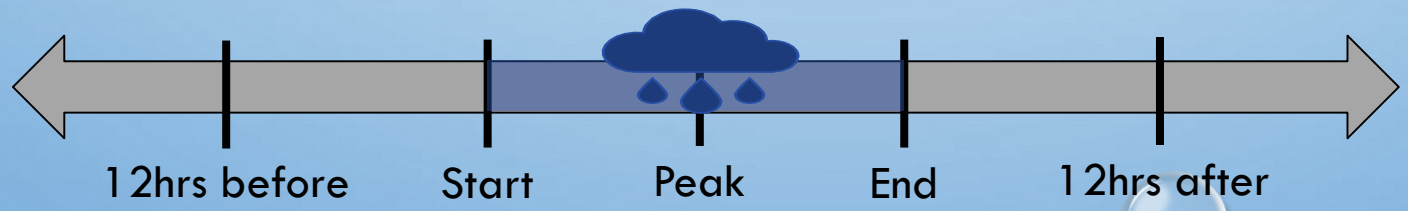


[1]Pierce (SSAI), [2]Zhou et al. 2019, [3]Gelaro et al. 2017

Process

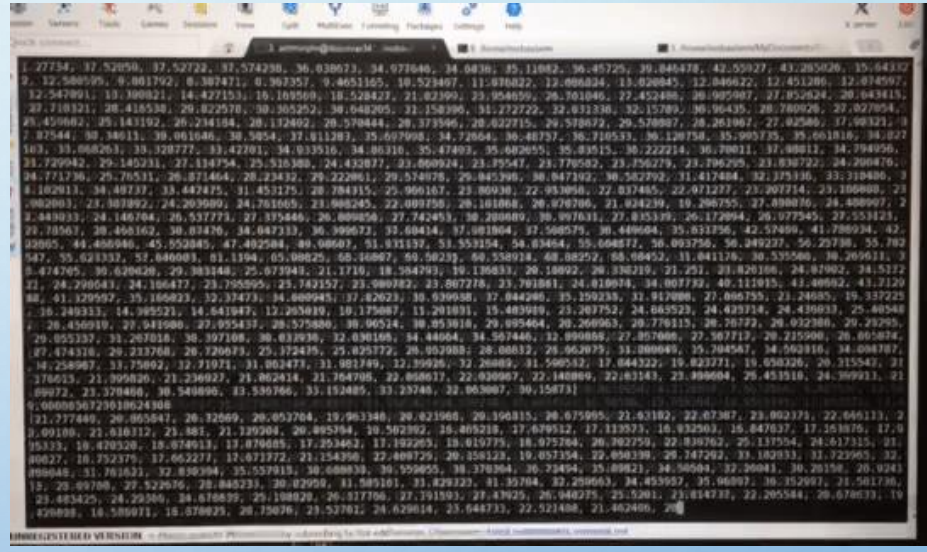
- **Goal**: correlate characteristics of EPEs with meteorological variables
  - **Characteristics**: duration, total volume, total area, propagation, etc.
  - **Variables**: specific and relative humidity, wind speed, temperature, etc.
    - Areas collected: relative to event duration
      - 0 – 6 hrs, 6 – 24 hrs, > 24 hrs
    - Times collected: 5 time steps



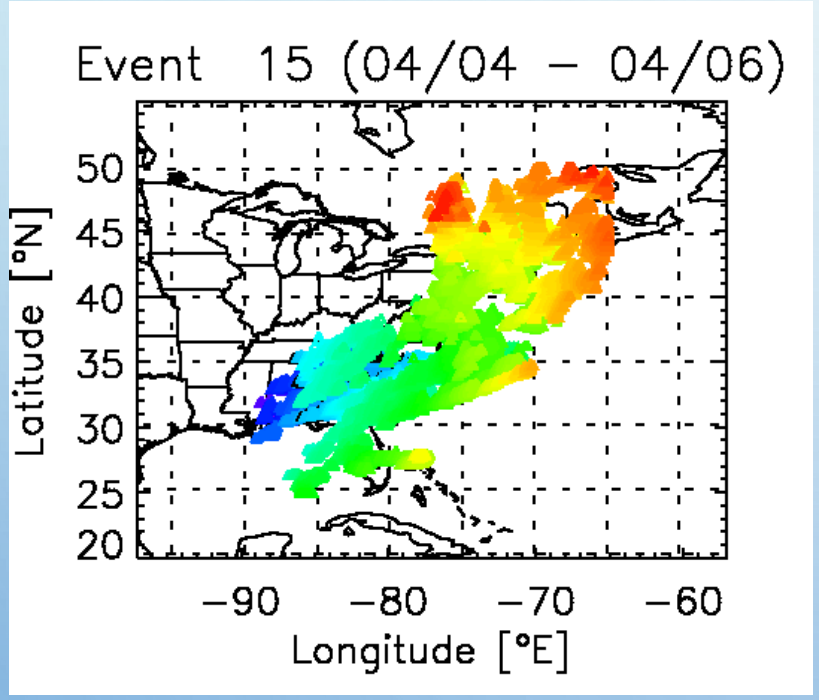


Approach

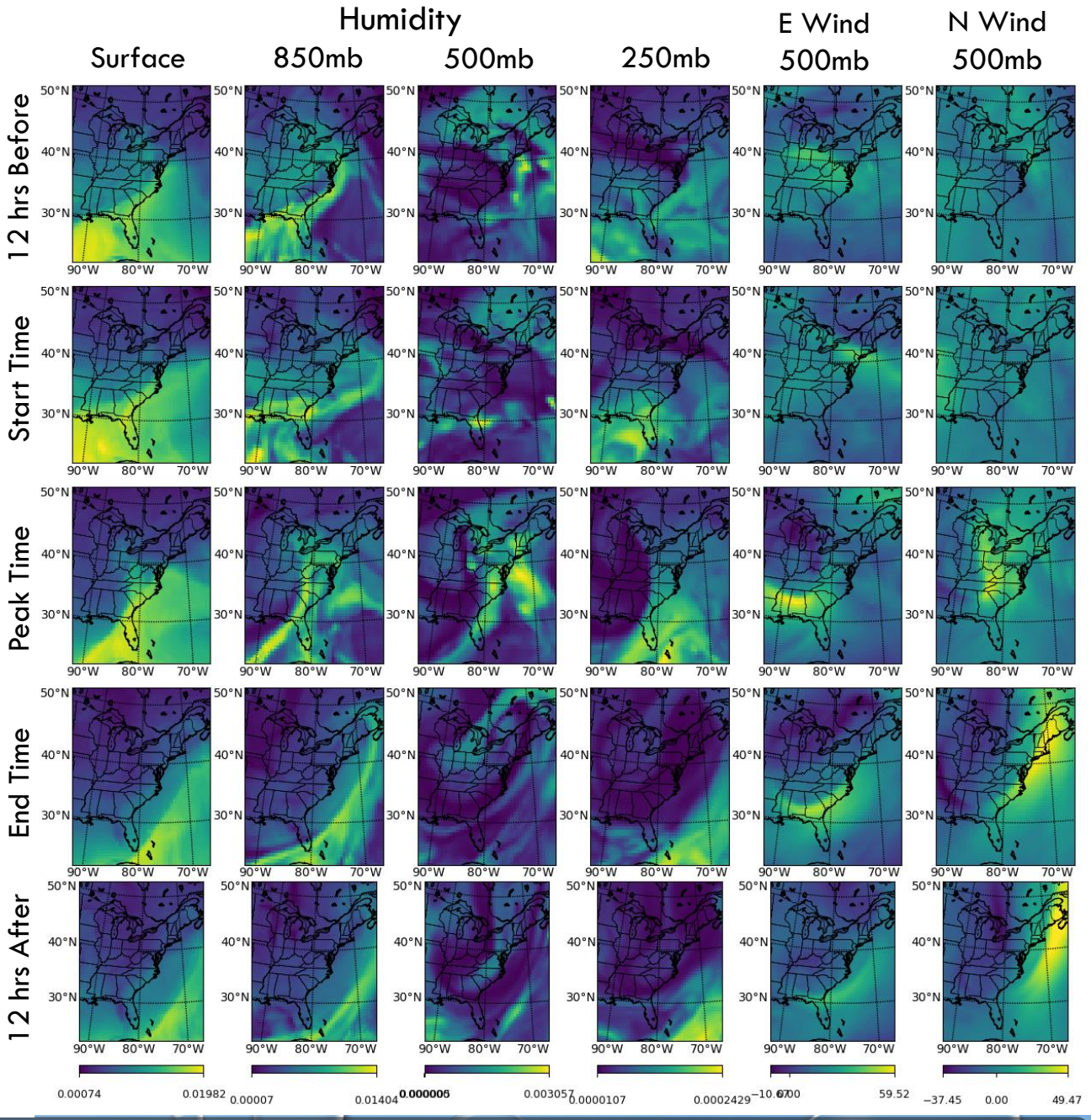
- Python!
  - Locate and characterize EPEs in MERRA-2
  - Compute seasonal trends in variables
  - Within Discover supercomputer
- Inputs: IMERG EPE statistics, MERRA-2 data
- Outputs: data files, maps of event variables, scatter plots of averages



Locating EPEs

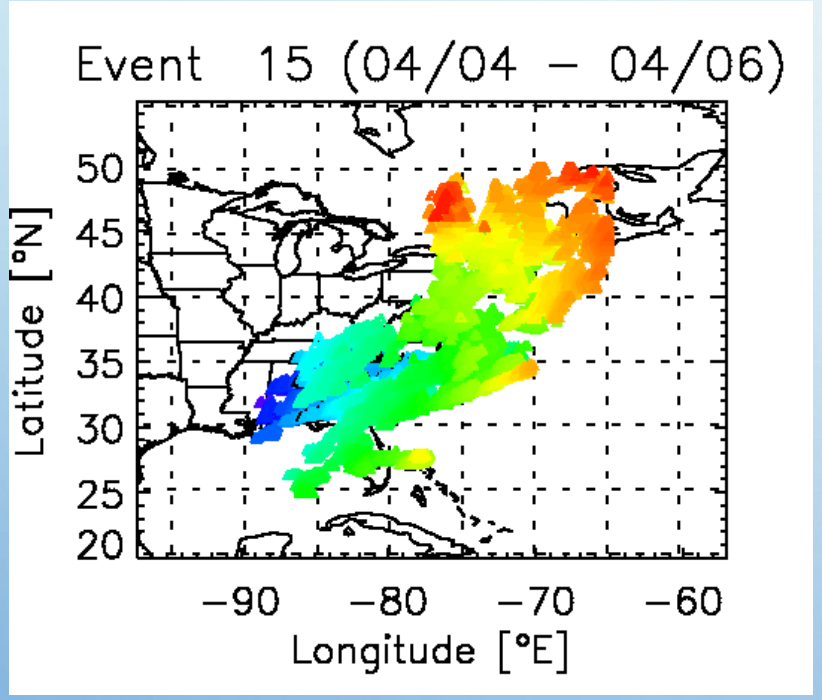


IMERG: Spring 2017, Event 15



MERRA-2

Locating EPEs



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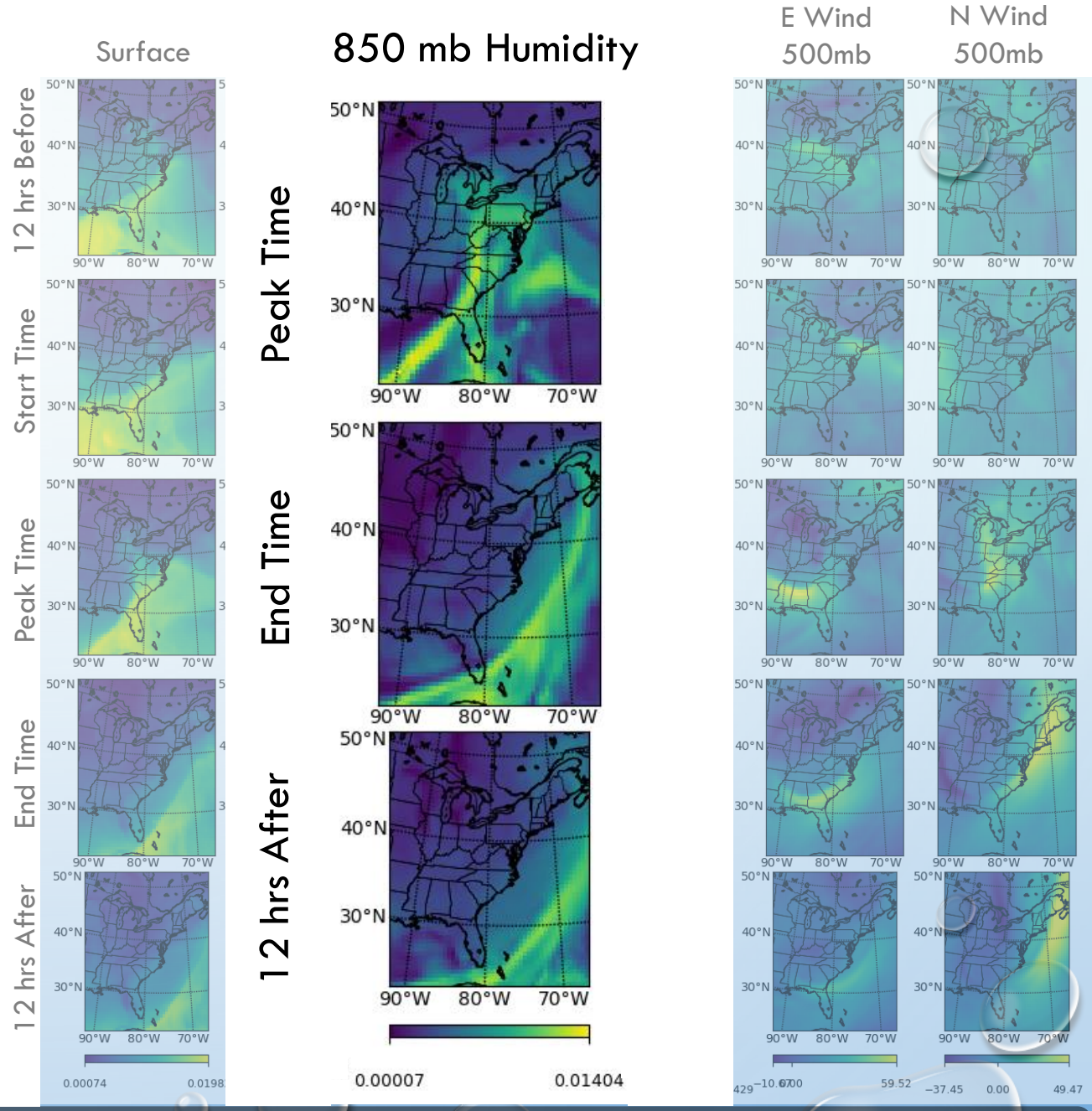
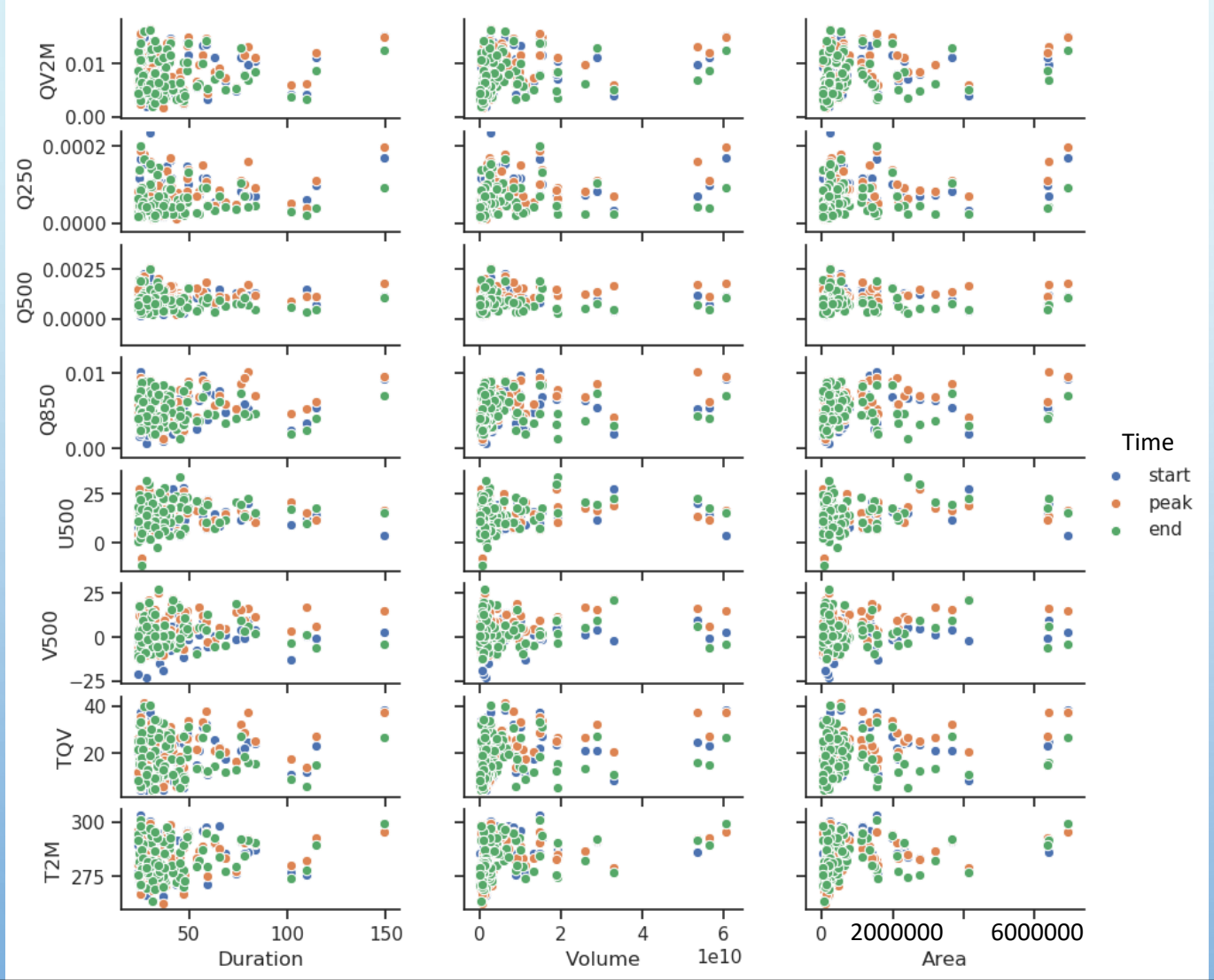


MERRA-2

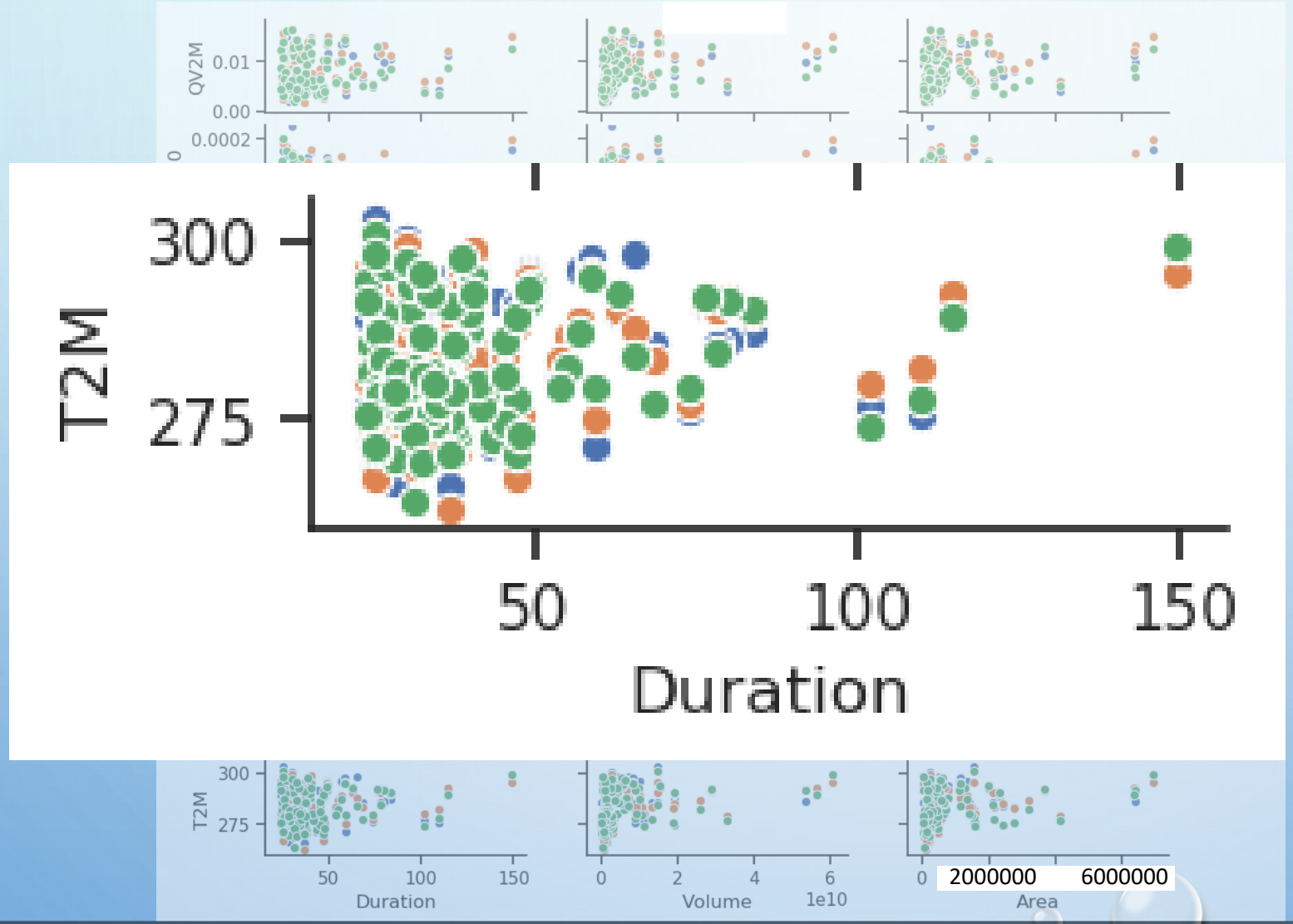
Characterizing EPEs



Spring 2017
Long events (> 24 hrs)

- No clear relationships
- Next steps:
  - Optimize code
  - Run code on many seasons at a time

Characterizing EPEs



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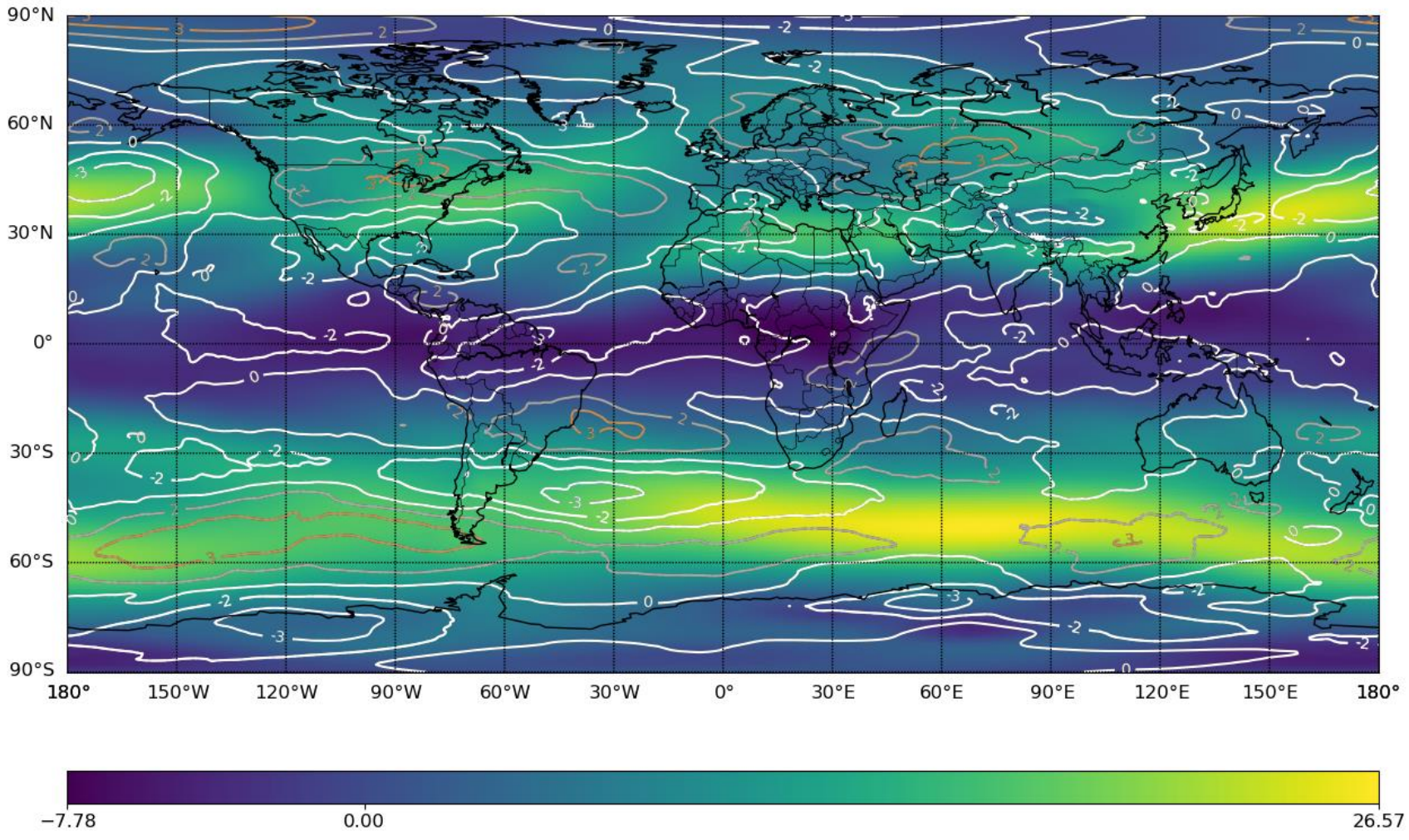
Wind Trends: Spring

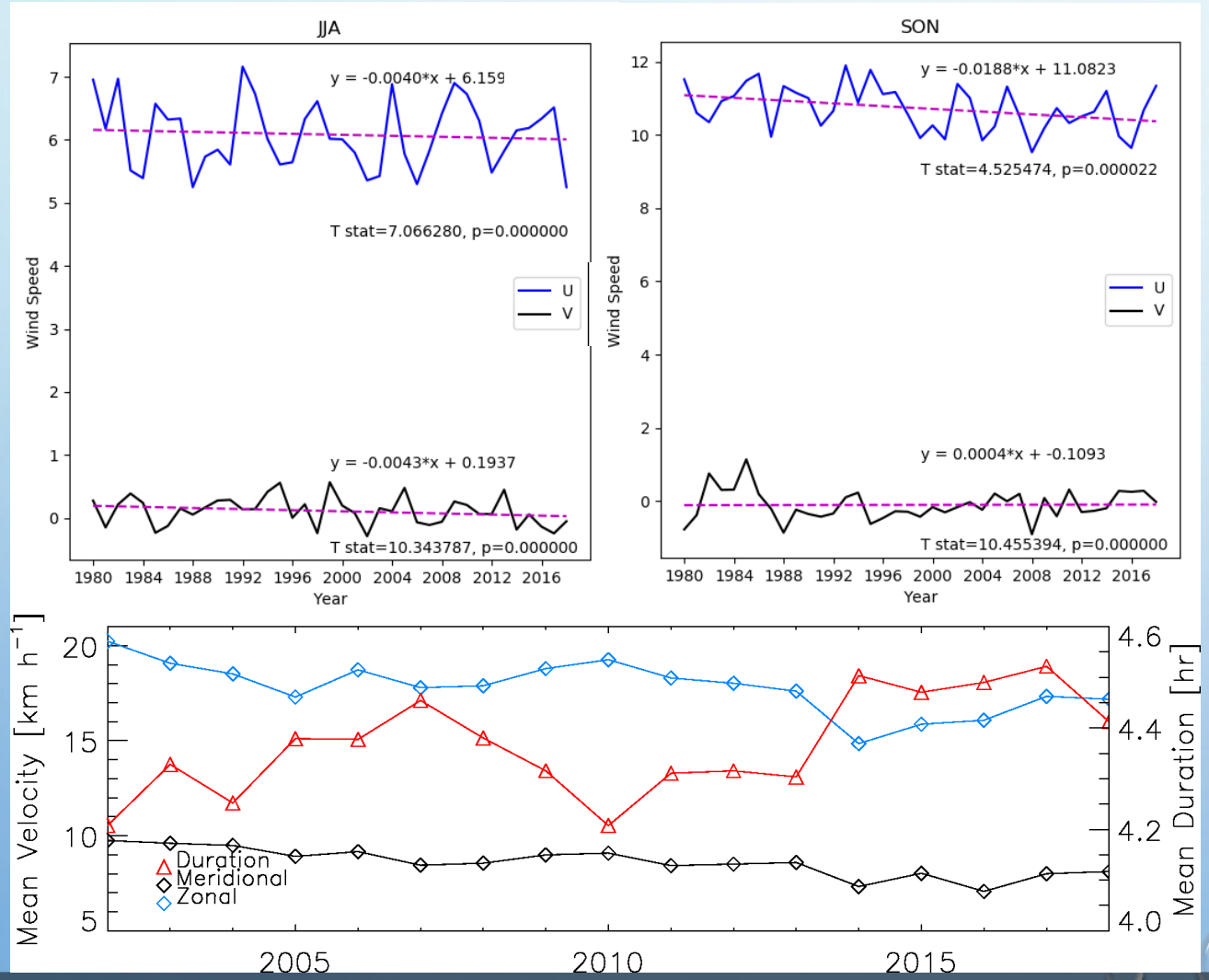


Next step:
Put EPEs in context of global circulation changes

Map: average E wind in spring since 1980

Contours: slope of spring trend since 1980

Wind Speeds



Seasonal averages over CONUS

- Slight trends in summer and fall wind speeds
- Decreasing propagation of shorter EPEs

Conclusions

- Developed codes that can:
  - Locate EPEs, collect variables, and plot them
  - Collect seasonal trends in wind speeds
- Future work: determine correlated variables
  - Many variables and events to work with!
- Wind speeds:
  - Seasonal variability and EPE propagation

Acknowledgements

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References

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- Zhou, Y., Nelson, K., Mohr, K. I., Huffman, G. J., Levy, R., & Grecu, M. (2019). A spatial-temporal extreme precipitation database from GPM IMERG. Journal of Geophysical Research: Atmospheres, 124, 10,344-10,363. https://doi.org/10.1029/2019JD030449

Thank you!

Questions?