

The Importance of Summer Season Fronts in Extreme Precipitation Events

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Overview

- Motivation
- Data
- Seasonal Results
- Regional Results
- Future Work





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Motivation





Motivation

- Fronts of extratropical cyclones are the single largest cause of heavy precipitation events in the continental United States.
- Analysis of 935 Cooperative Observer stations
- Dataset of 1-day heavy precipitation events exceeding a 1-in-5year occurrence.
- Each event attributed to one of seven possible "causes"





Motivation



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Motivation

- Fronts cause more than half of all extreme precipitation events*
- Fronts are the dominant cause of the increase



Source: Kunkel, K.E., D.R. Easterling, D.A.R. Kristovich, B. Gleason, L. Stoecker, and R. Smith, 2012: Meteorological causes of the secular variations in observed extreme precipitation events for the conterminous United States. *J. Hydromet.*, **13**, 1131-1141.





Data

- 935 Cooperative Observer Network Stations
- 1908-2013
- Continental U.S.
- Identified events which exceed a 1-in-5-year occurrence
 - Station ID
 - Year, Month, Day of occurrence
 - Precipitation amount (mm)

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- Type of Event
- 18,242 total events
- 13,061 total events attributed to fronts



Updated Time Series of Frontal Events





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Annual Time Series of All Events



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Number of Frontal Events per Station







Analysis of Top 5 Events per Station

- Analyzed the top 5 events per station over 104 year period = 20-year return
 - 18,241 total events, of which, 13,061 are attribute to fronts (71.6%)
- Calculated the percentage of these top 5 events that are attributed to frontal events
 - 4,675 total "Top 5" events, of which, 3,141 are attributed to fronts (67.2%)
- Assigned frequency as one of 6 possible frequencies:
 - 0%
 - 20%
 - 40%
 - 60%
 - 80%
 - 100%

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Percentage of Top 5 Events per Station





Number of Events per Season





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Cold Season Results (Nov-Apr)









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Warm Season Results (May-Oct)









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Warm Season Results (May-Oct)









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Regional Results - Midwest







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Regional Results - Midwest





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Regional Results - Southeast







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Regional Results - Southeast





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Future Work

- Analyze top events for significant regions
- Identify patterns in atmospheric variables
- Derive "typical" dynamic picture for predictability of future events of the similar magnitude





Conclusions

- Summer fronts are the dominant cause of extreme precipitation in the Midwest region
- Summer fronts are also important in the Southeast region
- Of 18,241 total events, 71.6% are attributed to fronts
- Of 4,676 top 5 events for each observing station, 67.2% are attributed to fronts

