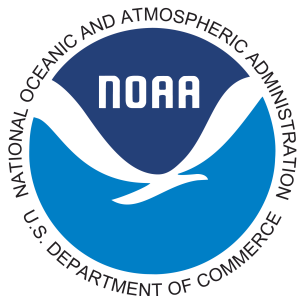


Heavy and Extreme Precipitation from Supercell Thunderstorms in the United States

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Motivation

- Supercells produce severe weather more frequently and at higher intensities than other morphologies (Duda and Gallus 2010)
- Moller et al. (1994) introduced supercell spectrum, noting prevalence of “high-precipitation” supercells
- Doswell (1994, 1999) suggested importance of supercells as heavy precipitation producers

Motivation

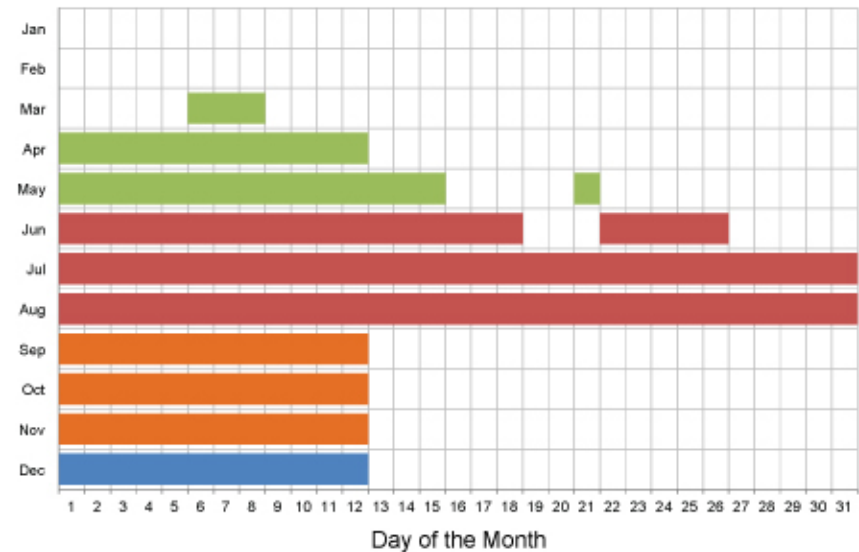
- Previous studies examined individual cases of heavy and extreme rainfall from **supercells** (e.g. Smith et al. 2001; Rogash and Smith 2000; Rogash and Racy 2002)
- Our goal is to objectively identify and classify convective storms and assess the contribution of supercells to the climatology of heavy and extreme precipitation

Description of Data

- 3D mosaicked radar data used with WDSS-II algorithm to classify convective storm types
 - Storm typing at 200-km scale by decision tree
 - Variables include reflectivity, VIL, mid-level shear
 - Data every 5-min at $.01^\circ \times .01^\circ$ grid spacing

Description of Data

- “Dataset of opportunity” used due to high computational expense to run WDSS-II storm-typing algorithm
 - 164 days from 10 months during the year 2009

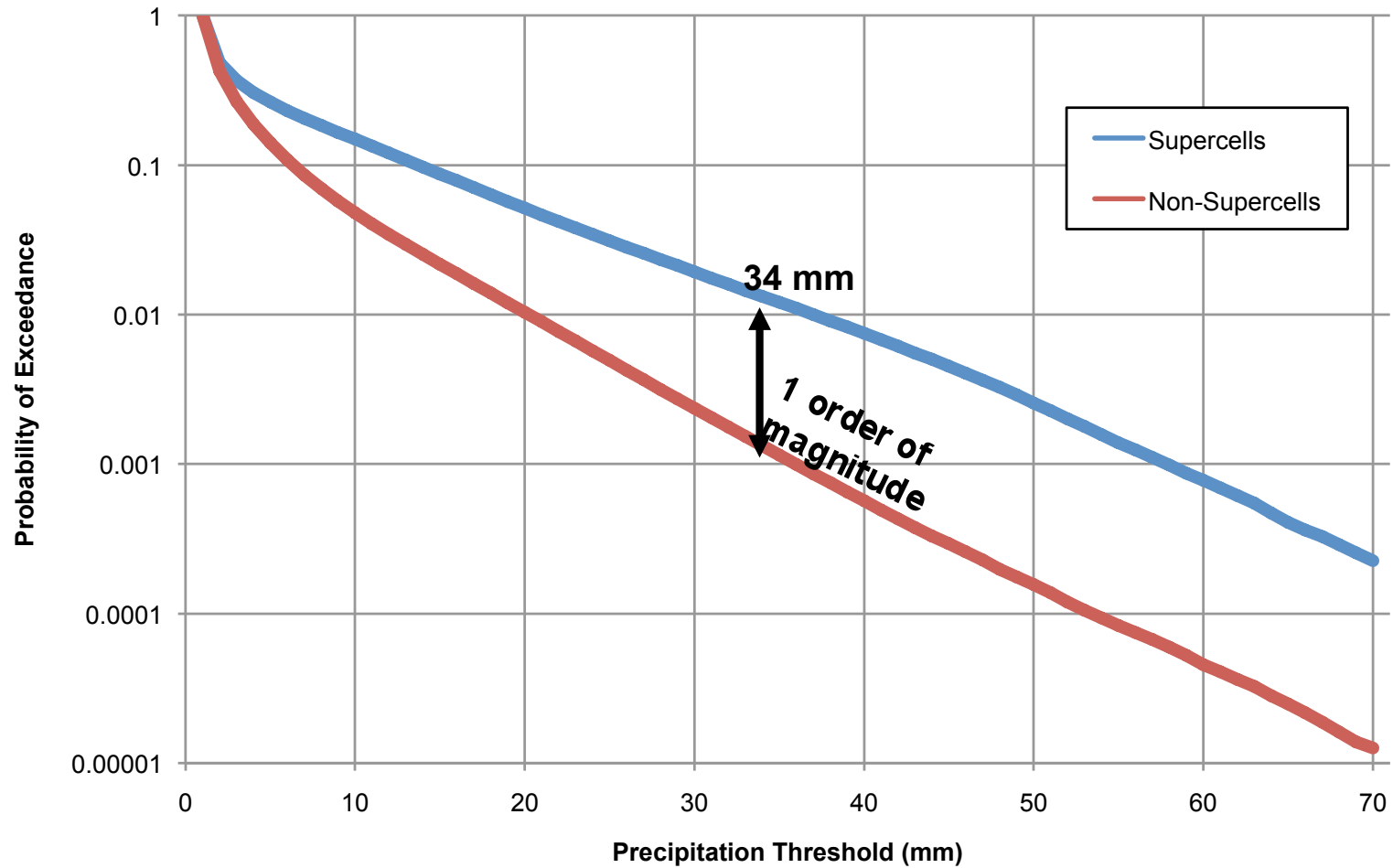


- Next-generation QPE (Q2) gauge-adjusted radar product used for rainfall (Vasiloff et al. 2007; Zhang et al. 2011)
 - Hourly accumulations for 2009 at $.01^\circ \times .01^\circ$ grid spacing

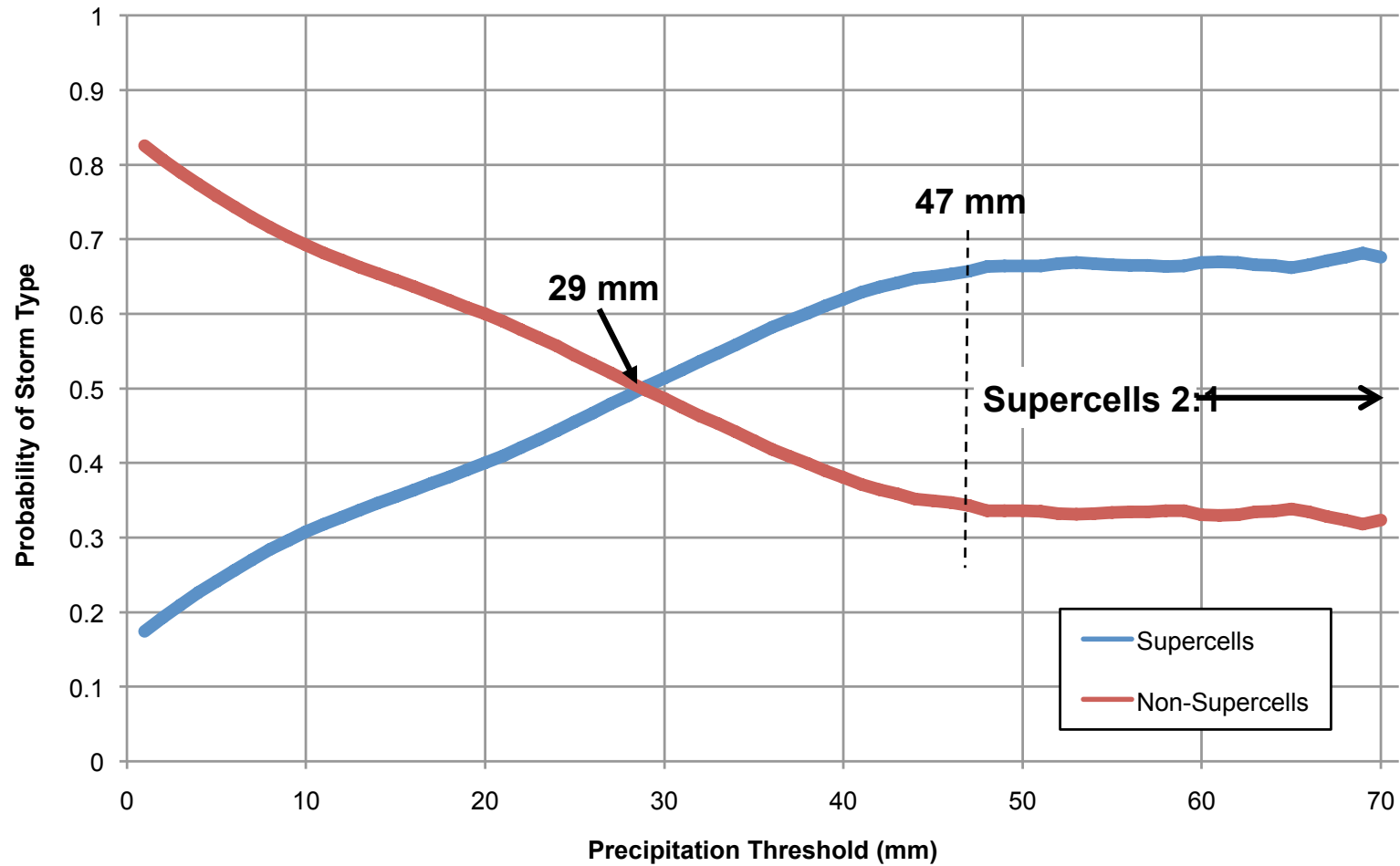
Methods

- WDSS-II algorithm identifies storms as supercell or non-supercell for each volume
 - Individual storms tracked between scans
- Q2 rainfall associated with storms during hour
 - Considered supercellular if storm classified as such at least once during hour
 - Other storms must be identified in 10 of 12 scans

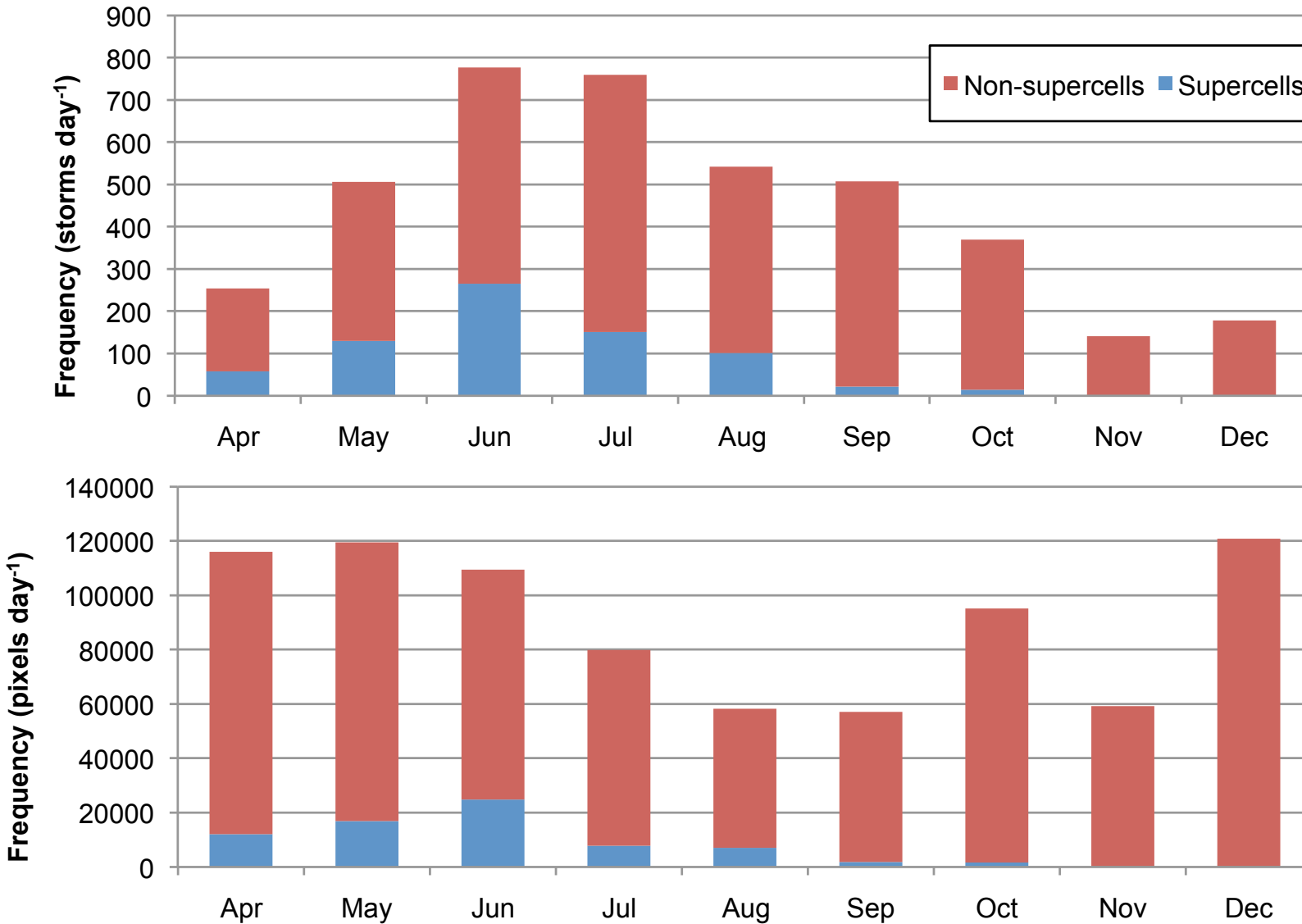
Probability of Exceedance (POE) by Storm Type



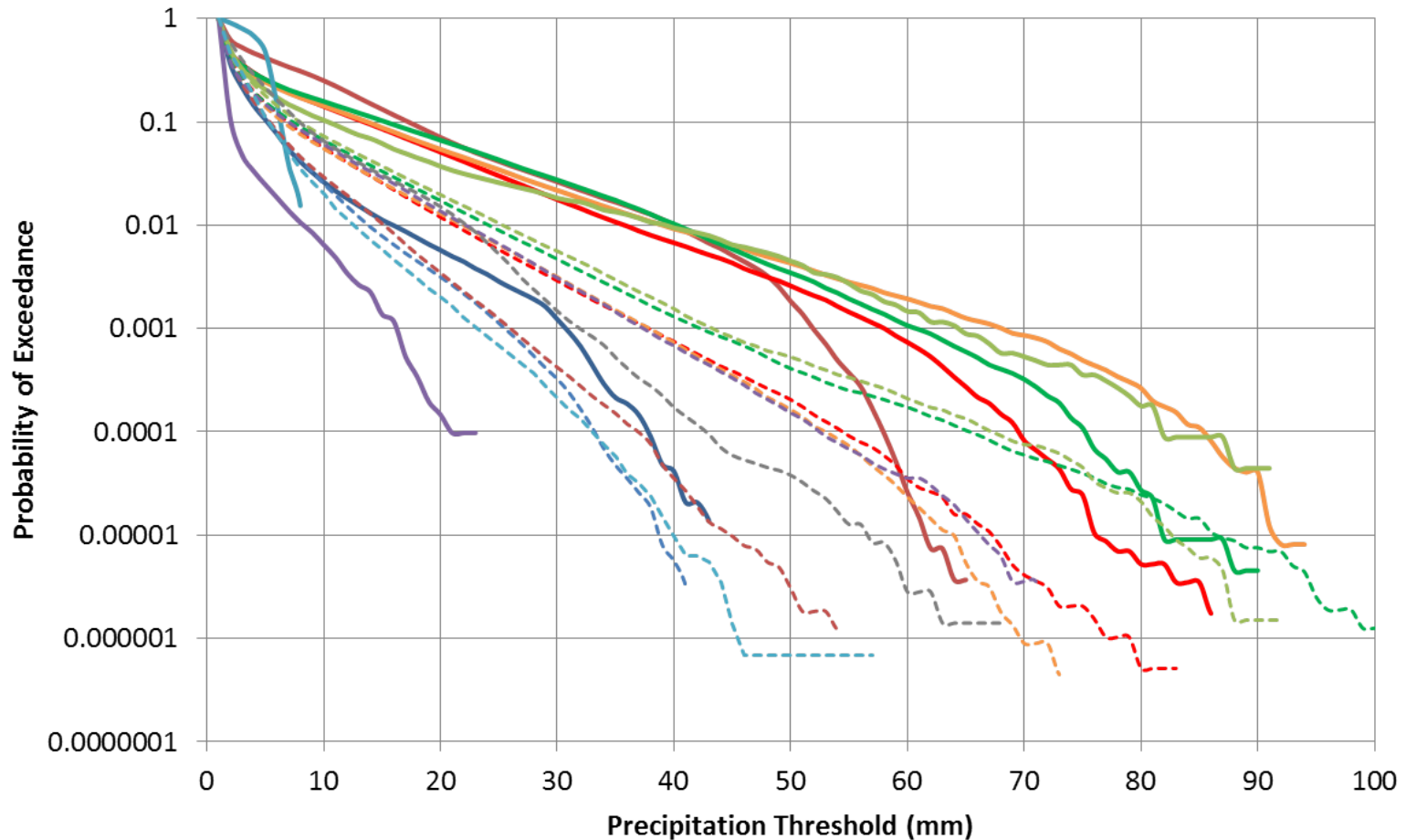
Probability of Storm Type (POST) by Exceedance Threshold



Frequency of Storms by Month

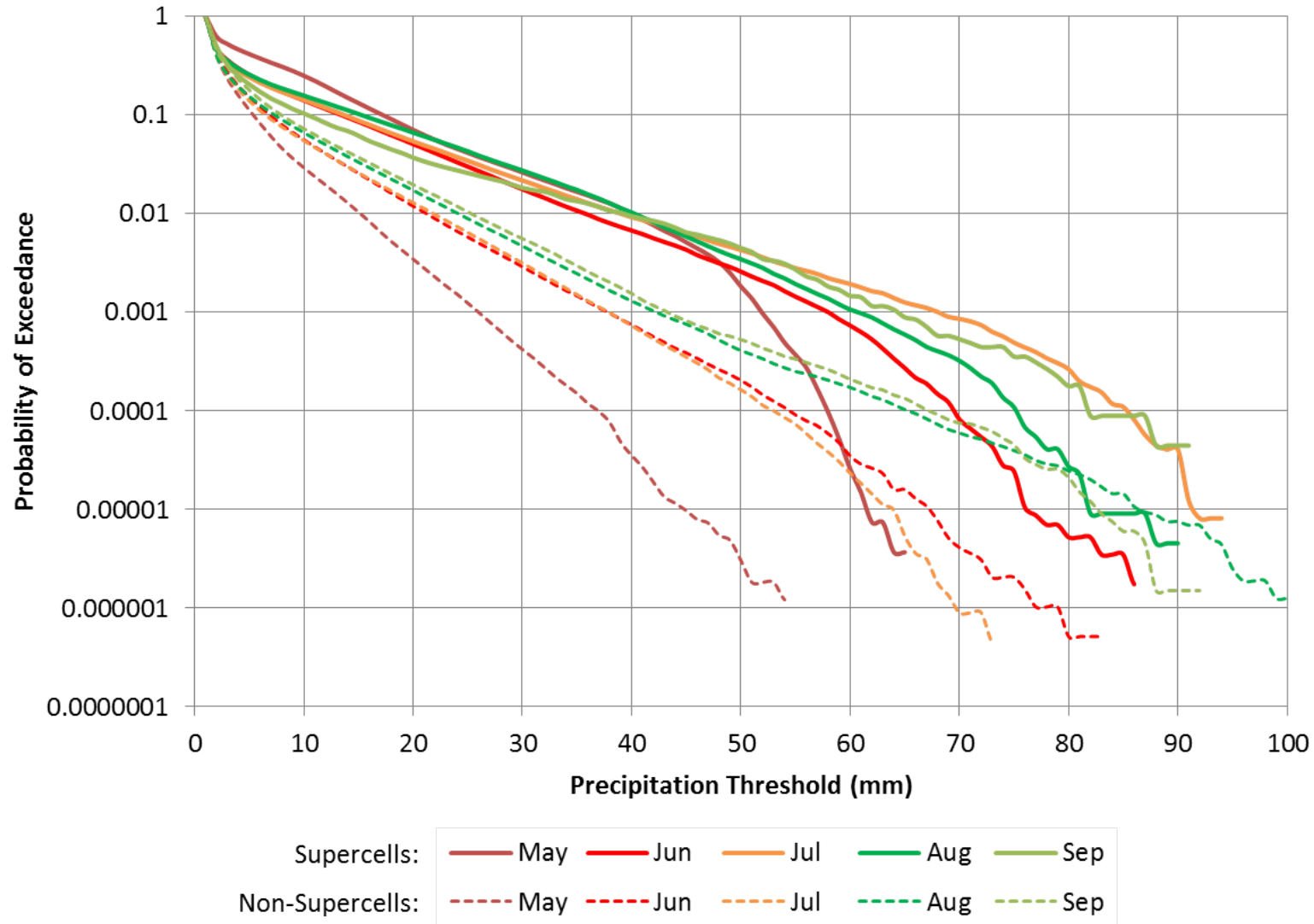


POE by Month

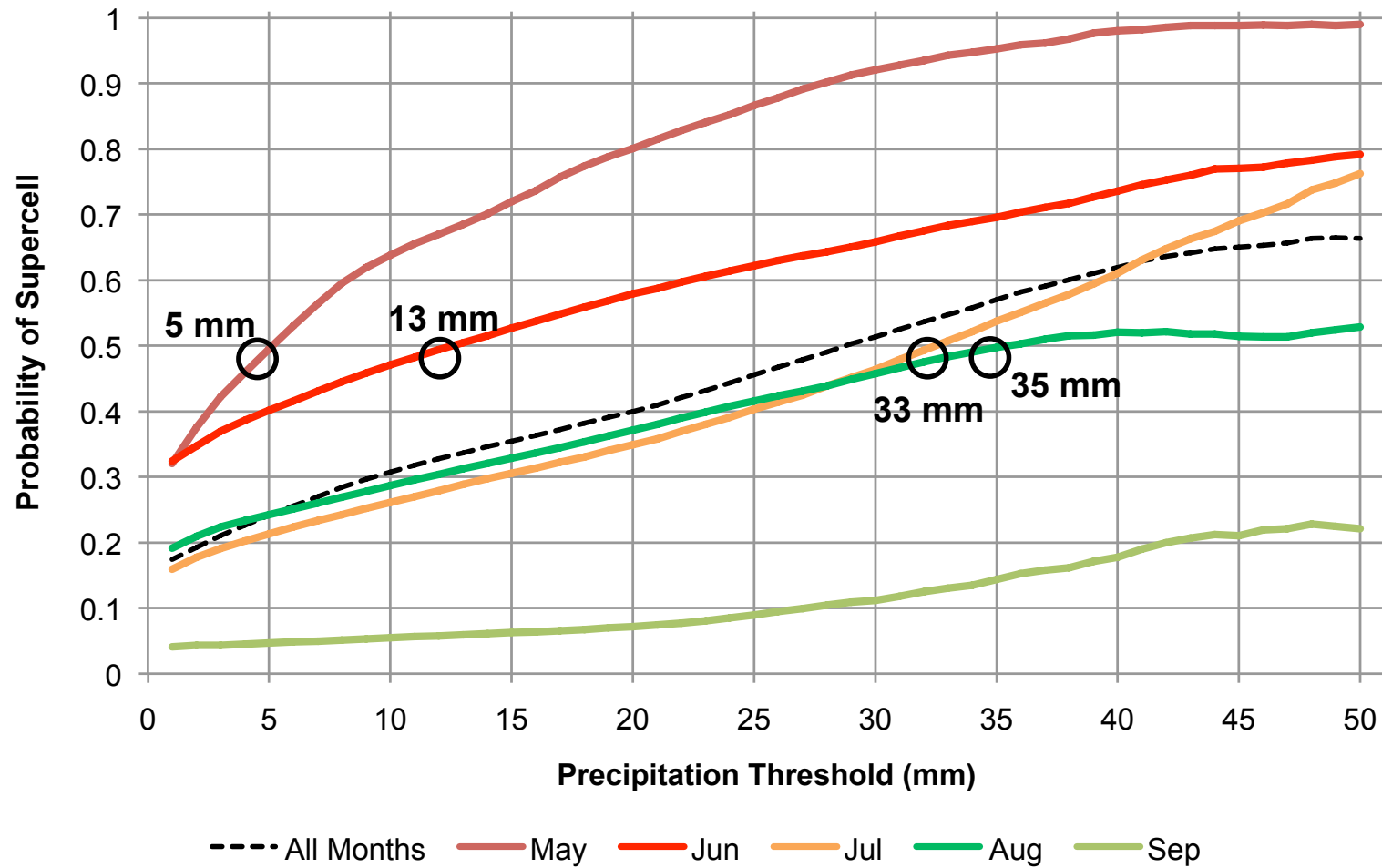


Supercells:	— Apr	— May	— Jun	— Jul	— Aug	— Sep	— Oct	— Nov	— Dec
Non-Supercells:	- - - Apr	- - - May	- - - Jun	- - - Jul	- - - Aug	- - - Sep	- - - Oct	- - - Nov	- - - Dec

POE for Selected Months



POST for Selected Months



Conclusions

- Supercell thunderstorms produce heavy and extreme precipitation more frequently than other convective storms
- Hourly rainfall exceeding 47 mm is twice as likely to be produced by supercells
- Early warm season dominated by supercell rainfall while other storms dominate later