Potential Predictability and Impacts of Subseasonal Extreme Precipitation Events in the United States

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Motivation
- S2S prediction of climate extremes is needed for disaster mitigation.
- Flooding is costliest of all natural disasters (Miller et al. 2008)
- Most studies focus on precipitation on the daily timescale and show increasing daily precipitation.
  - (Karl & Knight, 1998; Kunkel et al., 1999; Groisman et al., 2012 seen to right).
- Yet, planning for these events would ideally happen at a longer timeframe than current daily forecasts.
Defining our extreme events

Using a 14 day sliding window from Jan 1, 1981 to Dec 31, 2018:

1. Total area of rainfall exceeding PRISM 95th percentile of 14 day precipitation must be above the area threshold
2. Area-averaged precipitation must exceed 10 mm/day for 5 (or 3 for MW) of the total 14 day sliding window
3. The heaviest rainfall day and the surrounding two days must not exceed 50% of the event precipitation
4. If events are overlapping, the event with the higher rainfall totals is chosen as the event

<table>
<thead>
<tr>
<th>Area Threshold (km²)</th>
<th>WC</th>
<th>MW</th>
<th>NP</th>
<th>SP</th>
<th>SE</th>
<th>GL</th>
<th>NE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event Count</td>
<td>51</td>
<td>50</td>
<td>17</td>
<td>57</td>
<td>46</td>
<td>54</td>
<td>38</td>
</tr>
</tbody>
</table>

Potential Predictability

- Congruence Coefficient
  \[ r_c = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} \]
  
  \( X \rightarrow \) Composite of all event days
  
  \( Y \rightarrow \) Composite of 14 day sliding window from 1981-2018

- Found hits/false alarms from a Congruence Coefficient threshold of 0.35

- Used Composites of geopotential heights (circles) and the combination of geopotential heights and precipitable water (diamonds)
### Summary of Regional NCEI Storm Reports

<table>
<thead>
<tr>
<th>Region</th>
<th>Common Storm Report Types</th>
<th>Significantly more reports than 1000 random non-events</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE</td>
<td>Tropical Storm, Winter Reports, Convective Reports</td>
<td>Flash Flood: *, Flood: *, Heavy Rain: *</td>
</tr>
<tr>
<td>SE</td>
<td>Tropical Storm, Convective Reports</td>
<td>Flash Flood: *, Flood: *, Heavy Rain: *</td>
</tr>
<tr>
<td>GL</td>
<td>Convective Reports</td>
<td>Flash Flood: *, Flood: *, Heavy Rain: *</td>
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</tr>
<tr>
<td>SP</td>
<td>Convective Reports, Drought</td>
<td>Flash Flood: *, Flood: *, Heavy Rain: *</td>
</tr>
<tr>
<td>MW</td>
<td>Winter Reports, Convective Reports, Drought</td>
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</tr>
</tbody>
</table>

* indicates significantly more reports compared to 1000 random non-events.
Conclusions

• Impacts are related to seasonality of the regions.
• Significantly more flooding was seen during our 14 day events for all regions.
• Our event’s geopotential and precipitable water composites are not unique to event periods.
• Highest skill is seen for the West Coast and Great Lakes.

• Many other factors that could be considered
• Use new database of extreme events that does not utilize regional boundaries (Dickinson et al. 2021).
• Utilize seasonal models to look at predictability of events.