

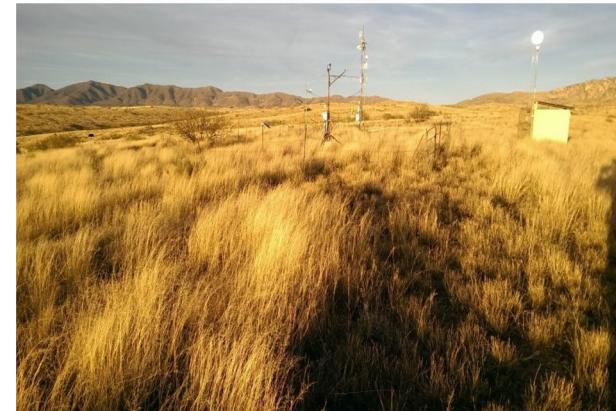
# Drivers of Extreme Carbon Sources and Sinks Across Diverse Ecosystems in the Western USA



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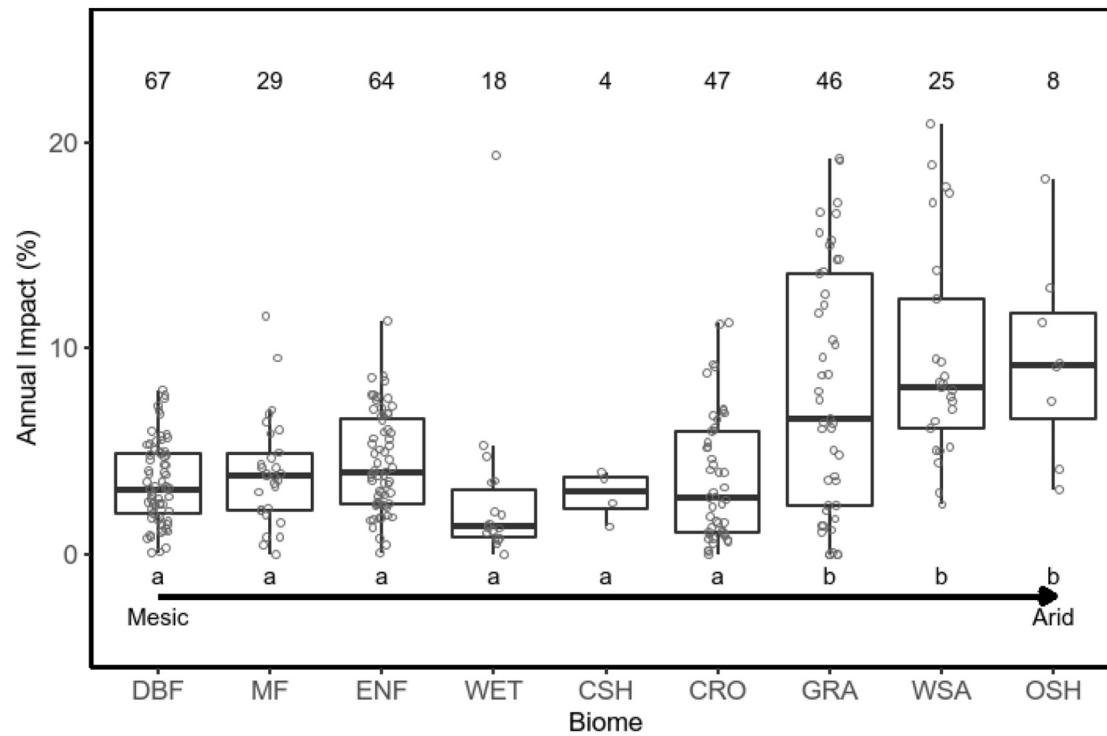
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<sup>2</sup>School of Life Sciences, University of Nevada



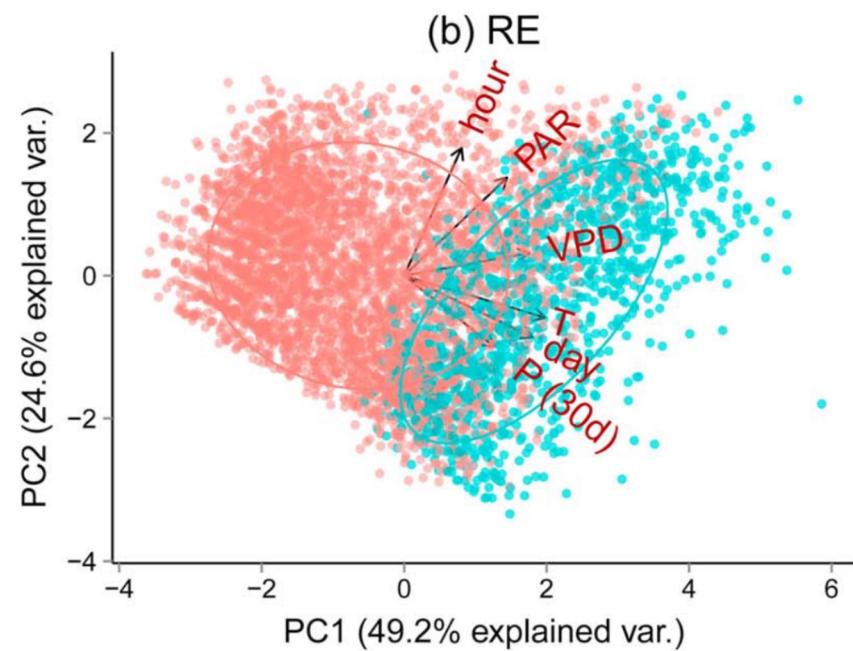
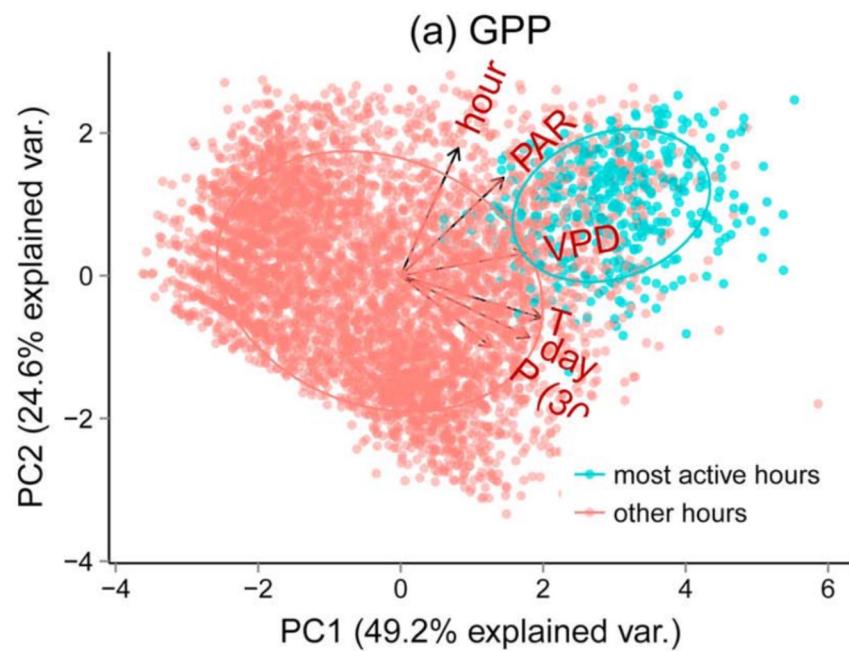
(Scott, 2015)

# Extreme carbon fluxes exert outsized influence in arid ecosystems



(Kannenberg 2020)

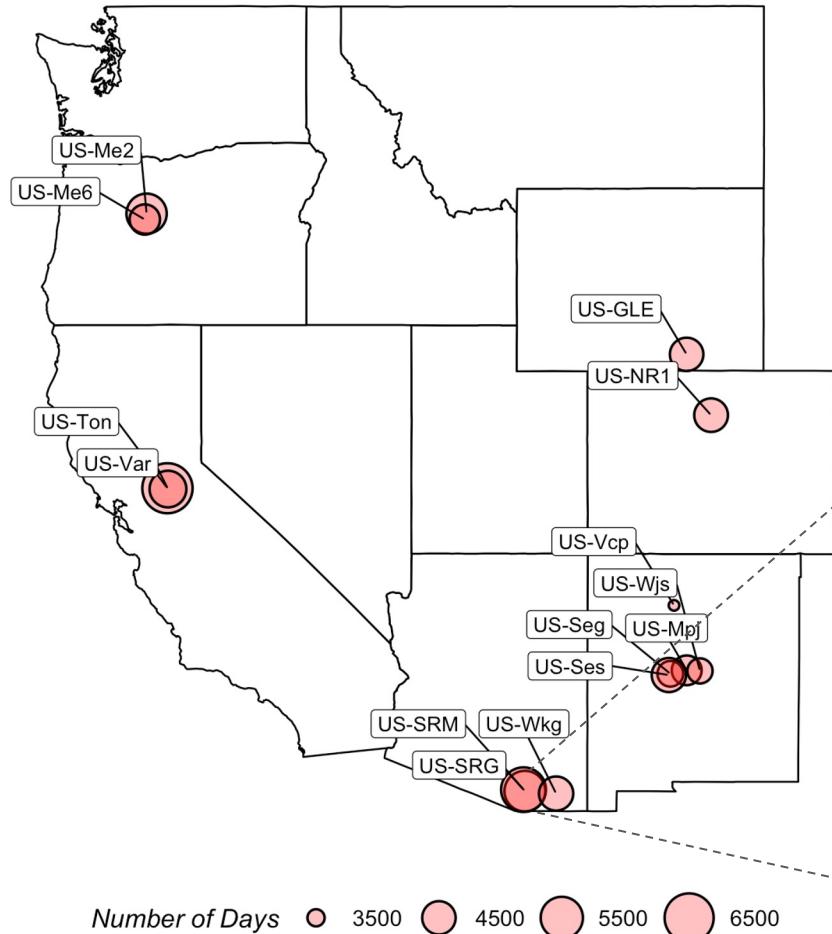
# Extreme are not instantaneous responses



(Zscheischler 2016)

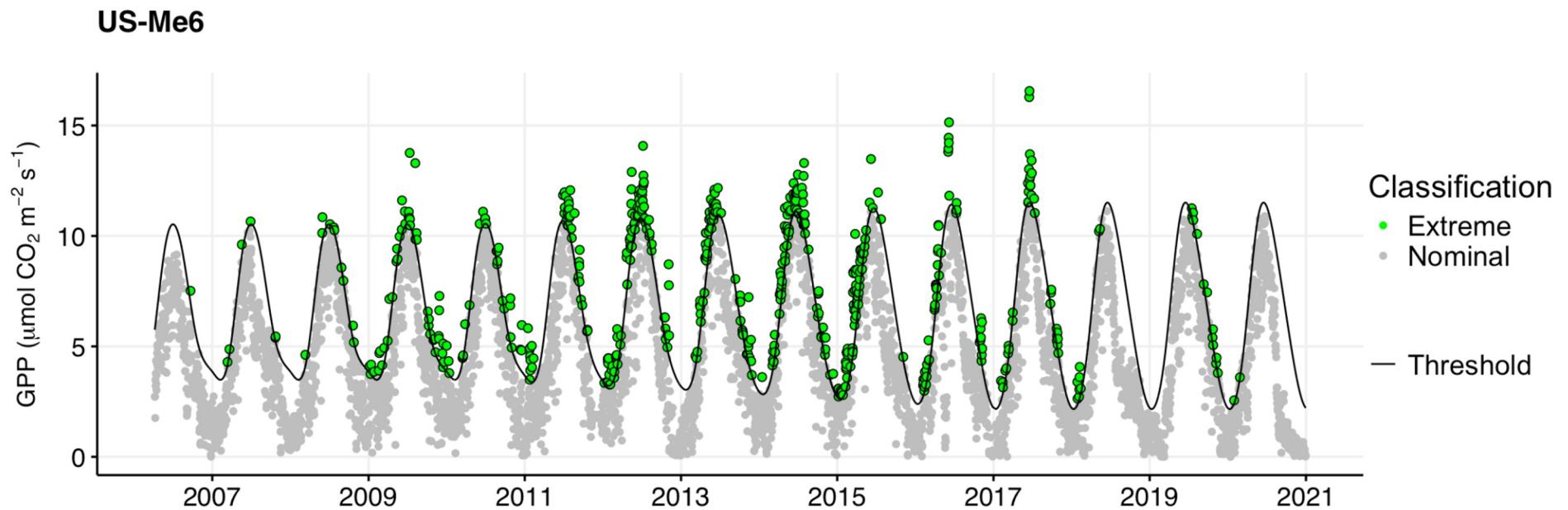
**What variables are key drivers of daily extreme sinks and sources in the western USA?**

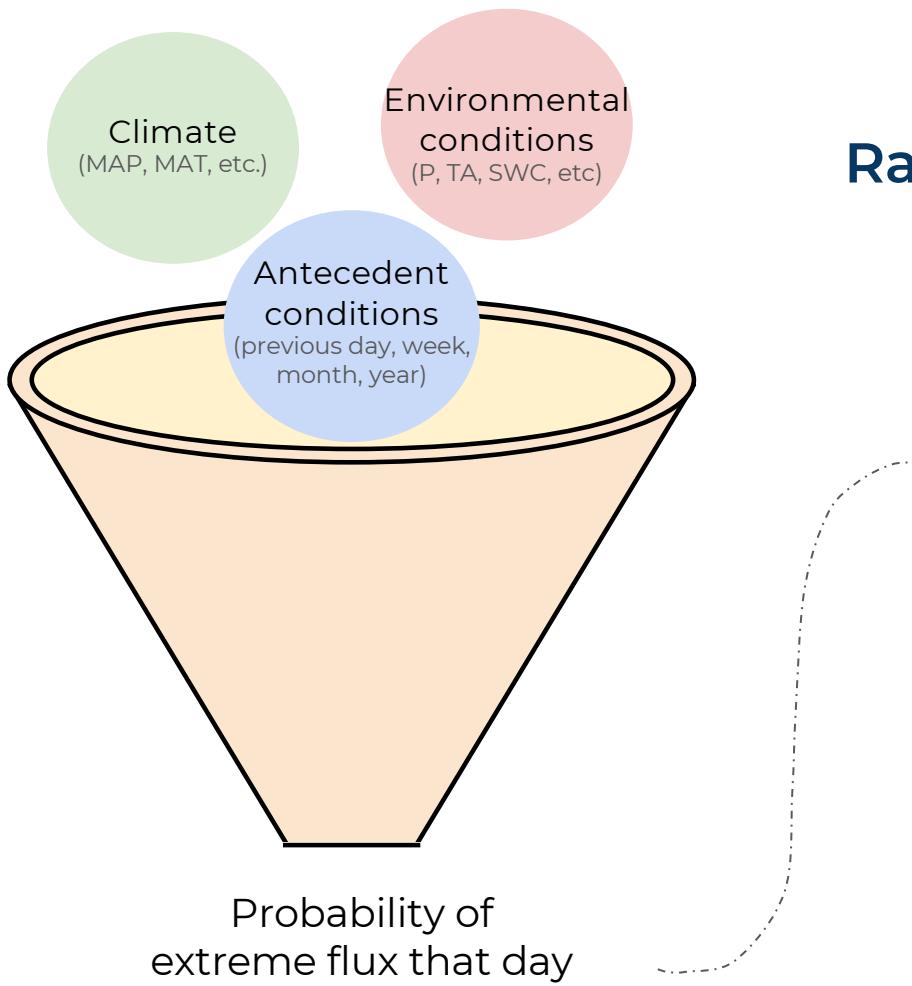
**Across what antecedent timescales are they most important?**



(Templeton 2011)

## Extreme sinks and sources classified defined by surpassing a seasonal 95th percentile threshold



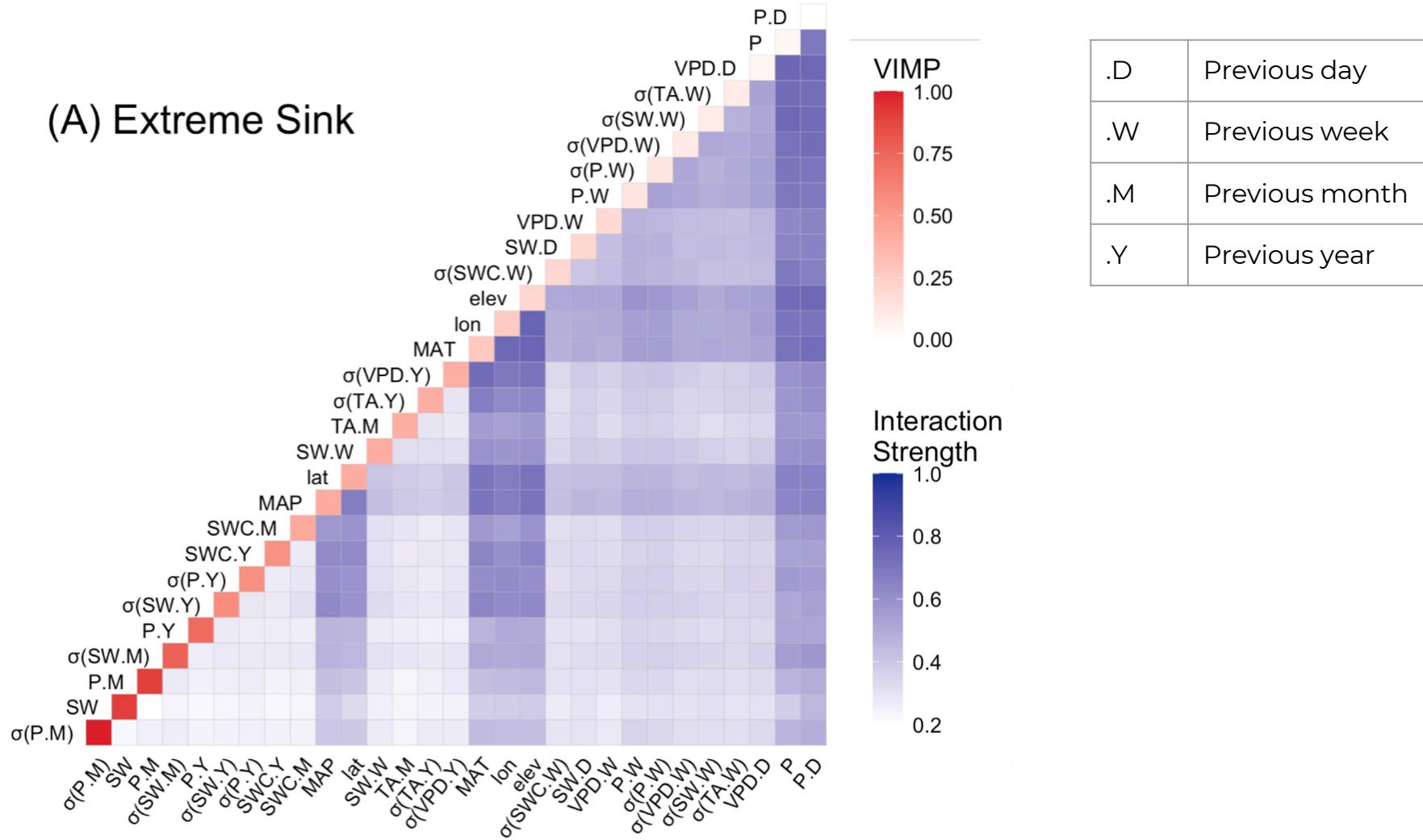


## Random forest classifiers

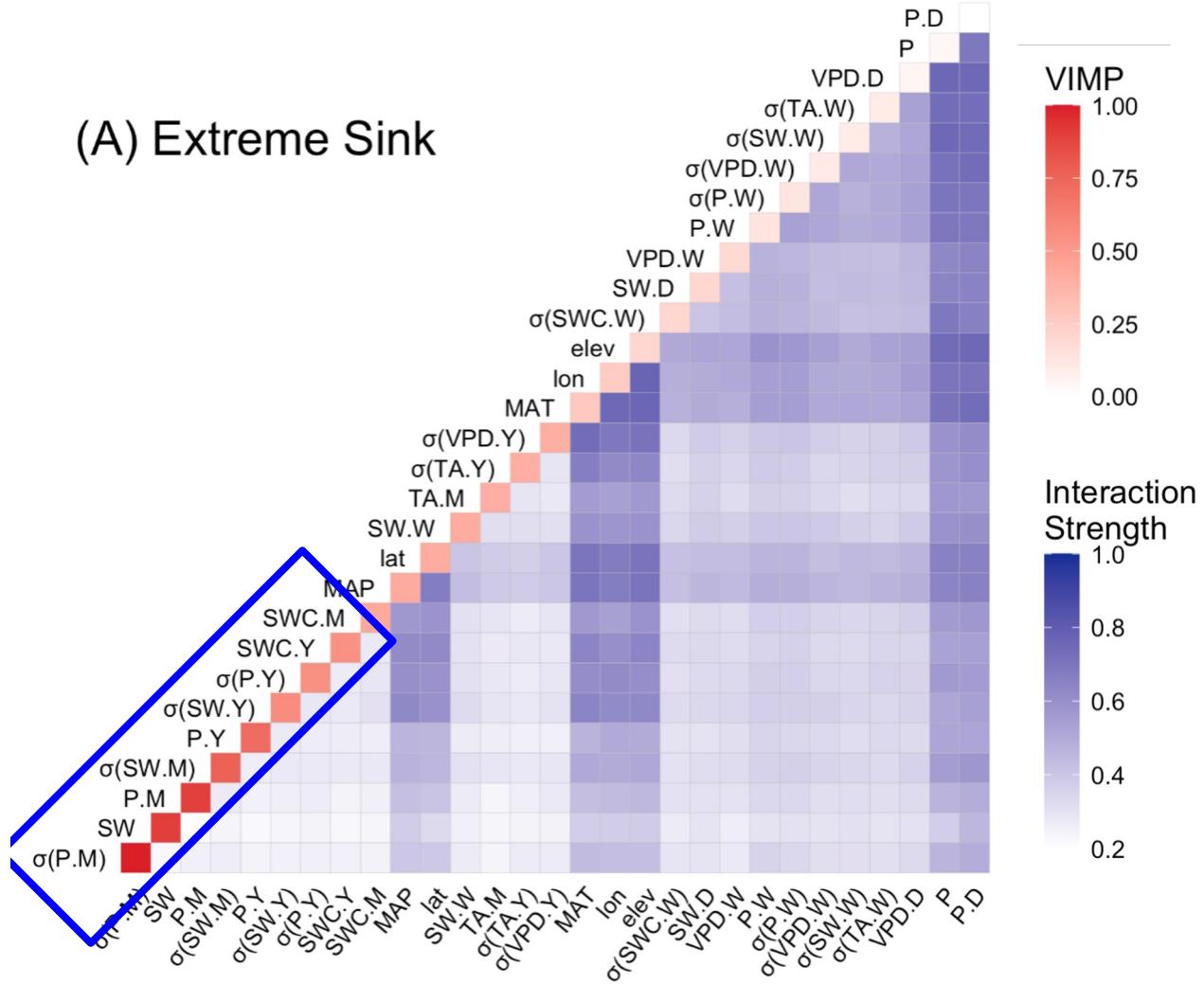
$p \geq 0.5 \Rightarrow$  Extreme flux

$p < 0.5 \Rightarrow$  Typical flux

(A) Extreme Sink



## (A) Extreme Sink

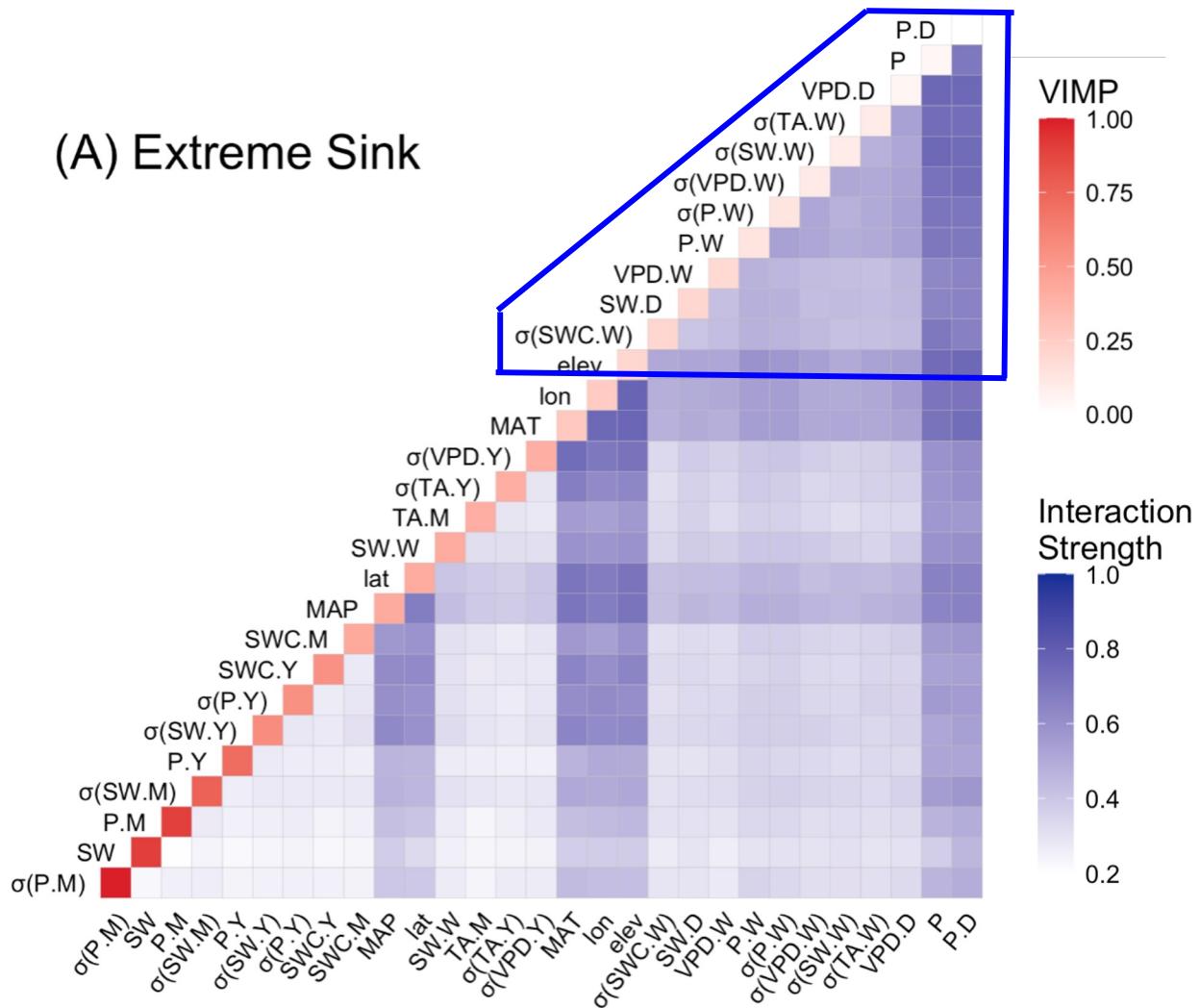


●

- Month- and year-long timescales are most important.

.D	Previous day
.W	Previous week
.M	Previous month
.Y	Previous year

## (A) Extreme Sink

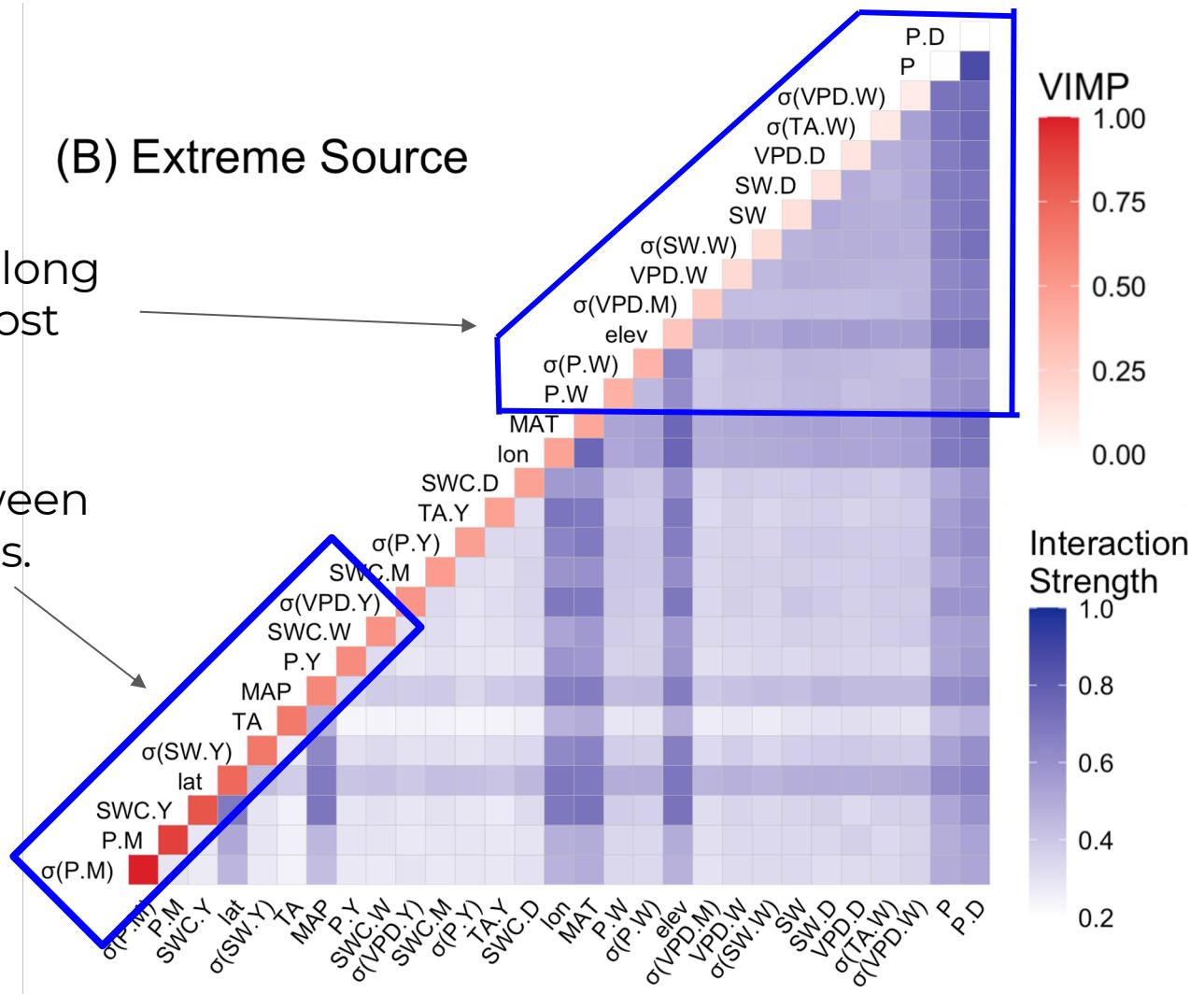


.D	Previous day
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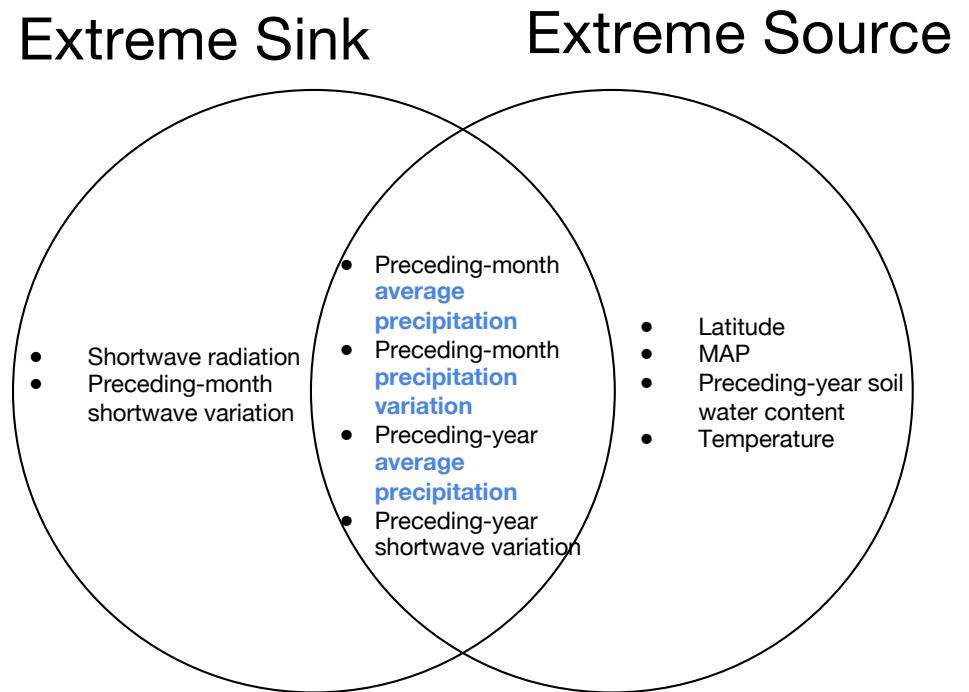
- Month- and year-long timescales are most important.
- Interactions between shorter timescales.

## (B) Extreme Source

- Month- and year-long timescales are most important.
  - Interactions between shorter timescales.



**Month- and year-long precipitation conditions are amongst the top influential drivers for extremes.**



VIMP > .05

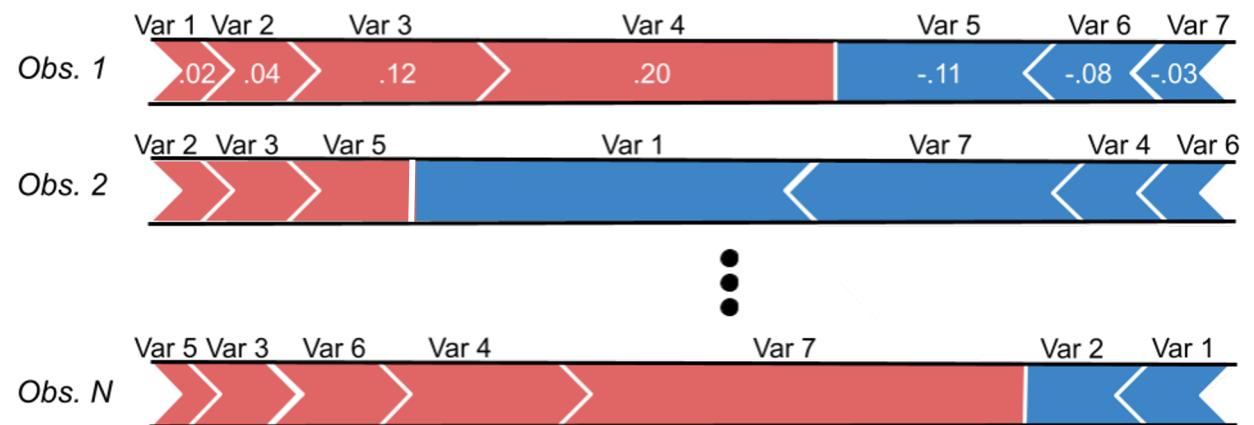
## SHAP values link variable importance to observation-specific impact.

$$f(x) = \text{mean prediction} + \sum(\text{SHAP values})$$

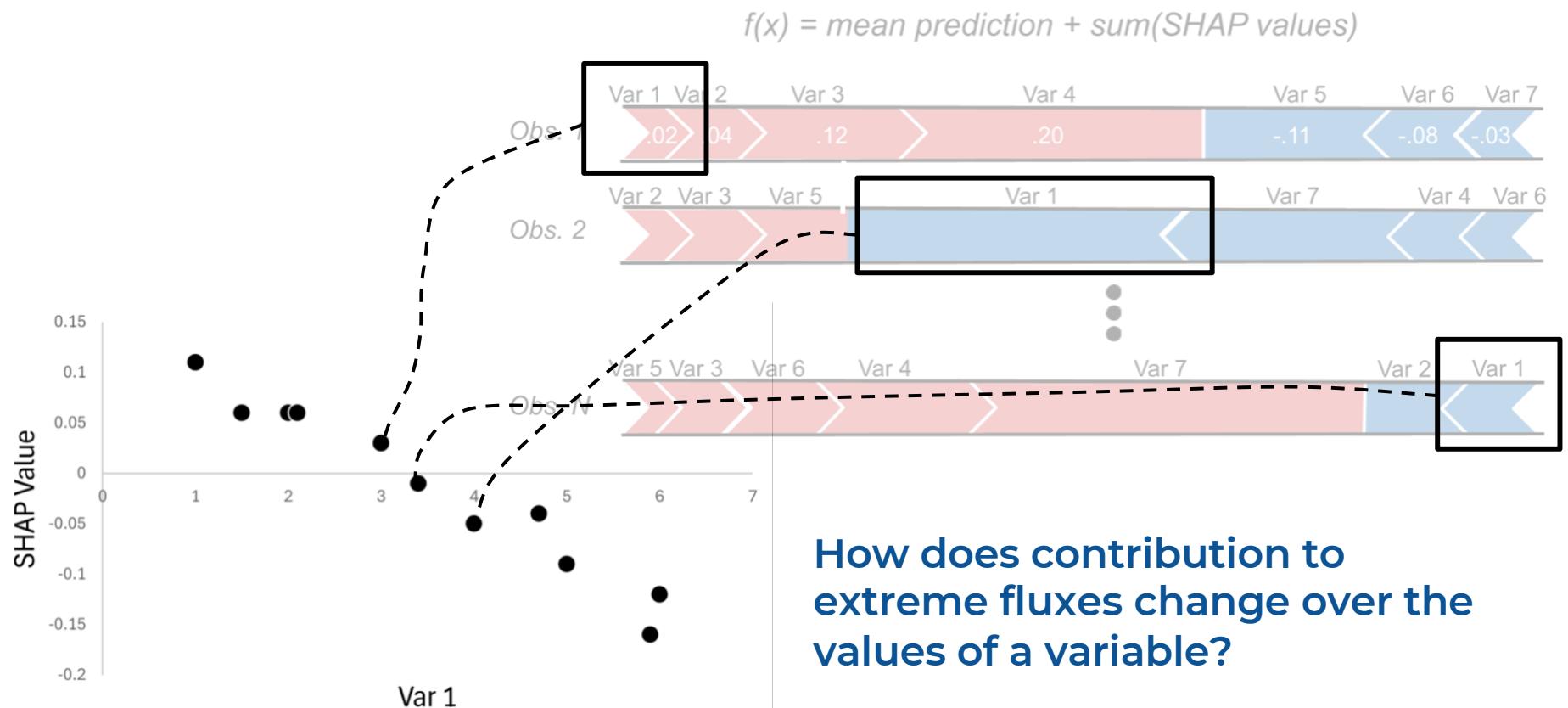


## SHAP values link variable importance to observation-specific impact.

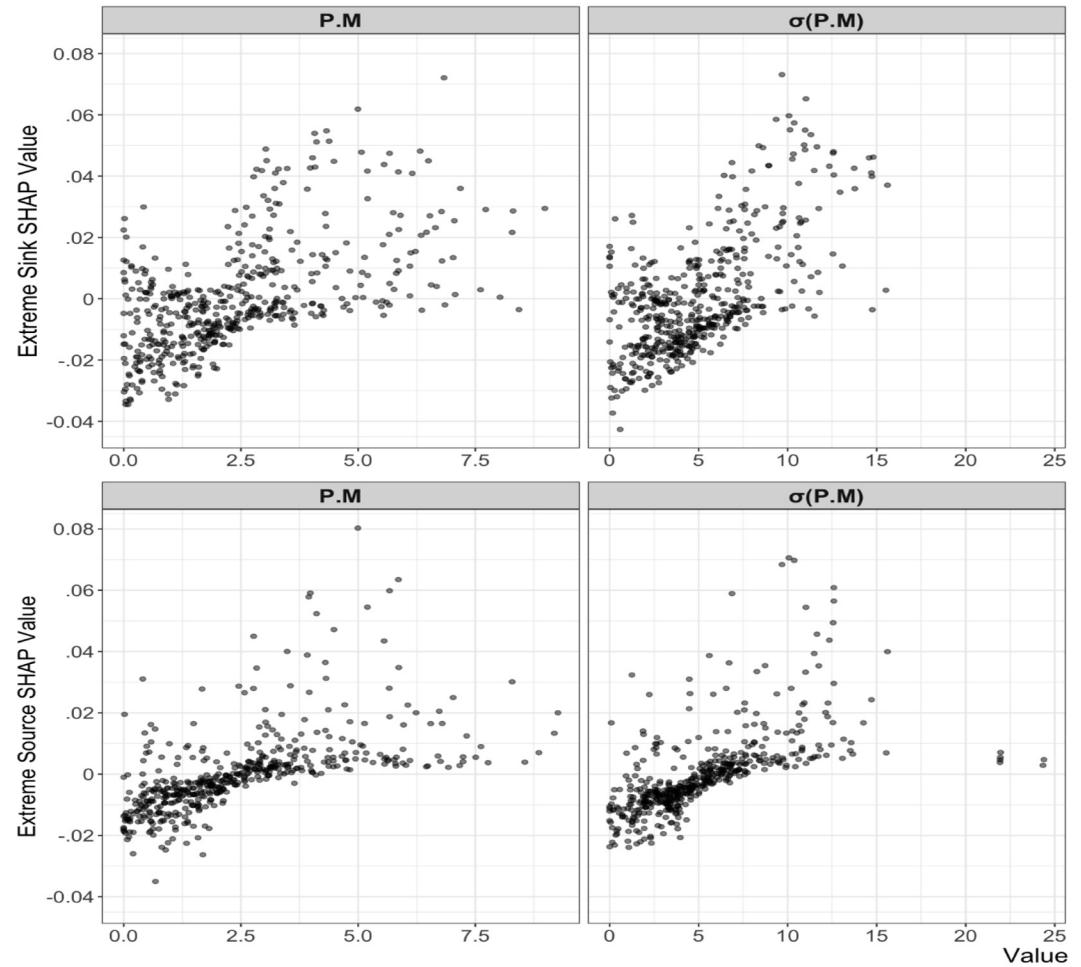
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## SHAP values link variable importance to observation-specific impact

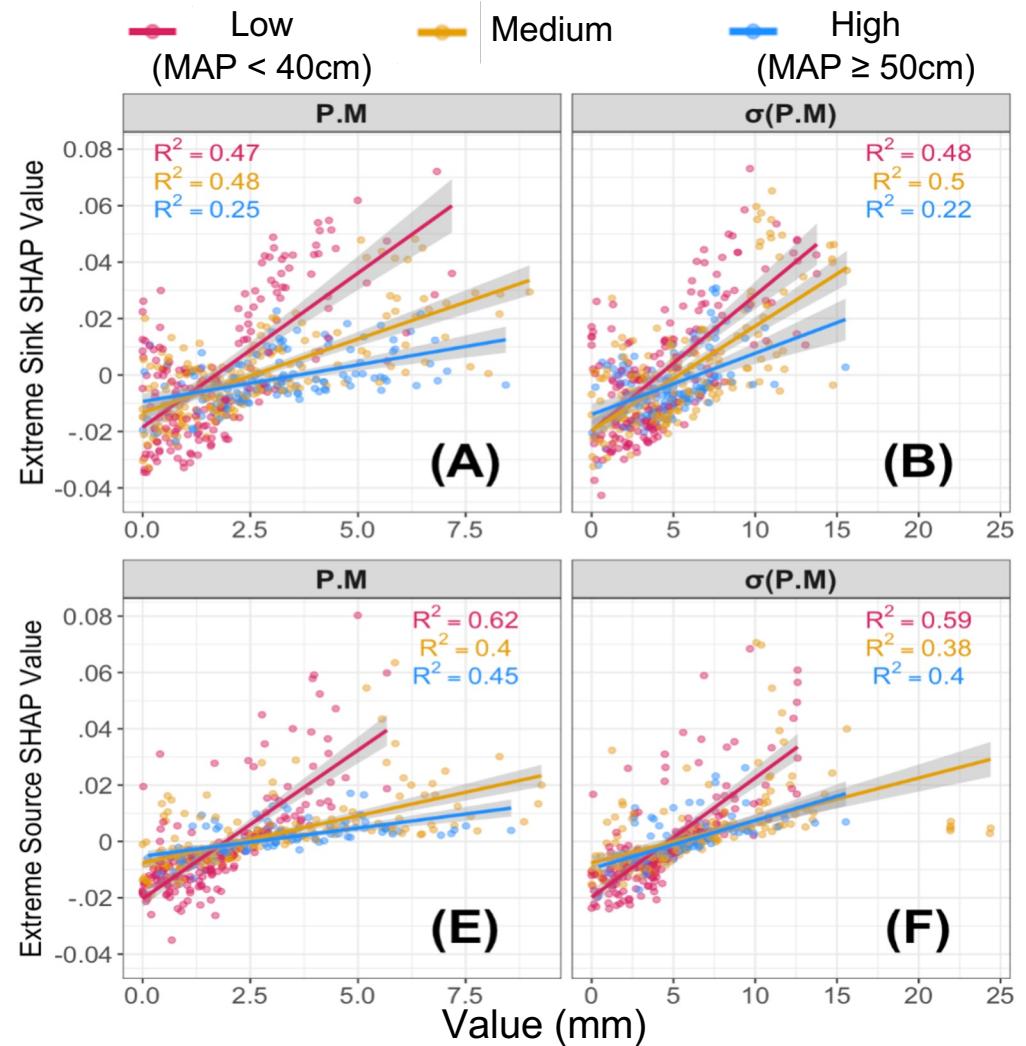


# Patterns of large, but infrequent precipitation events.



**Patterns of large, but infrequent precipitation events.**

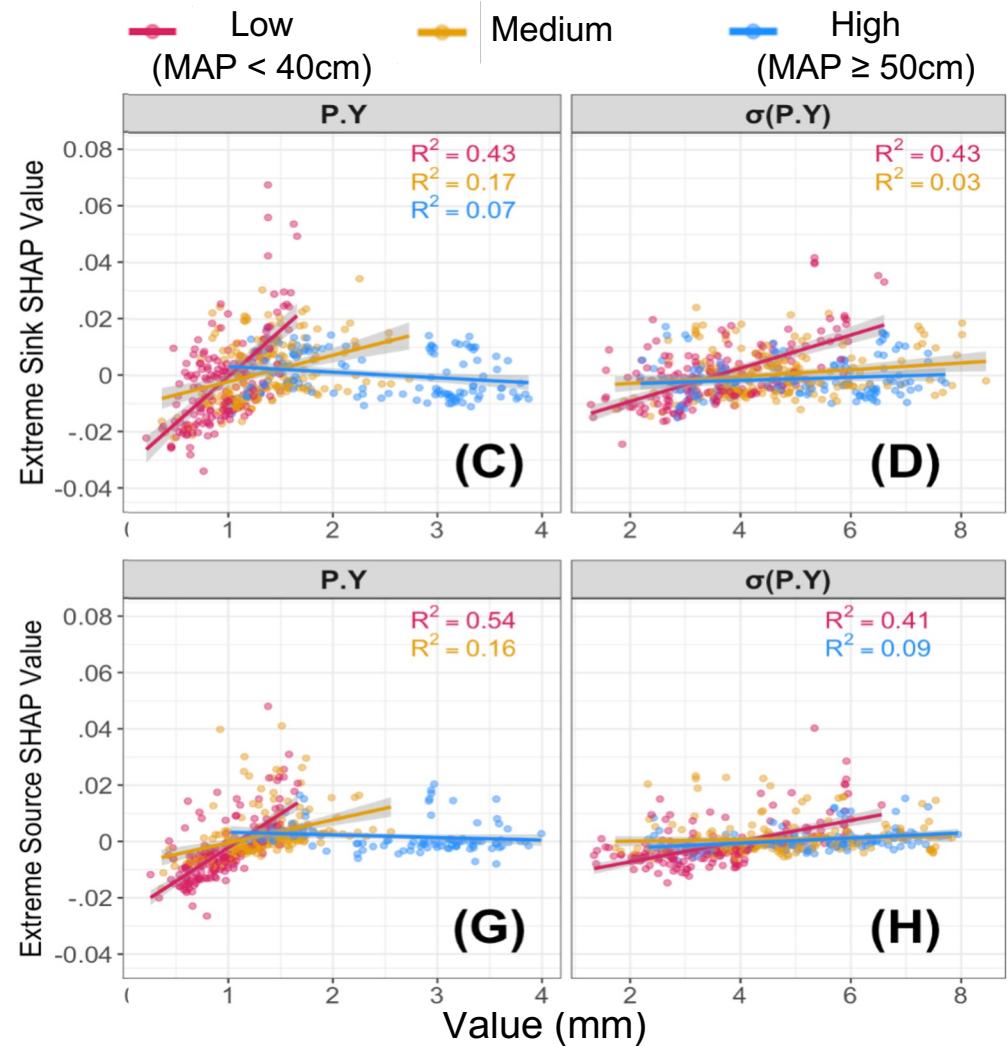
**Water limitation amplifies effects of precipitation packaging over month-long timescales.**



**Patterns of large, but infrequent precipitation events.**

**Water limitation amplifies effects of precipitation packaging over month-long timescales.**

This effect extends to the year-long timescale as well.



# Summary



- Intermediate to longer timescales have leading implications on daily extremes.
- Patterns of larger, but infrequent precipitation events over the previous month maximize extreme probabilities.
- Impact and memory of precipitation increases with water-limitation.

# Thank you!

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