# Mechanisms Responsible for Precipitation and Snowpack in the Upper Colorado River Basin: Preliminary Findings


Western Regional Climate Center
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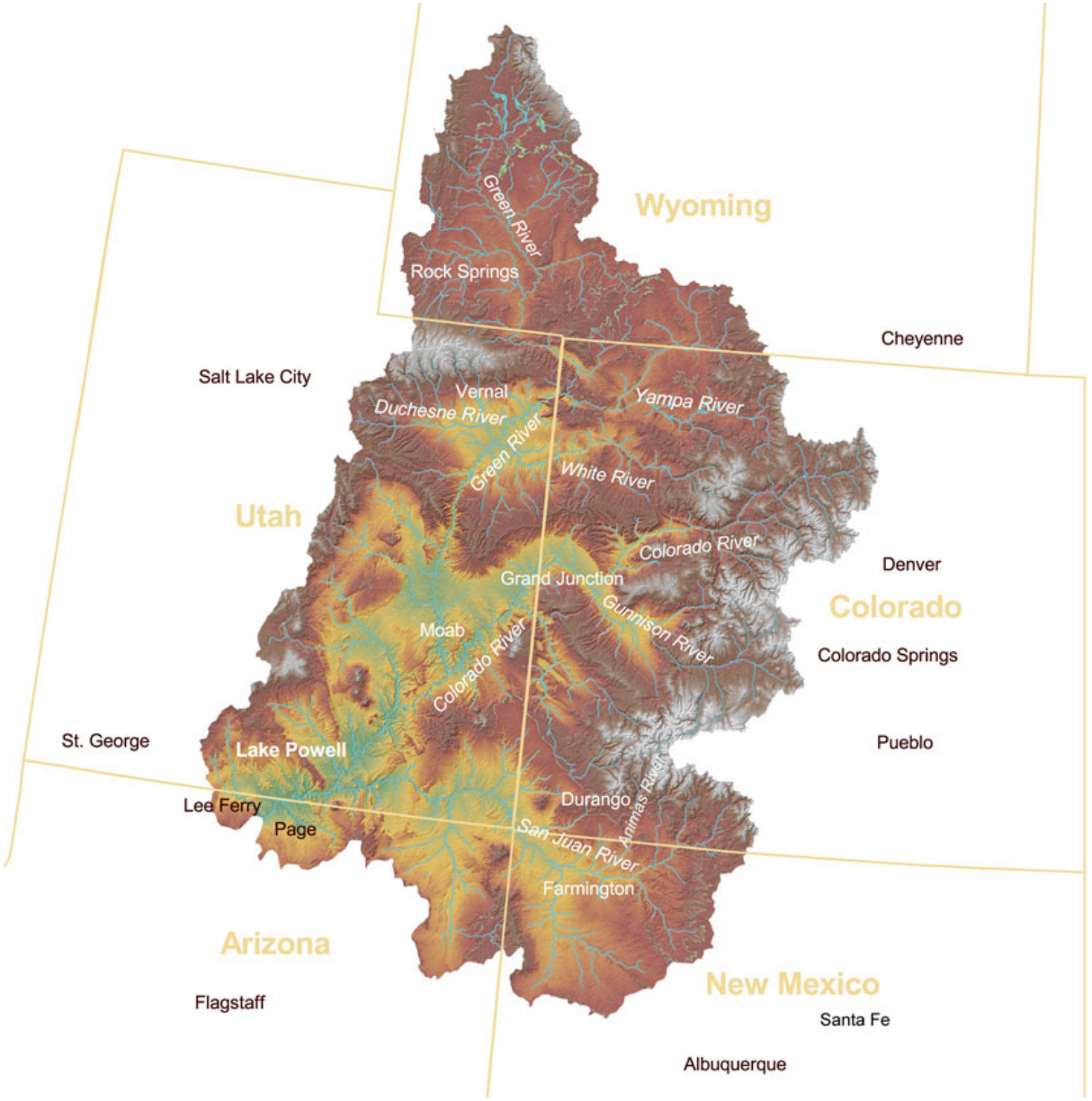
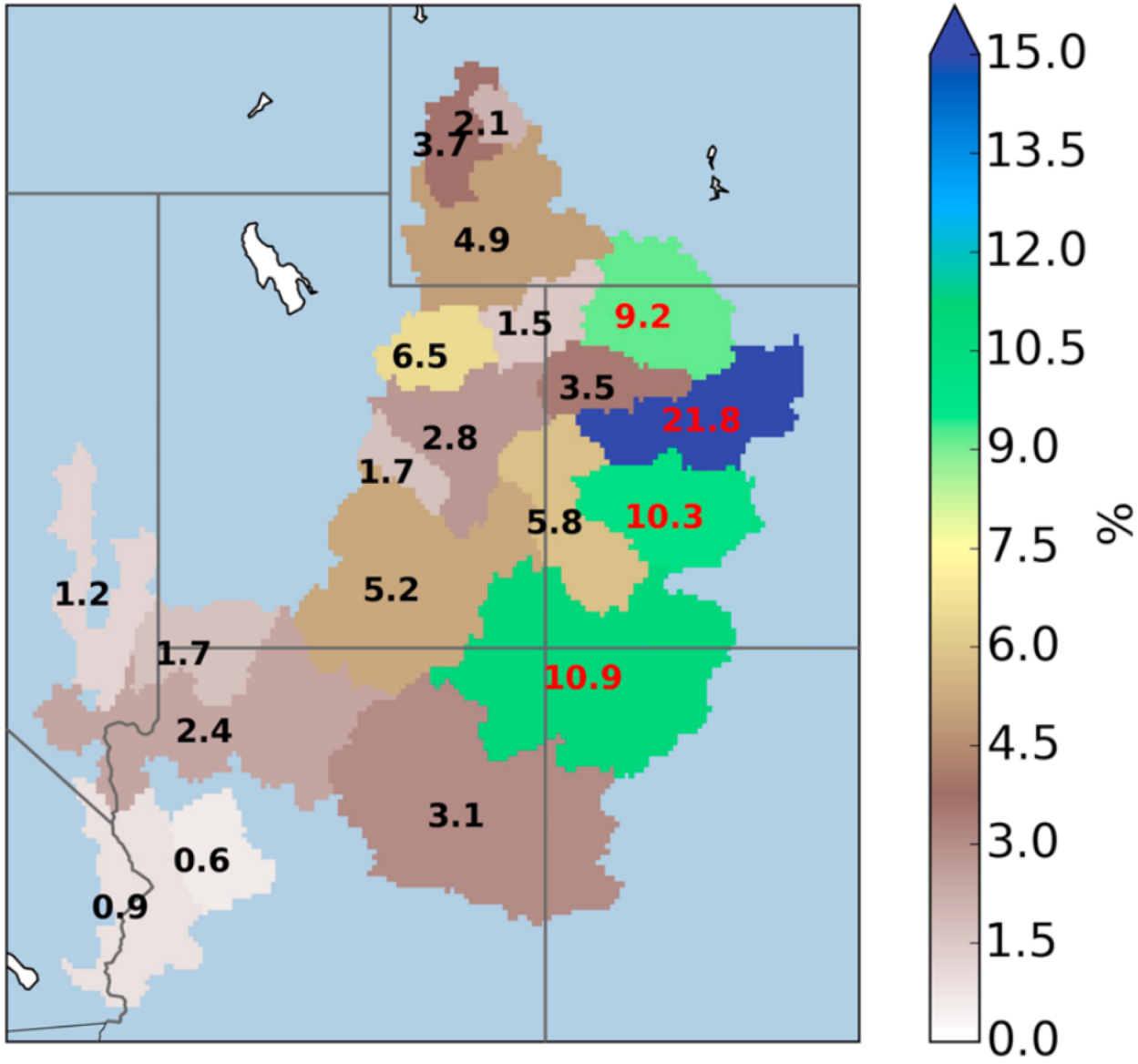
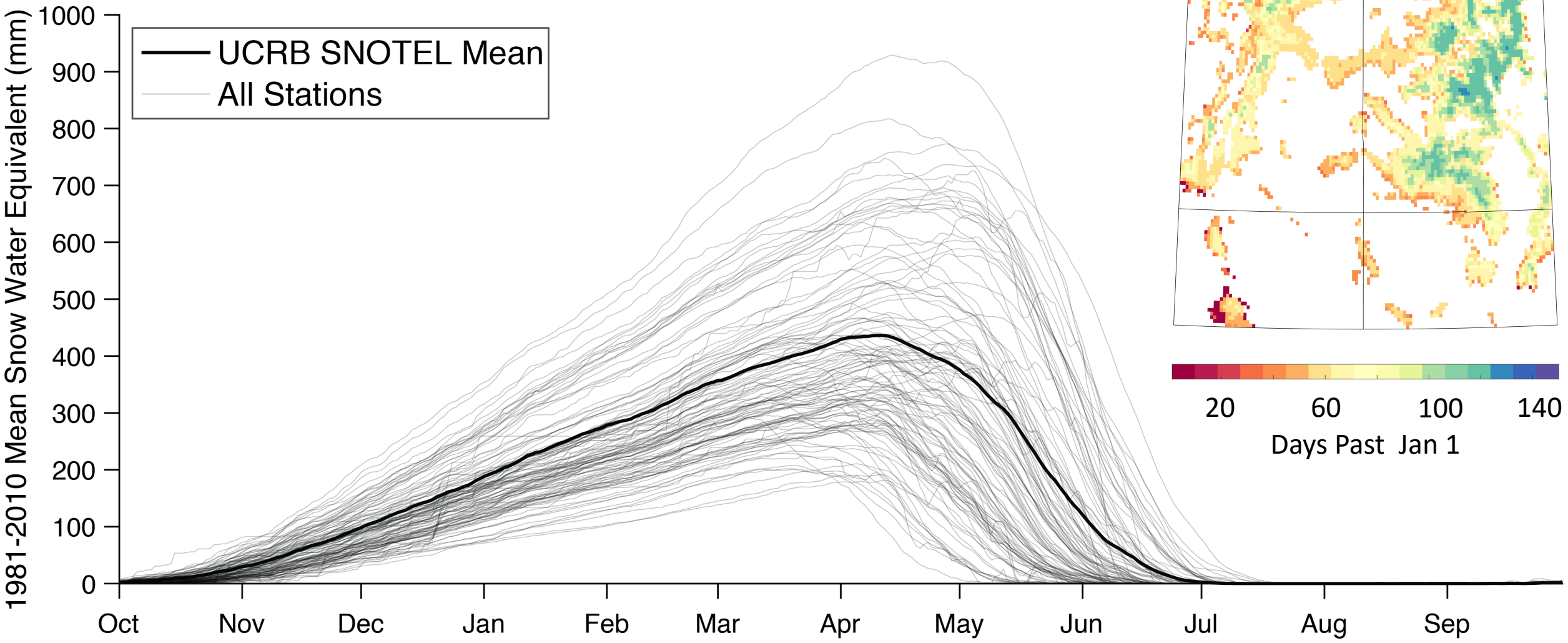
# The Upper Colorado River Basin (UCRB) at a glance:
# 15% of area provides 90% of runoff (70% via snow)



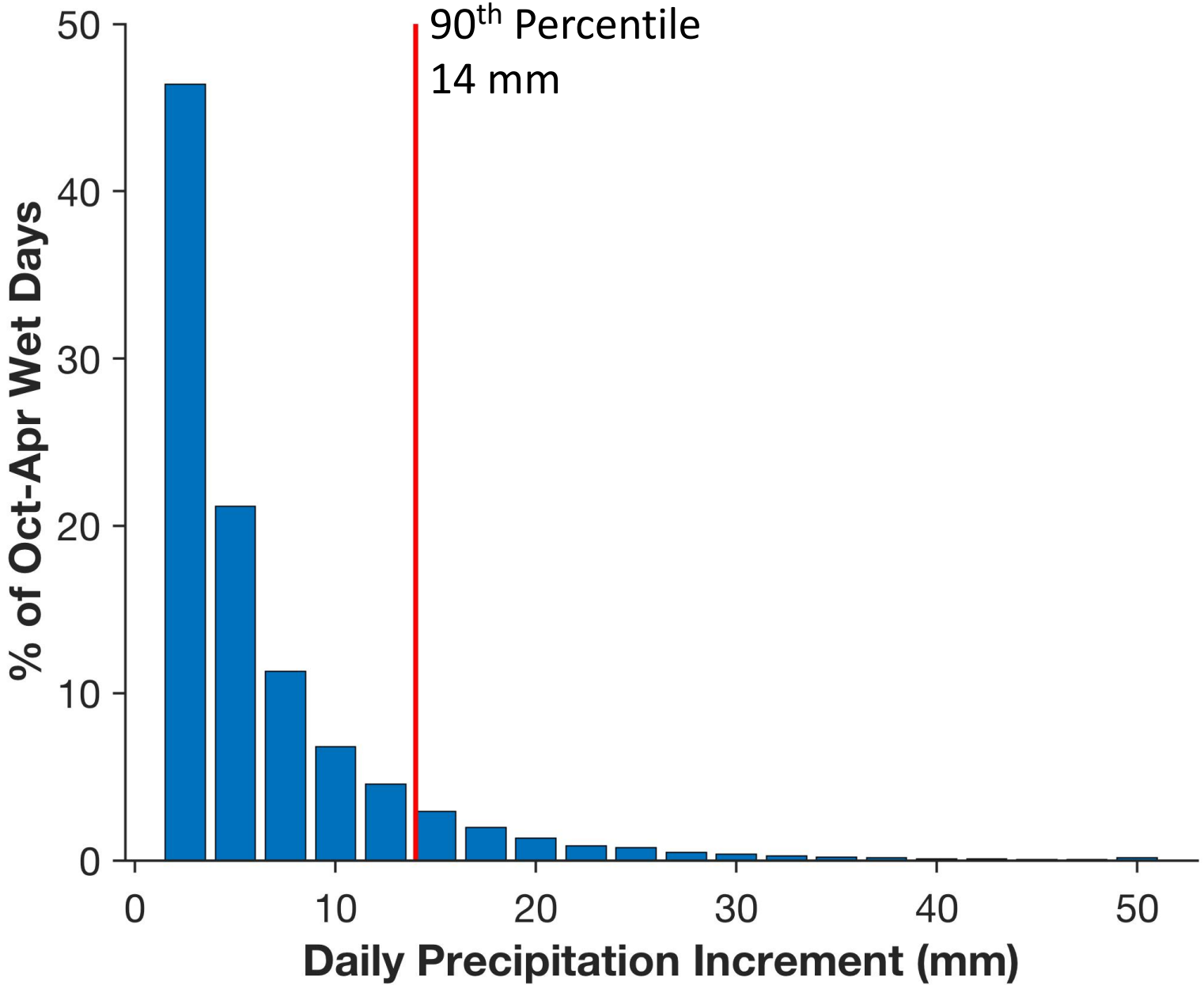

McCabe and Wolock (2007); Xiao et al. (2018 WRR)

# Snowpack Climatology



# Precipitation Contribution Distribution

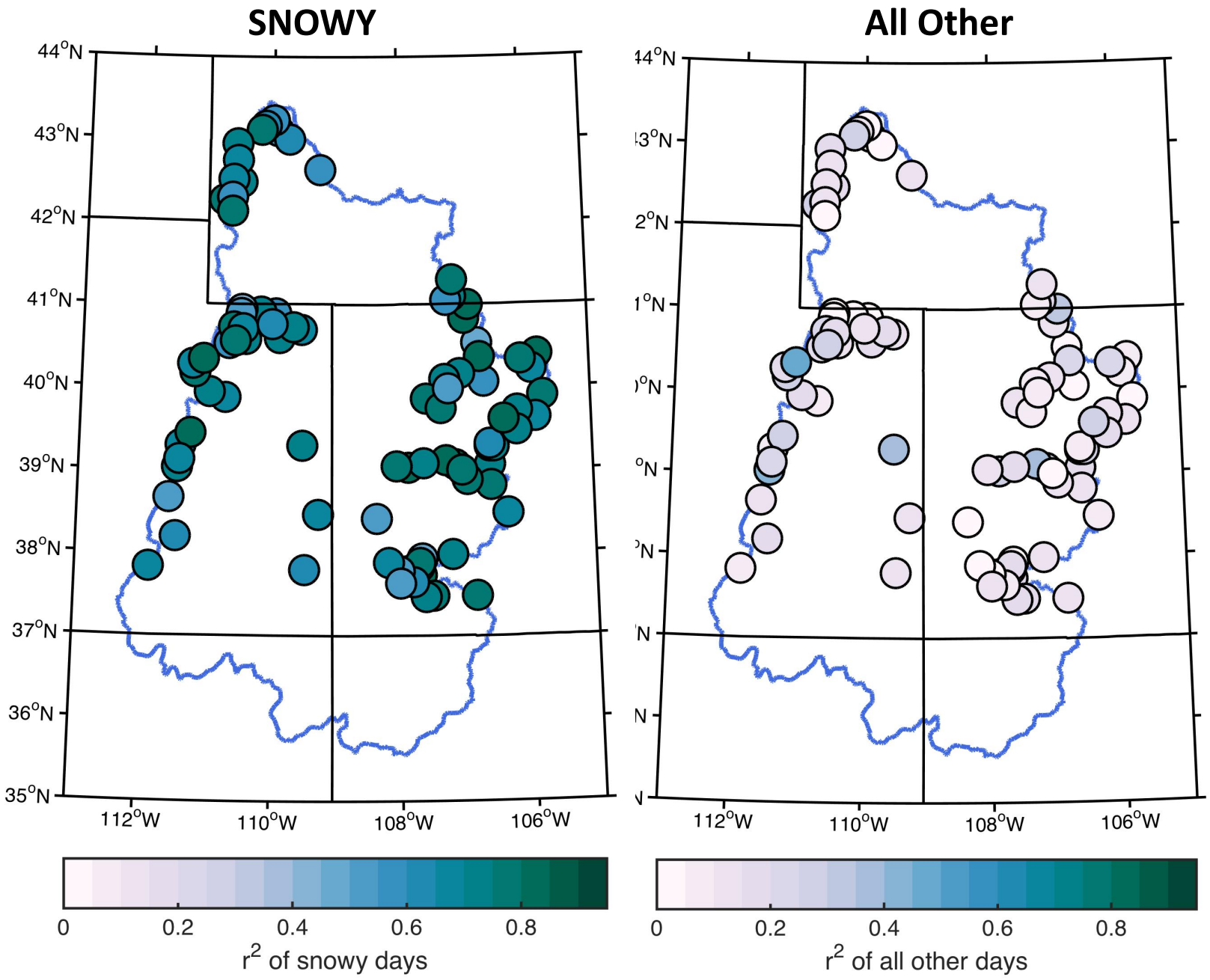
- The vast majority of precipitation events have small accumulations (>10 mm or 0.4”)
- The snowiest days result from the wettest days



*The snowiest days drive interannual variability of total snow accumulation*

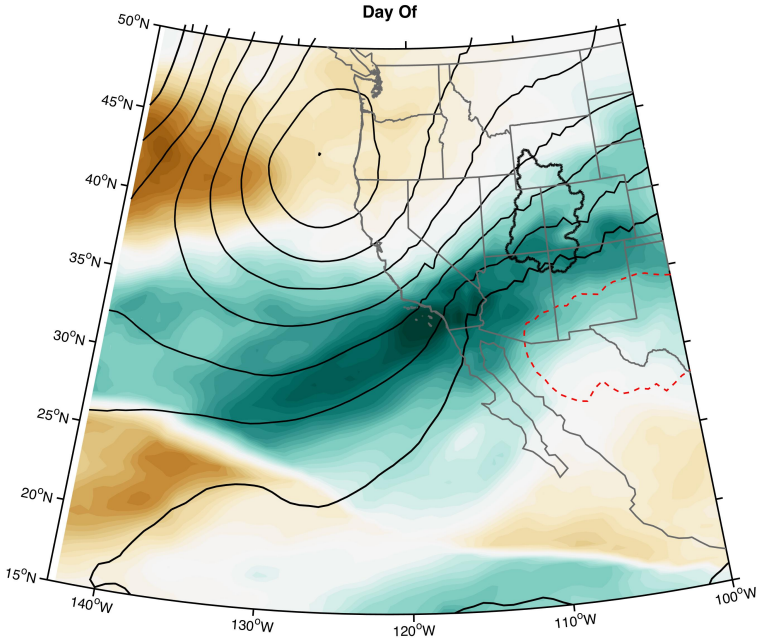
*(but only account for ~35% total snowpack)*

Snowpack provided by snowiest days in a season provide best correlation to streamflow (Kirk et al. 2017)

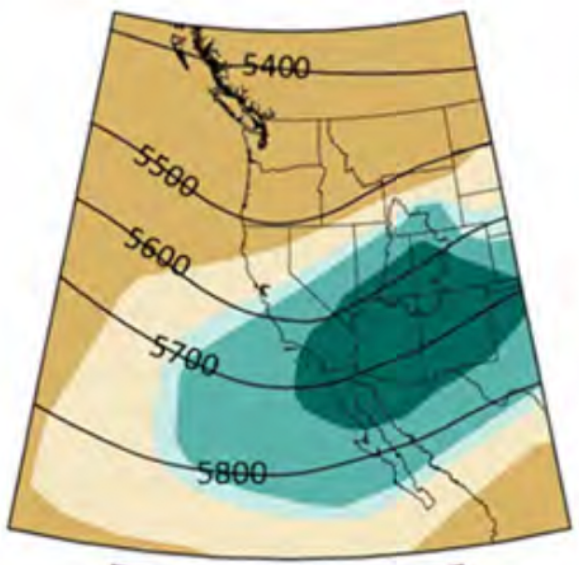


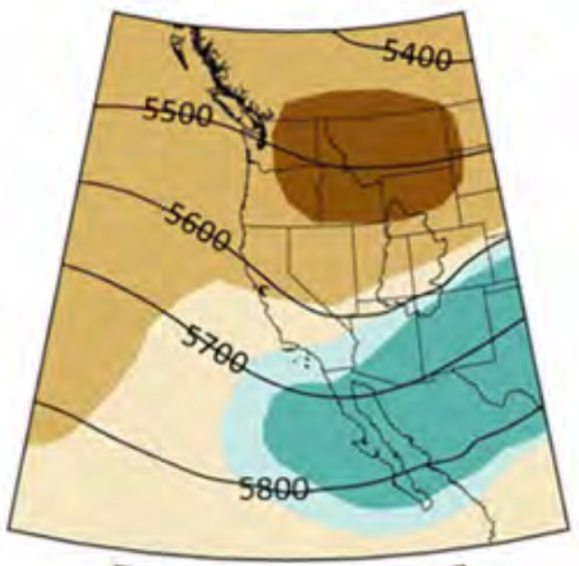
# Atmospheric Patterns Associated with Large Precipitation Events

## Strong moisture transport through Mojave Desert favors widespread precipitation and snow accumulation in UCRB




Note deep low pressure trough off North American Coast





**Below Average Moisture Transport**

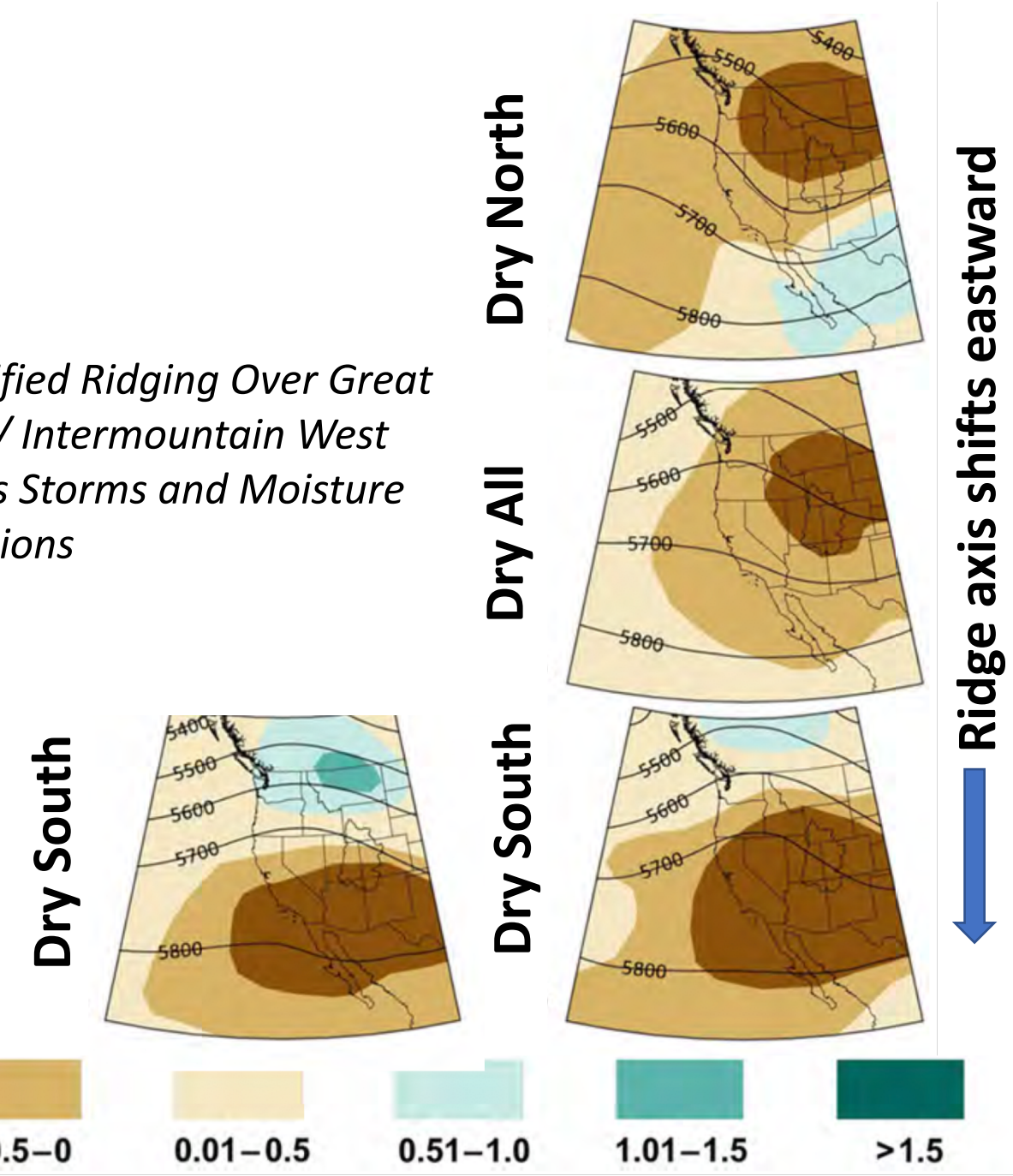
**Above Average Moisture Transport**

**Kirk and Schmidlin (2018)**

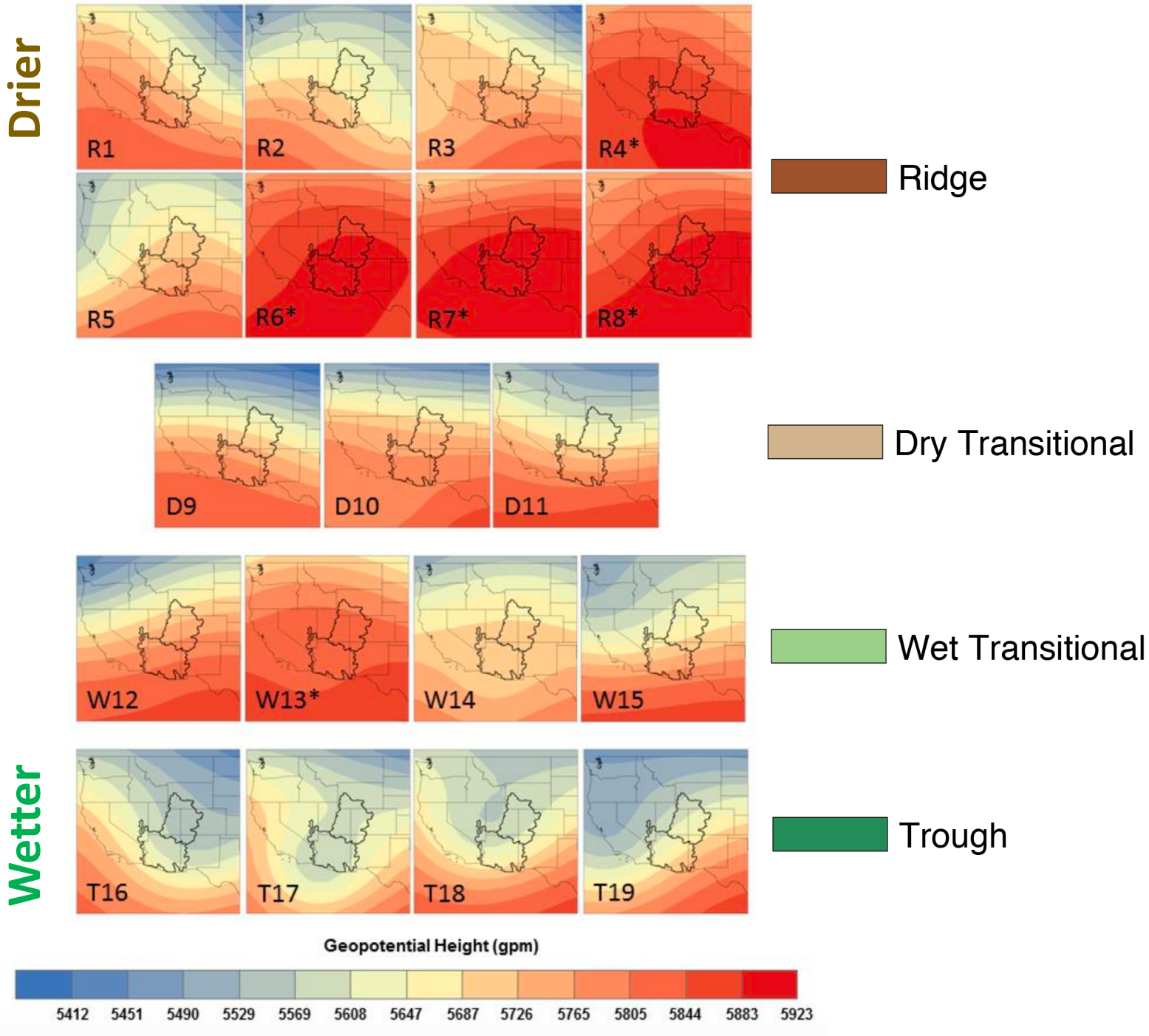
# Thinking the other way around:

## Lack of Large Snow Accumulation Events (Wettest Days) Produce Dry Years and Low Streamflow in UCRB

*Amplified Ridging Over Great Basin/ Intermountain West Blocks Storms and Moisture Intrusions*




**Kirk and Schmidlin (2018)**

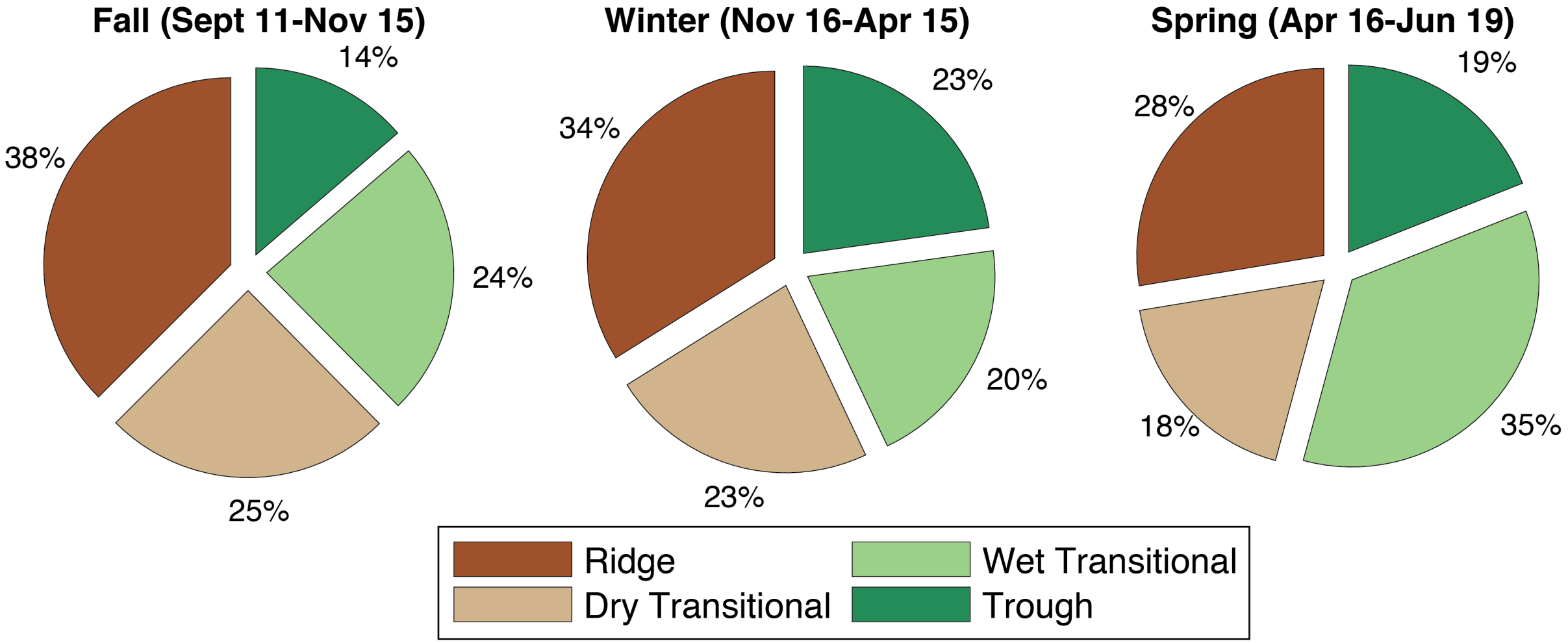



# Seasonal Climatology of UCRB Atmospheric Conditions:

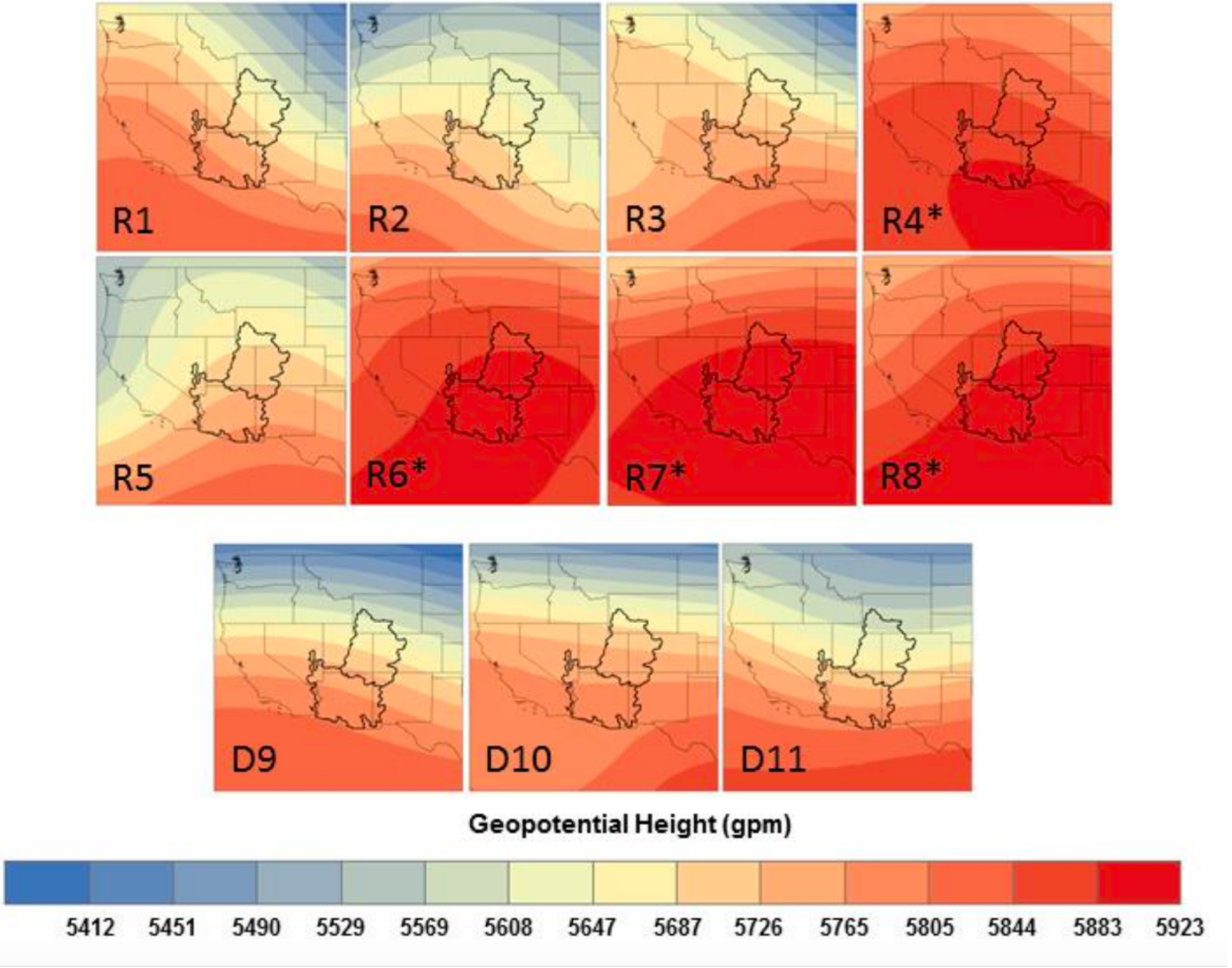
# A Cluster Analysis Approach

**Kirk et al. (2017)**

# Seasonal Climatology of Atmospheric Conditions




**Kirk et al. (2017)**

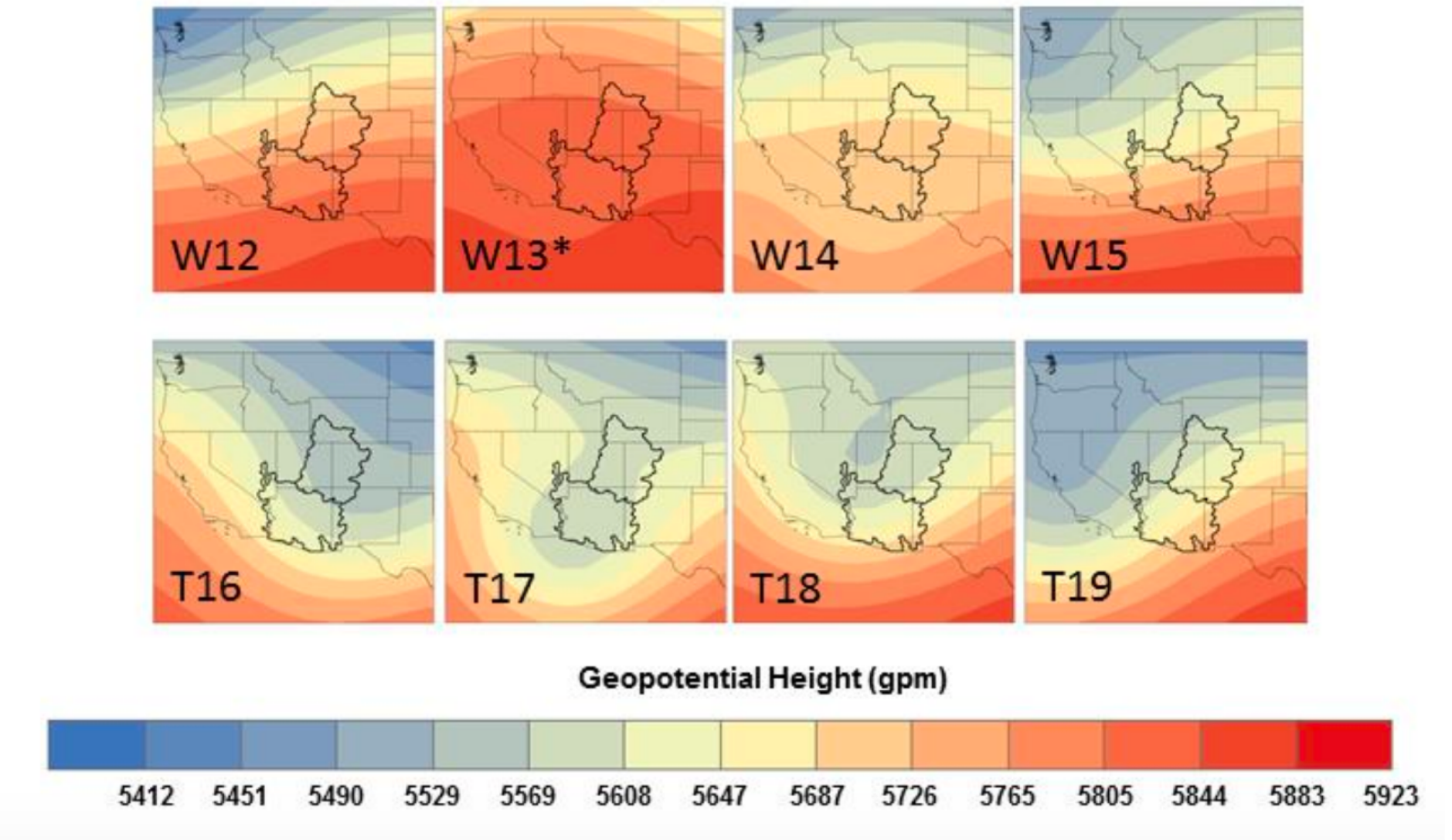



# Ridging (R) and Dry Transitional (D) Patterns

During the last 20 years ridging and dry transitional patterns are becoming more frequent

Kirk et al. (2017)

# Wet Transitional (W) and Trough (T) Patterns




T16: Lee cyclongenesis: Good pattern for snowfall, but low accumulations

T17: Cutoff Low

T18: Closed Low (spring and fall peak)

T19: Best setup for prolonged heavy snowfall (the variability!)

# Concluding Remarks

- Large snow accumulation events control variability in UCRB
  - However, these only account for ~35% of total snowpack
- Dry Years
  - More frequent ridging centered over WA-CA, prevents moisture transport into UCRB
  - Ridging conditions and dry transitional regimes are becoming more prevalent (especially in spring) during the last two decades
  - Next steps: Examine teleconnections associated with persistent ridging
- Wet Years
  - Wet years defined by more frequent large snowfall events
  - Number of large snowfall events correlates positively with increased streamflow