

Extreme Daily Precipitation in Global and Regional Climate Simulations of North America

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NARCCAP Simulations

MM5

Iowa State/
PNNL

RegCM3

UC Santa Cruz
ICTP

CRCM

Quebec,
Ouranos

HADRM3

Hadley Centre

RSM

Scripps

WRF

NCAR/
PNNL

PLUS:

- GFDL Atmosphere GCM

- ▶ - 0.5° resolution

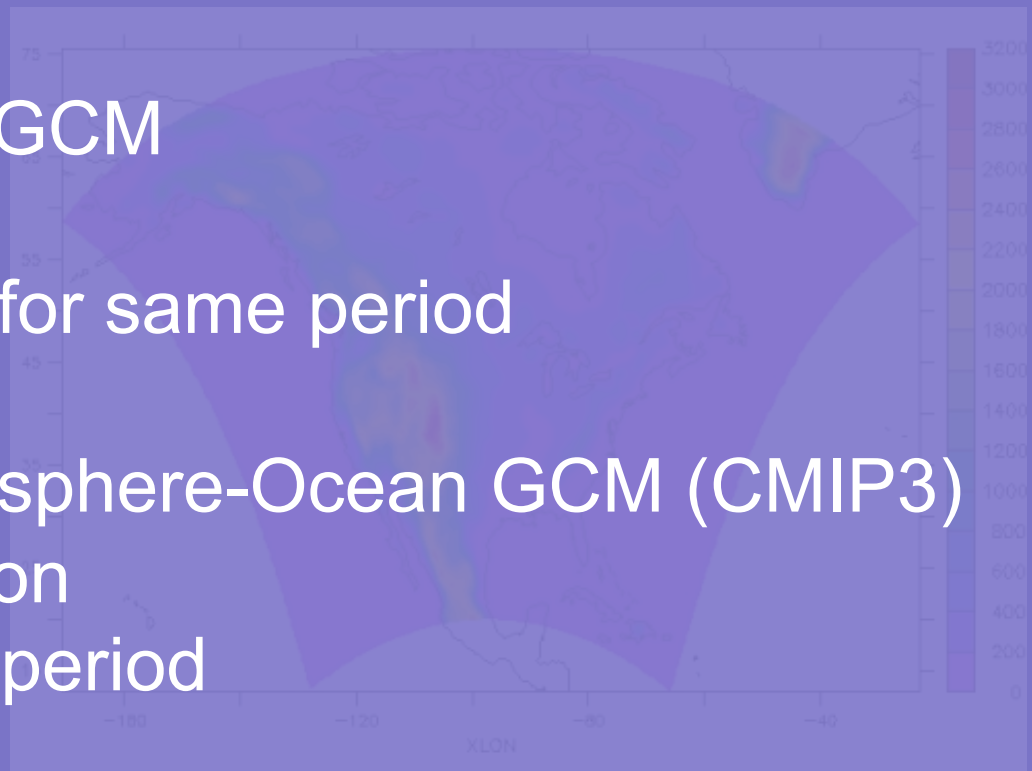
- specified SST/ice for same period

- ▶ Simulation Period

- NCAR CCSM Atmosphere-Ocean GCM (CMIP3)

- ▶ - 1.4° (T85) resolution

- analysis for same period



CMIP5 20C GCM Simulations

MODEL	COUNTRY	RESOLUTION
MIROC4h	Japan	0.56° X 0.56°
HadGEM2-CC	UK	1.25° X 1.88°
INM-CM4	Russia	1.5° X 2°
CSIRO-Mk3.6	Australia	1.87° X 1.88°
NorESM1-M	Norway	1.9° X 2.5°
IPSL-CM5A-LR	France	1.9° X 3.75°
BCC-CSM1.1	China	2.8° X 2.8°
CanESM2 (V2)	Canada	2.8° X 2.8°
HadCM3	UK	2.5° X 3.75°

Comparison with observations

► Observation-based Fields

- ★ **Precip: University of Washington VIC retrospective analysis**
- ★ **Other fields: North American Regional Reanalysis**

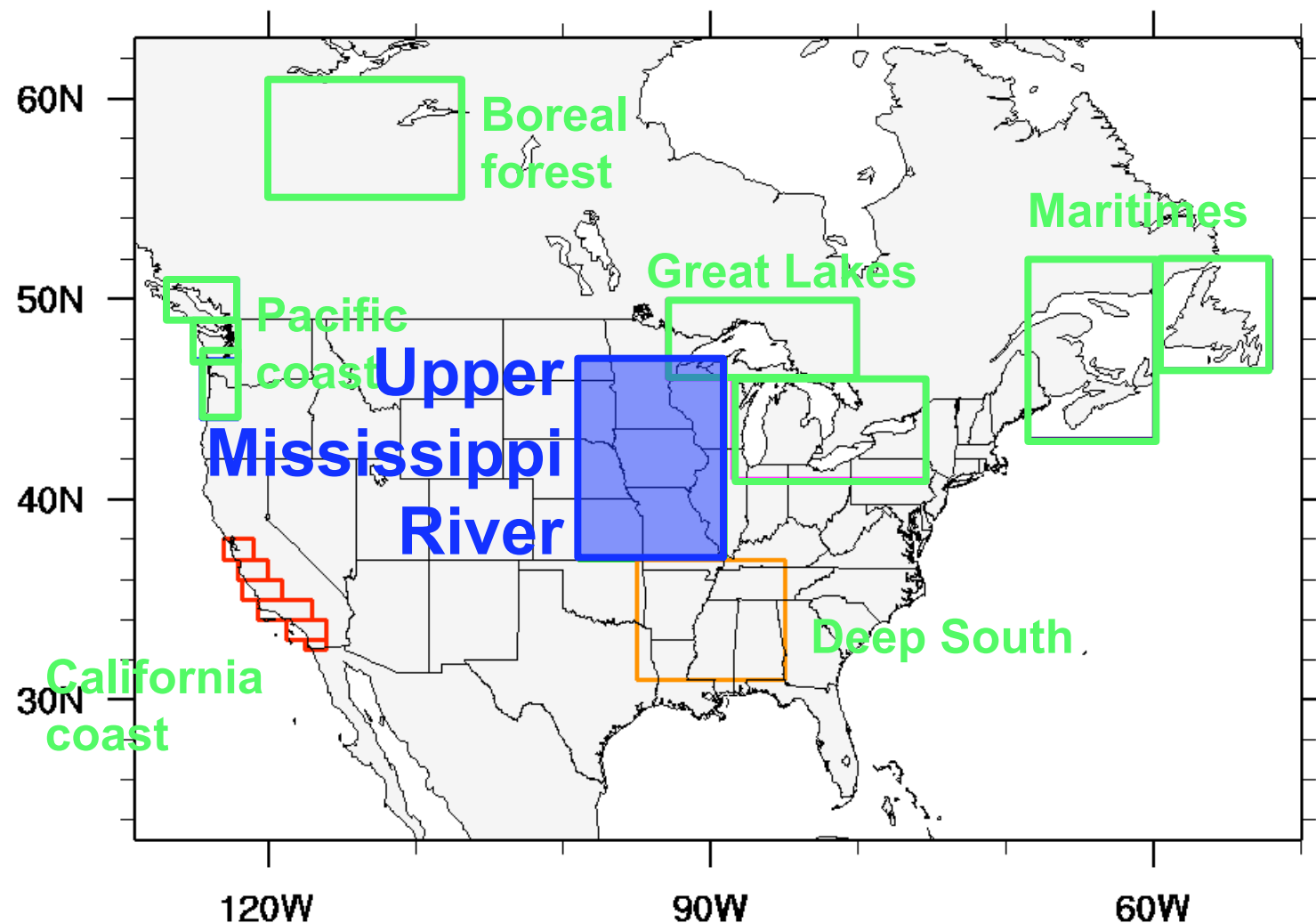
► Comparison period: 1982 -1999

- ★ **1979-1981 omitted for RCM spinup**
- ★ **UW data end in mid-2000**

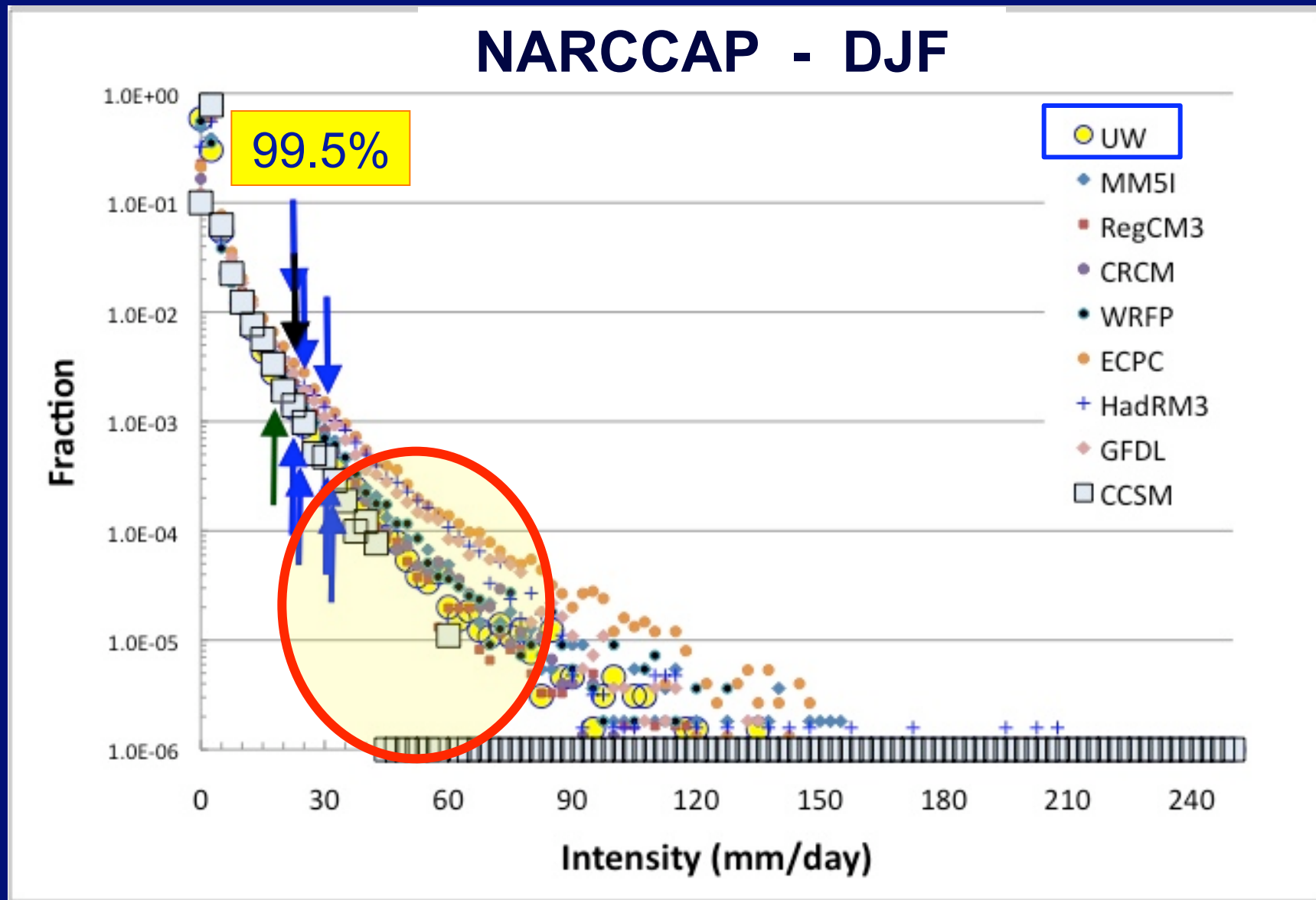
► Analysis

- ★ **“Precipitation event” = Daily precip ≥ 2.5 mm at a grid point**
- ★ **Focus on precip intensity $\geq 99.5\%$**
- ★ **Pool all “events” in the target region**

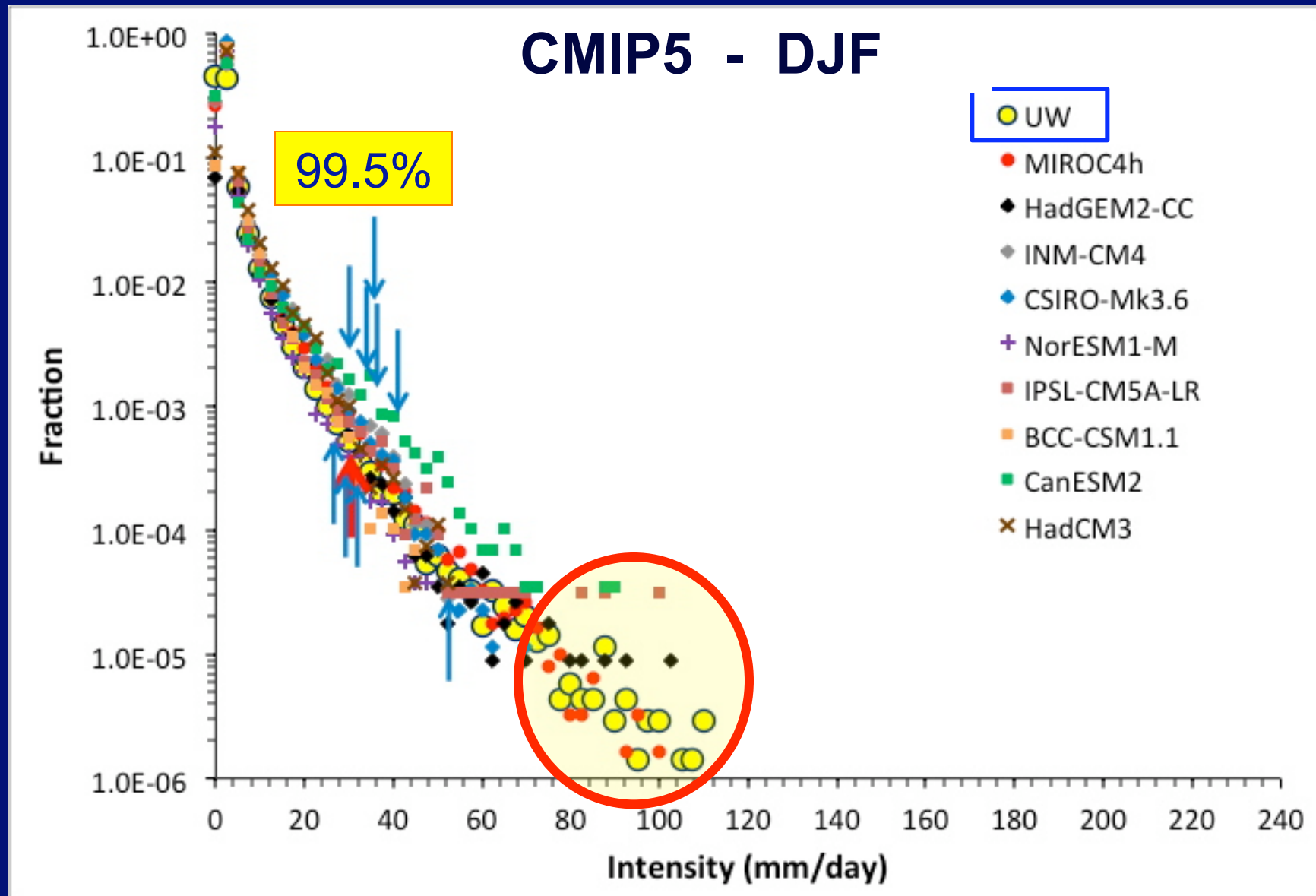
Region Analyzed



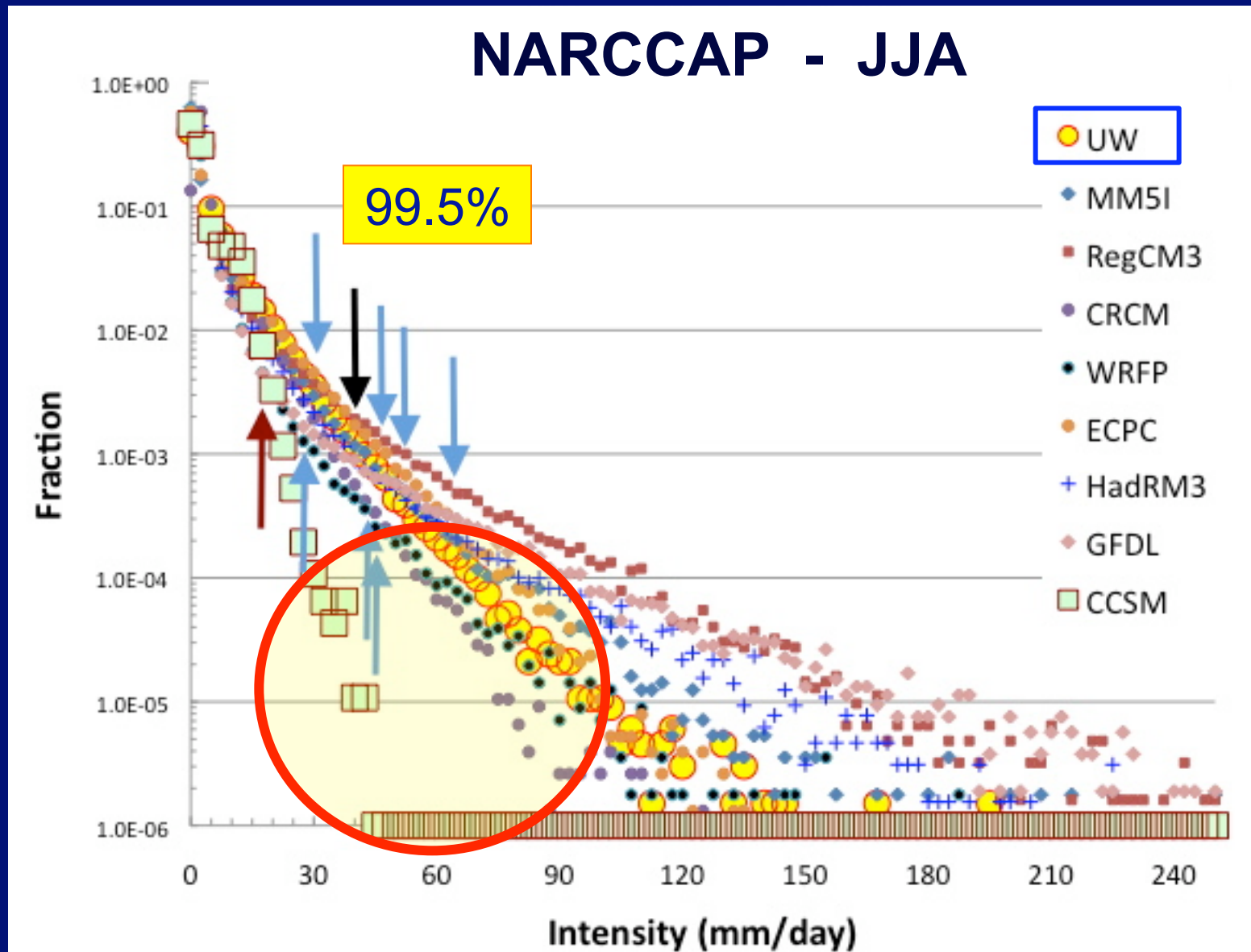
Precipitation Frequency vs. Intensity



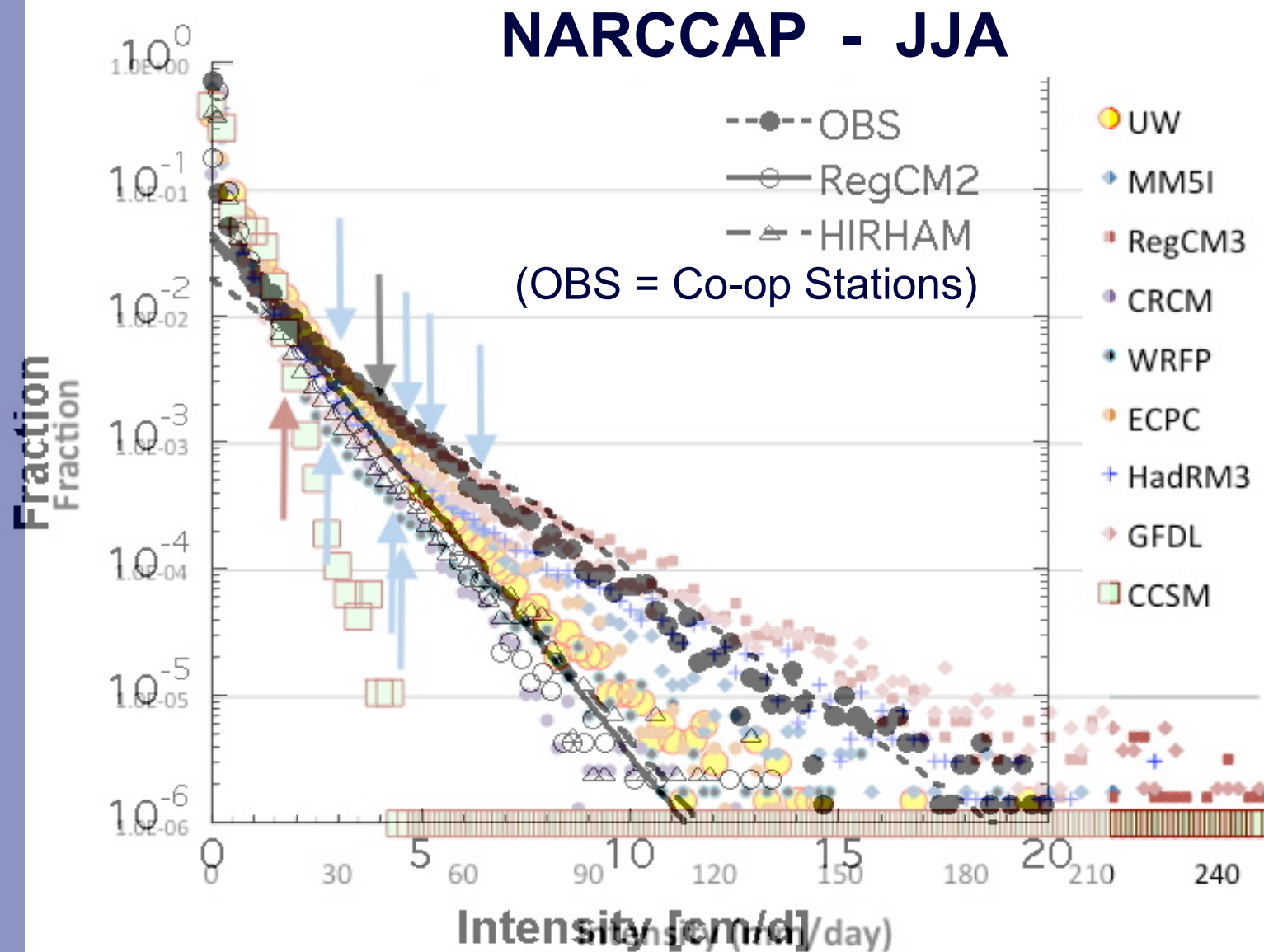
Precipitation Frequency vs. Intensity



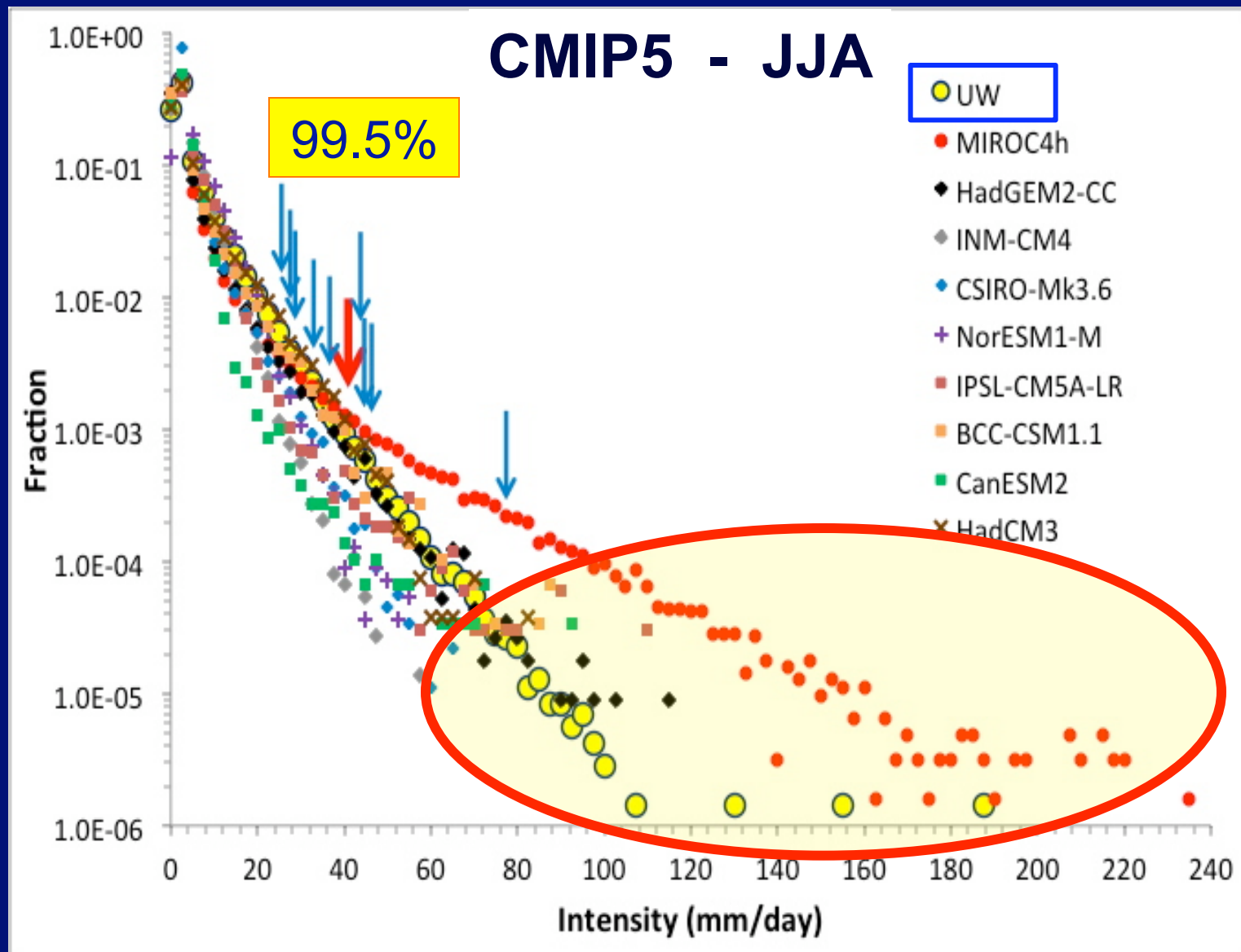
Precipitation Frequency vs. Intensity



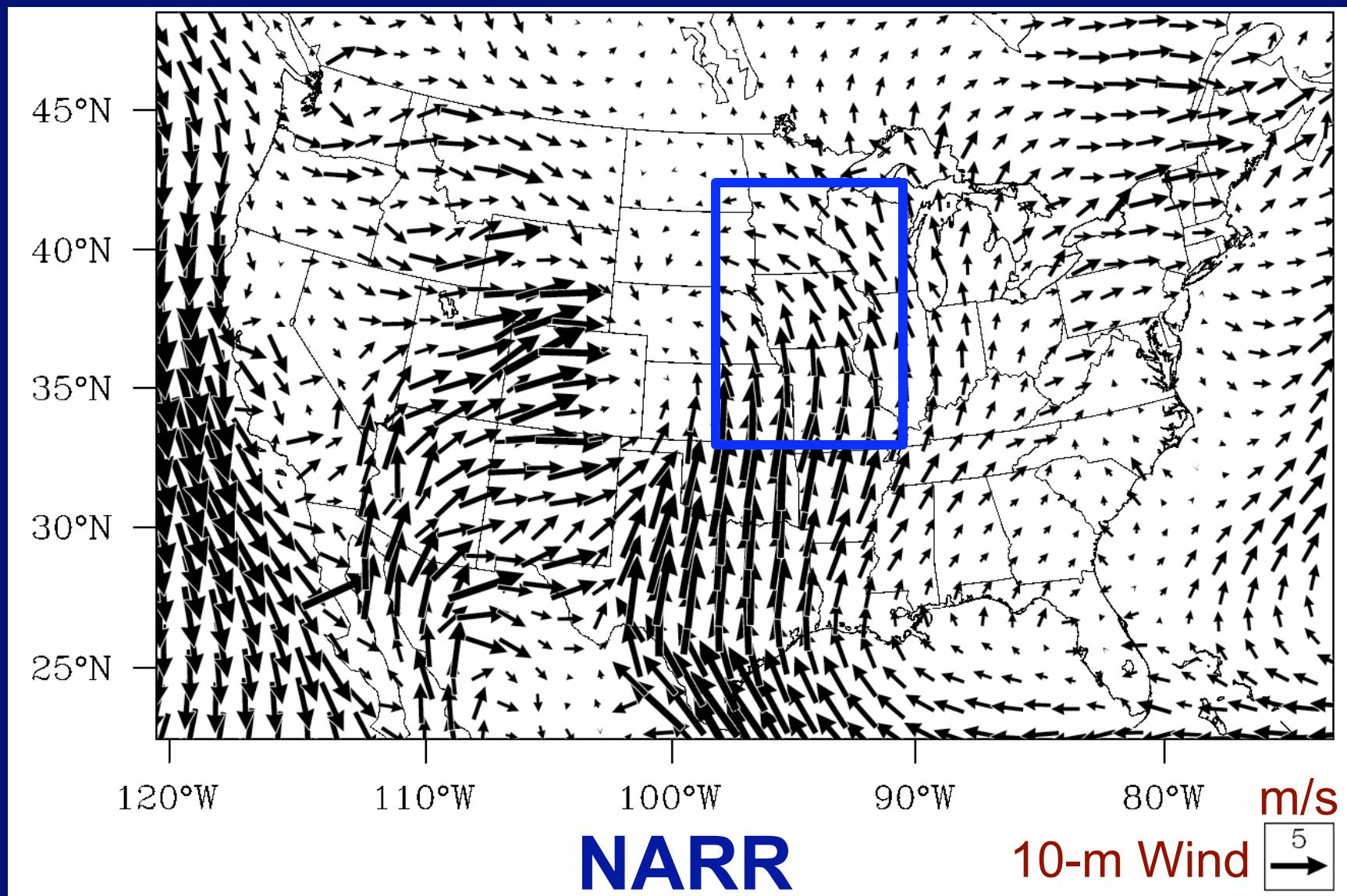
Precipitation Frequency vs. Intensity



Precipitation Frequency vs. Intensity

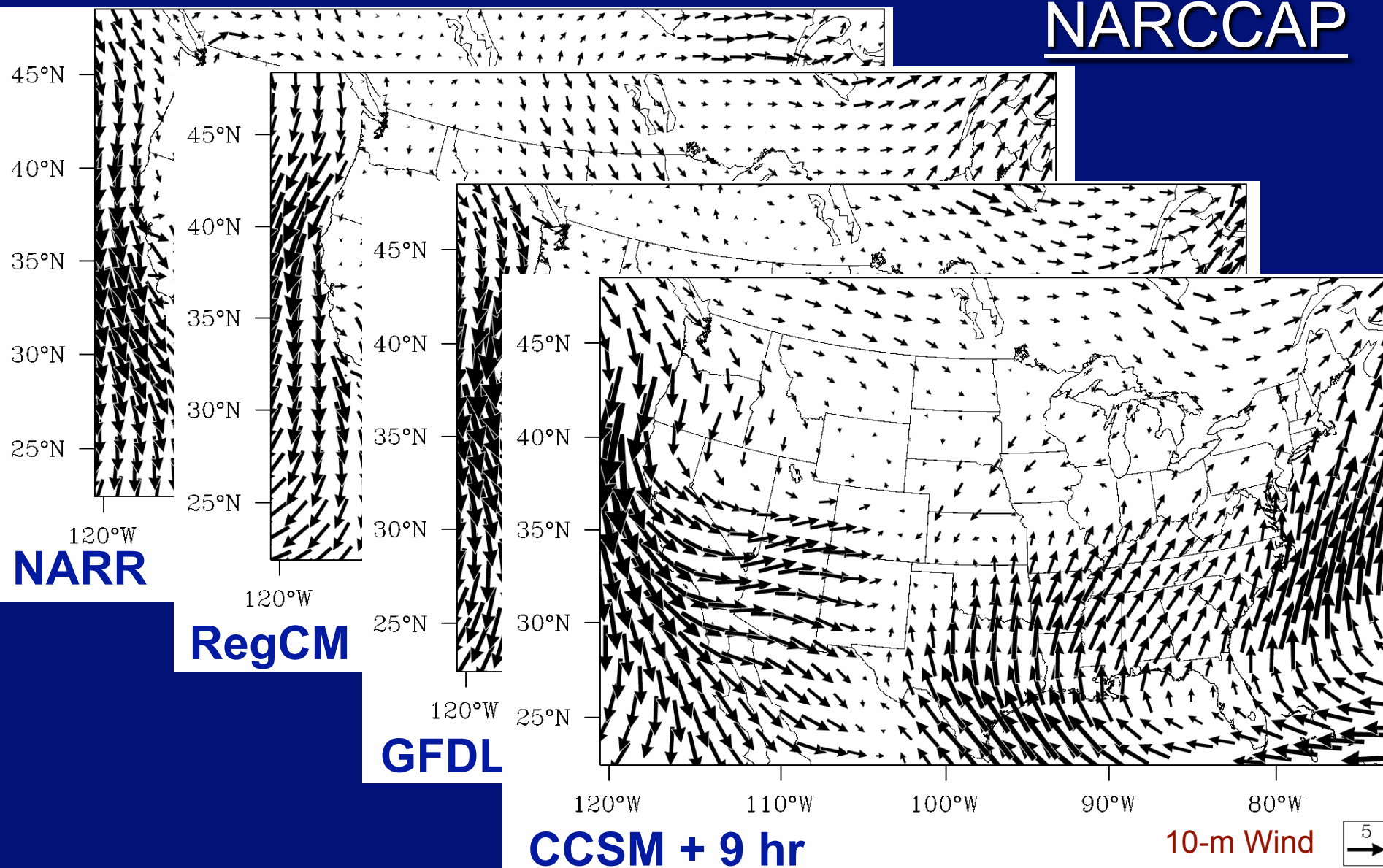


Composite Structure of Extreme Events - JJA



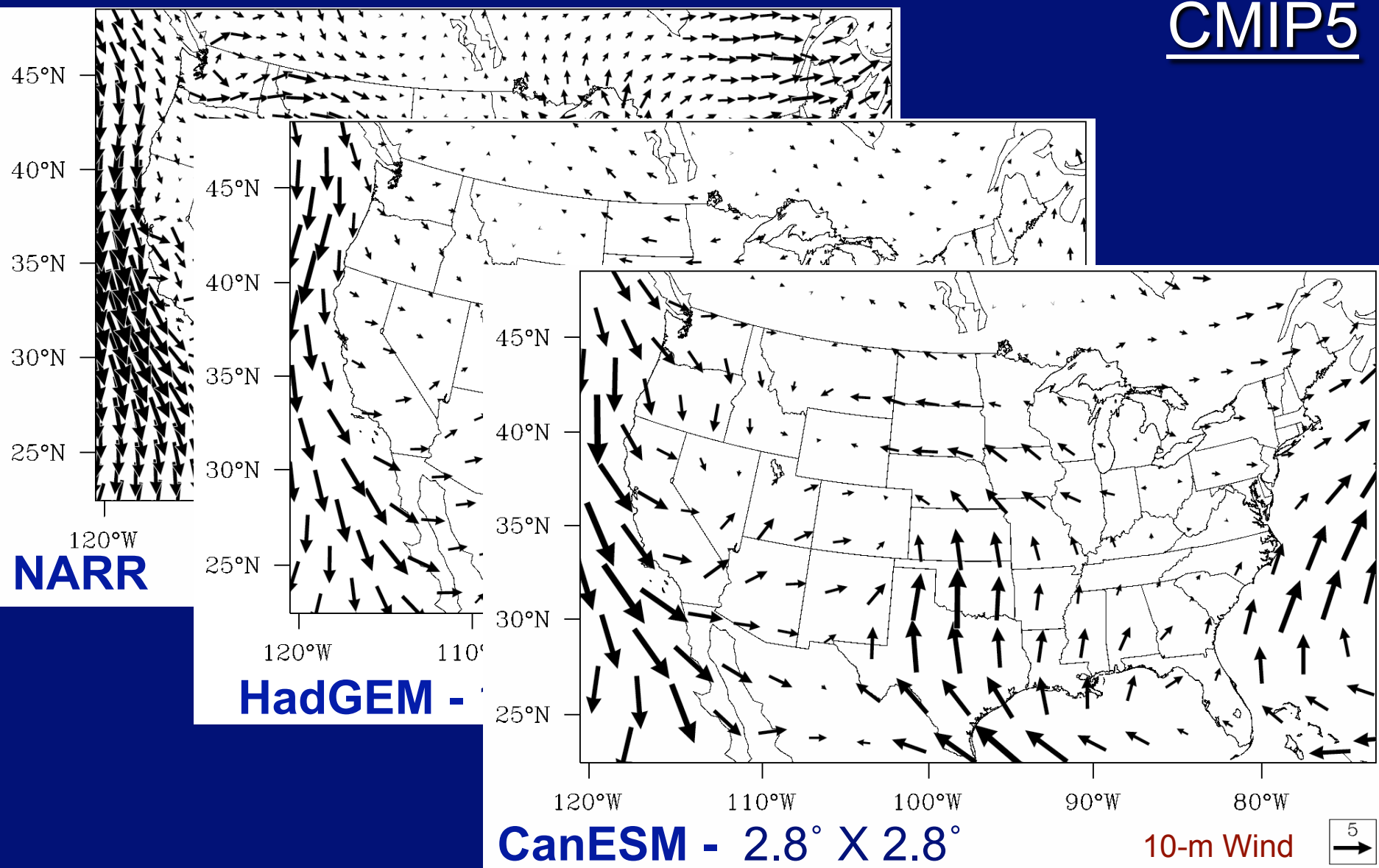
Composite Structure of Extreme Events - JJA

NARCCAP

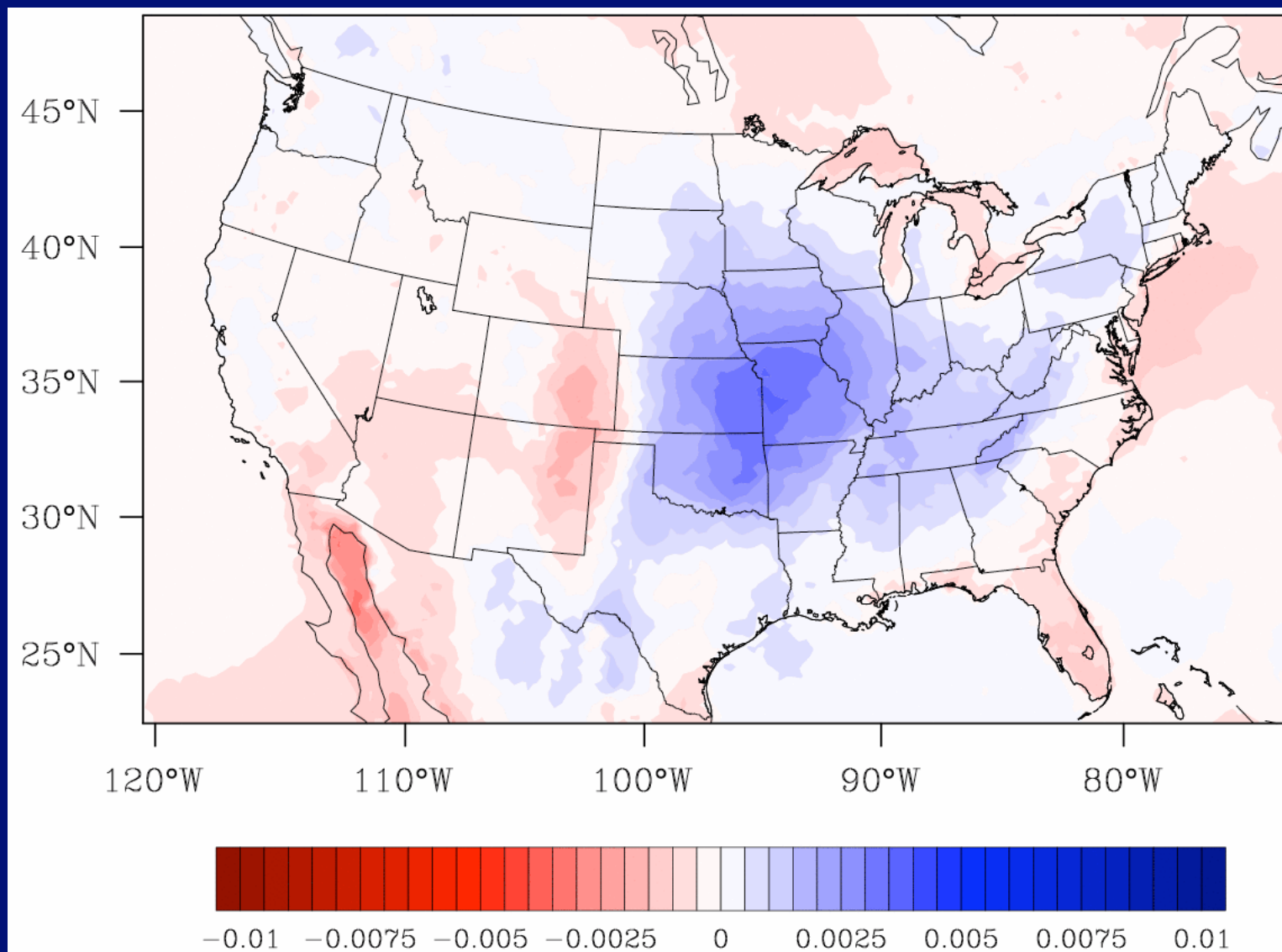


Composite Structure of Extreme Events - JJA

CMIP5



Composite Structure of Extreme Events - JJA

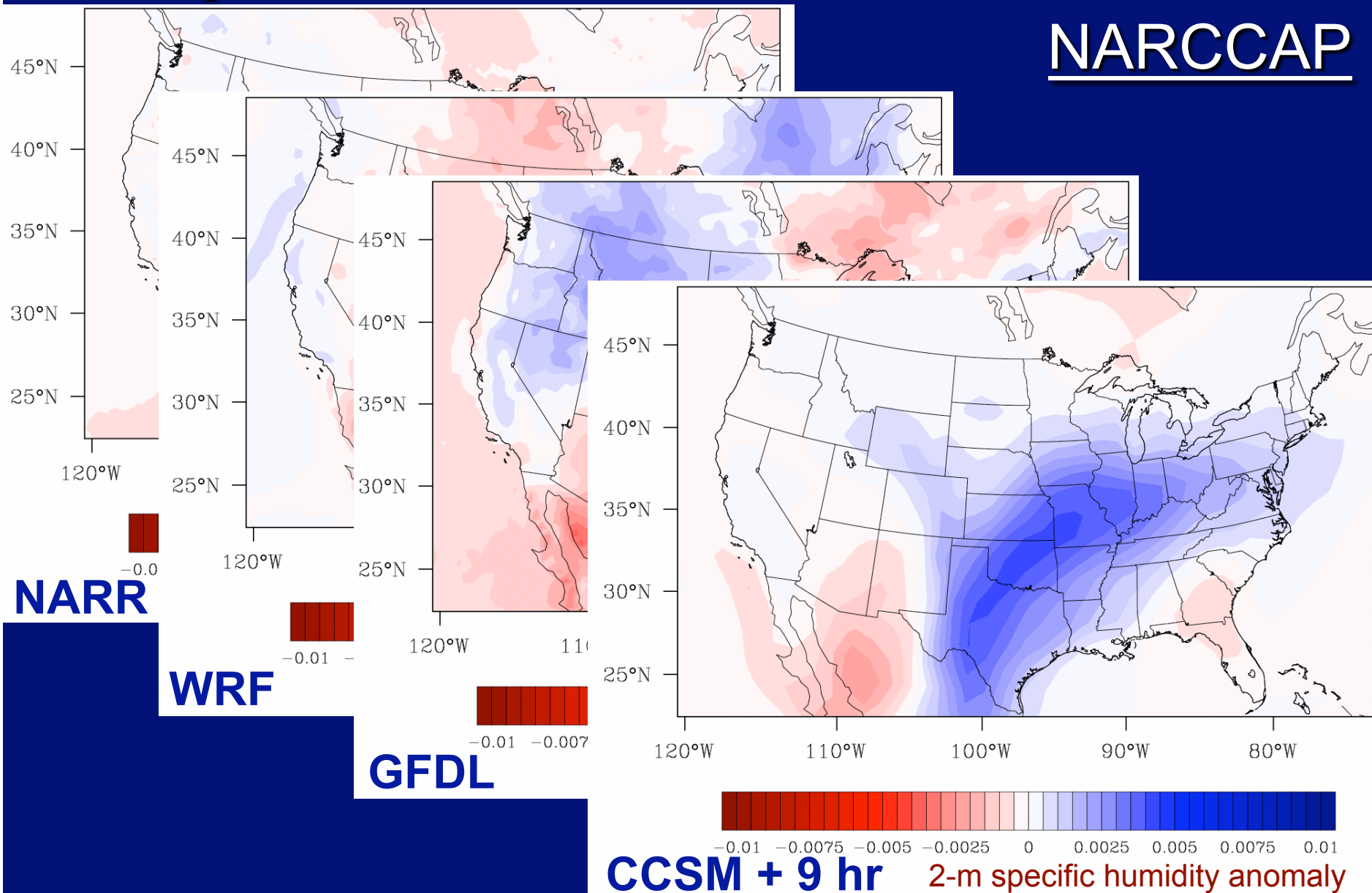


NARR

2-m specific humidity anomaly

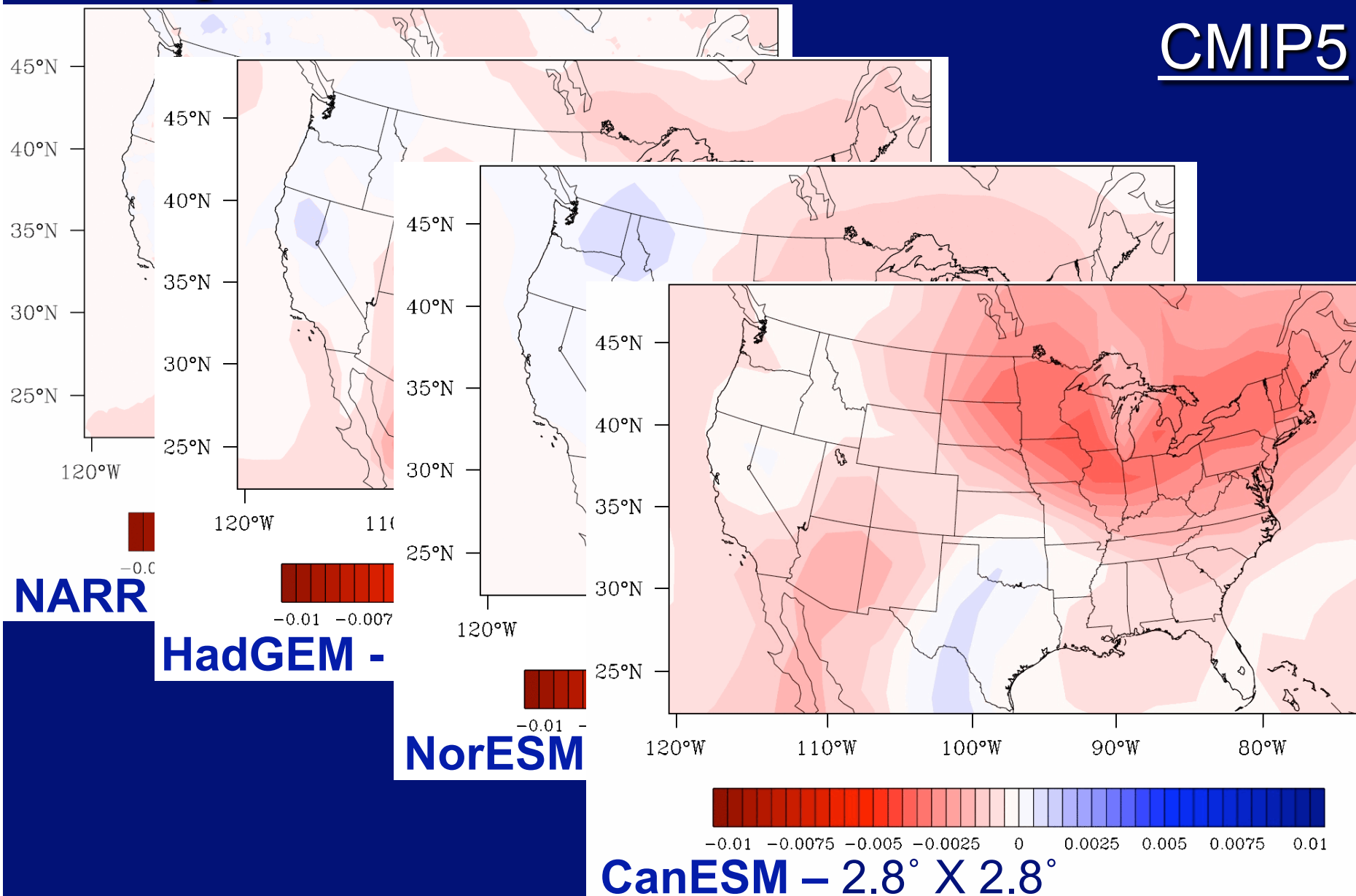
Composite Structure of Extreme Events - JJA

NARCCAP



Composite Structure of Extreme Events - DJF

CMIP5



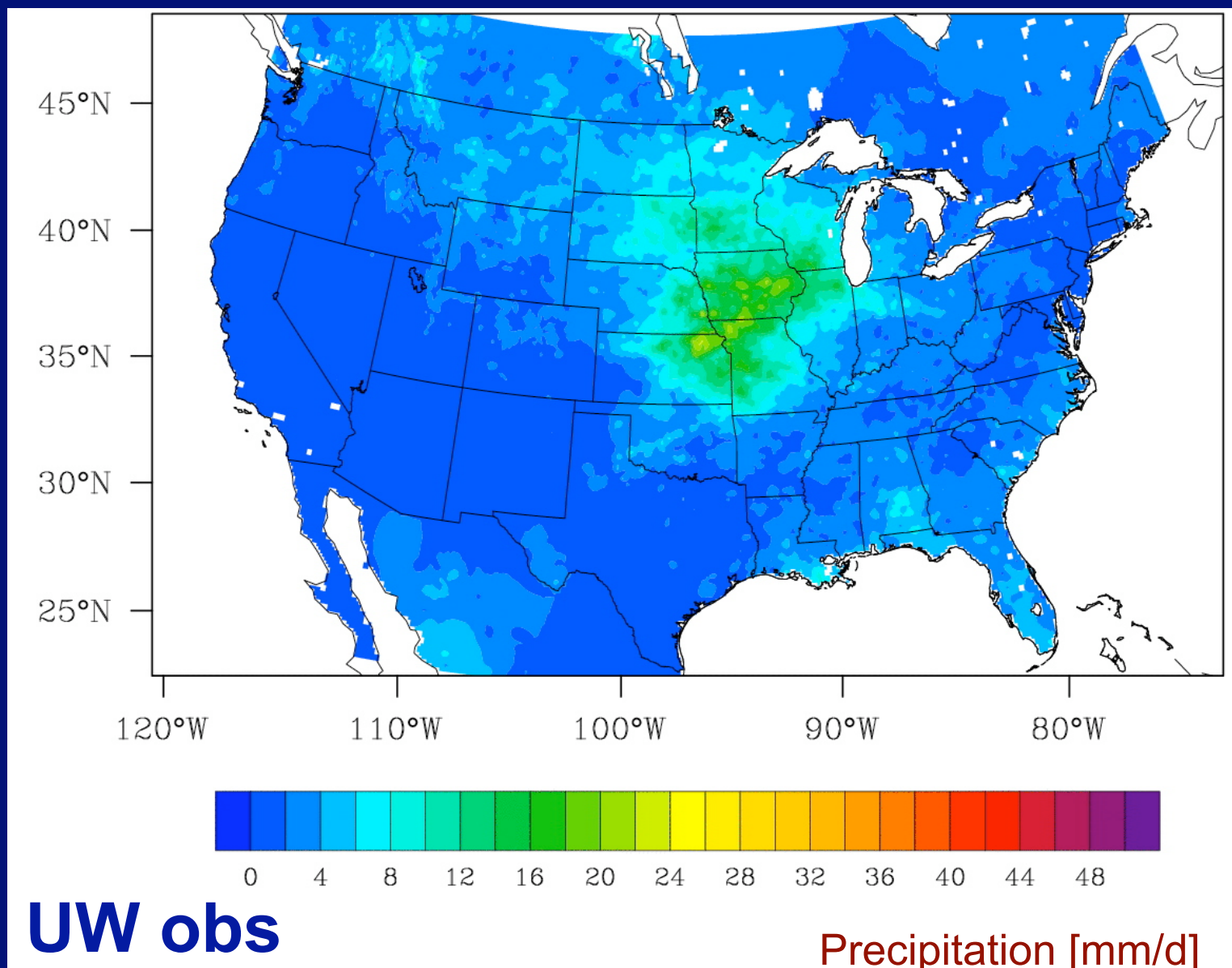
SUMMARY

- ❖ Higher resolution is necessary, but not sufficient, for simulating daily precipitation extremes.
- ❖ Coarser models (and nudged regional models) tend to have daily extremes covering a wider area than observed extremes.
- ❖ Models over a range of resolutions simulating processes giving extremes
 - Do well in DJF (synoptic weather)
 - Need finer resolution in JJA (convective processes)

Thank You

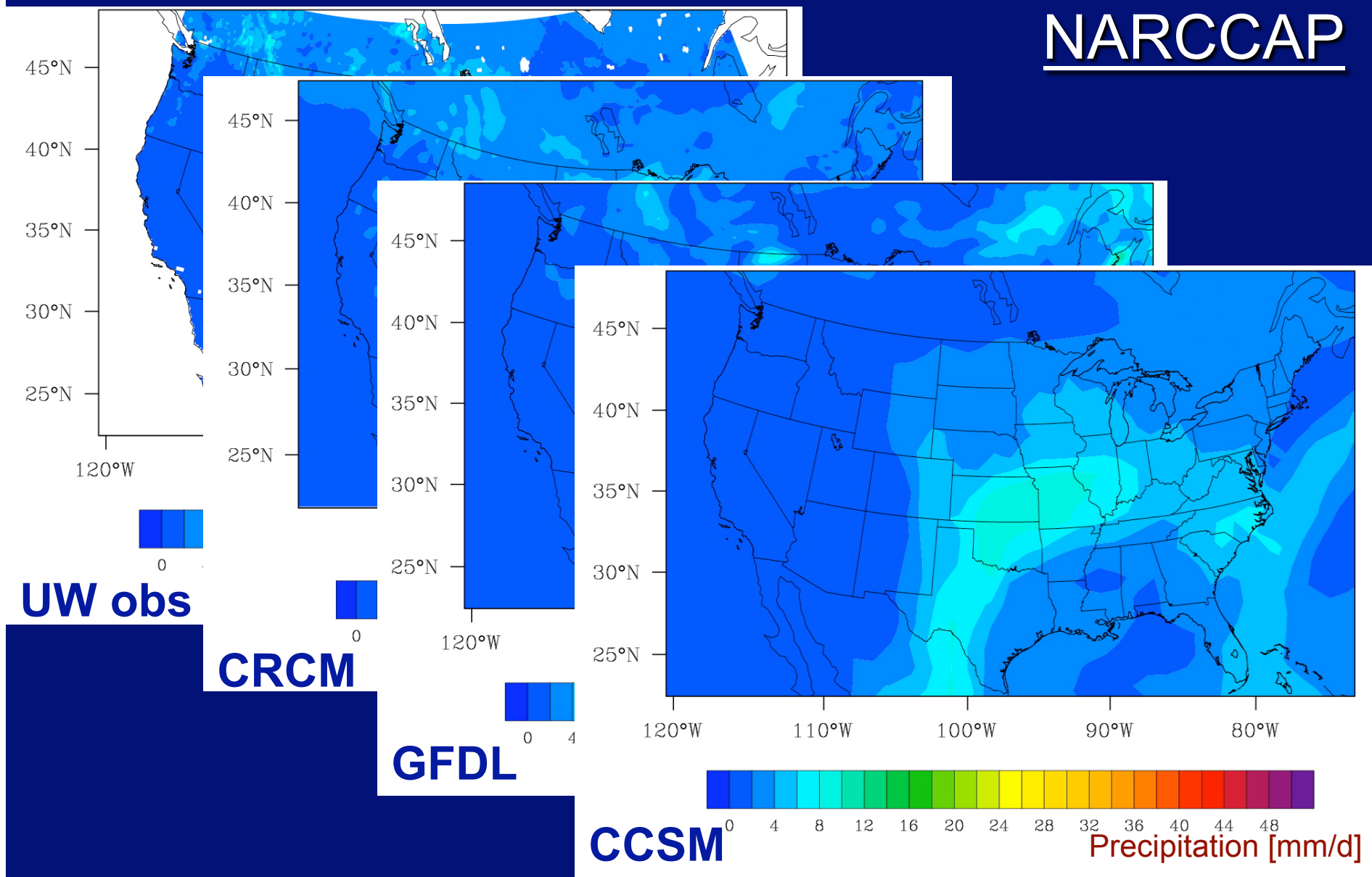
Extra Slides

Composite Structure of Extreme Events - JJA



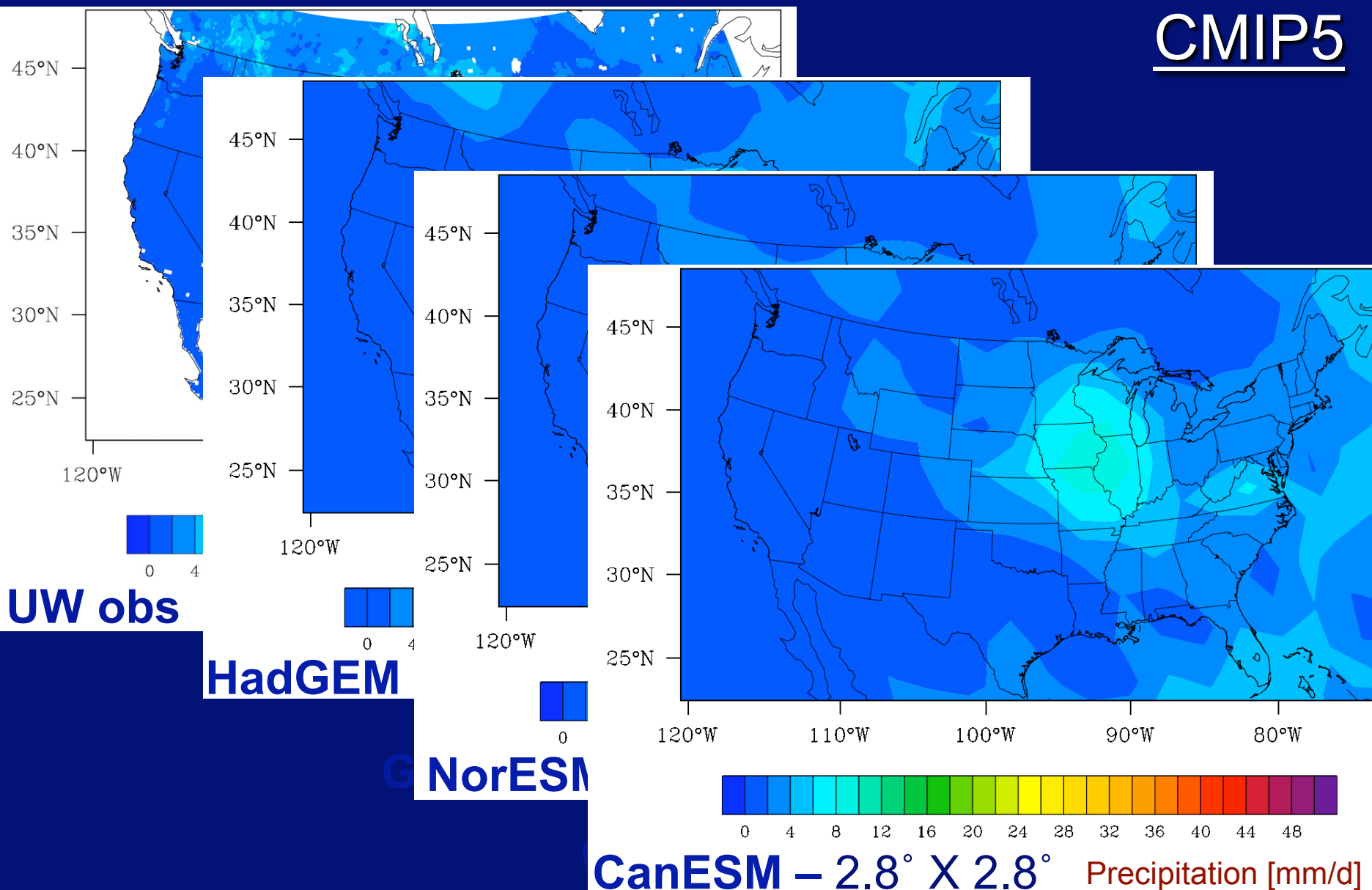
Composite Structure of Extreme Events - JJA

NARCCAP

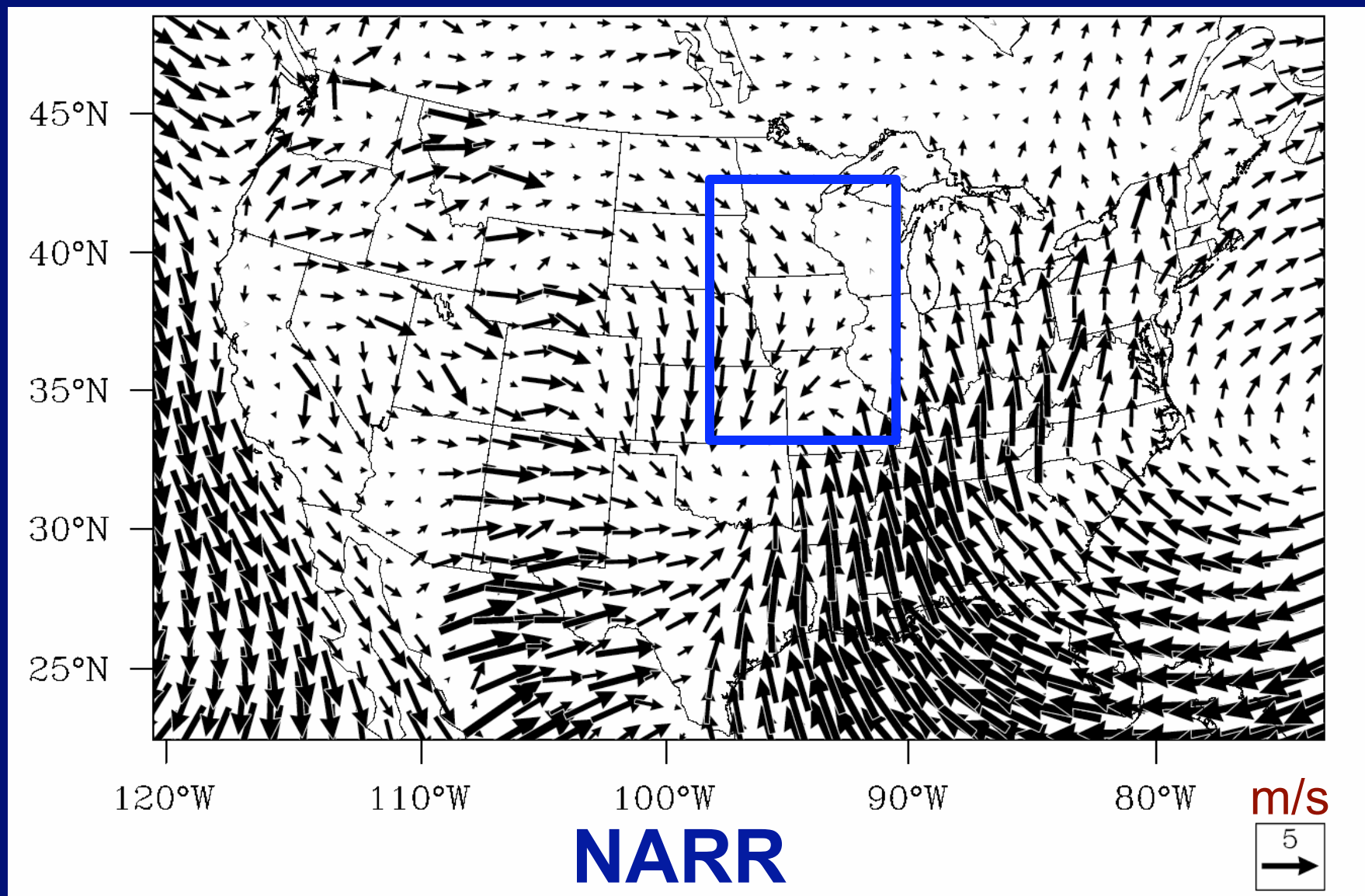


Composite Structure of Extreme Events - JJA

CMIP5

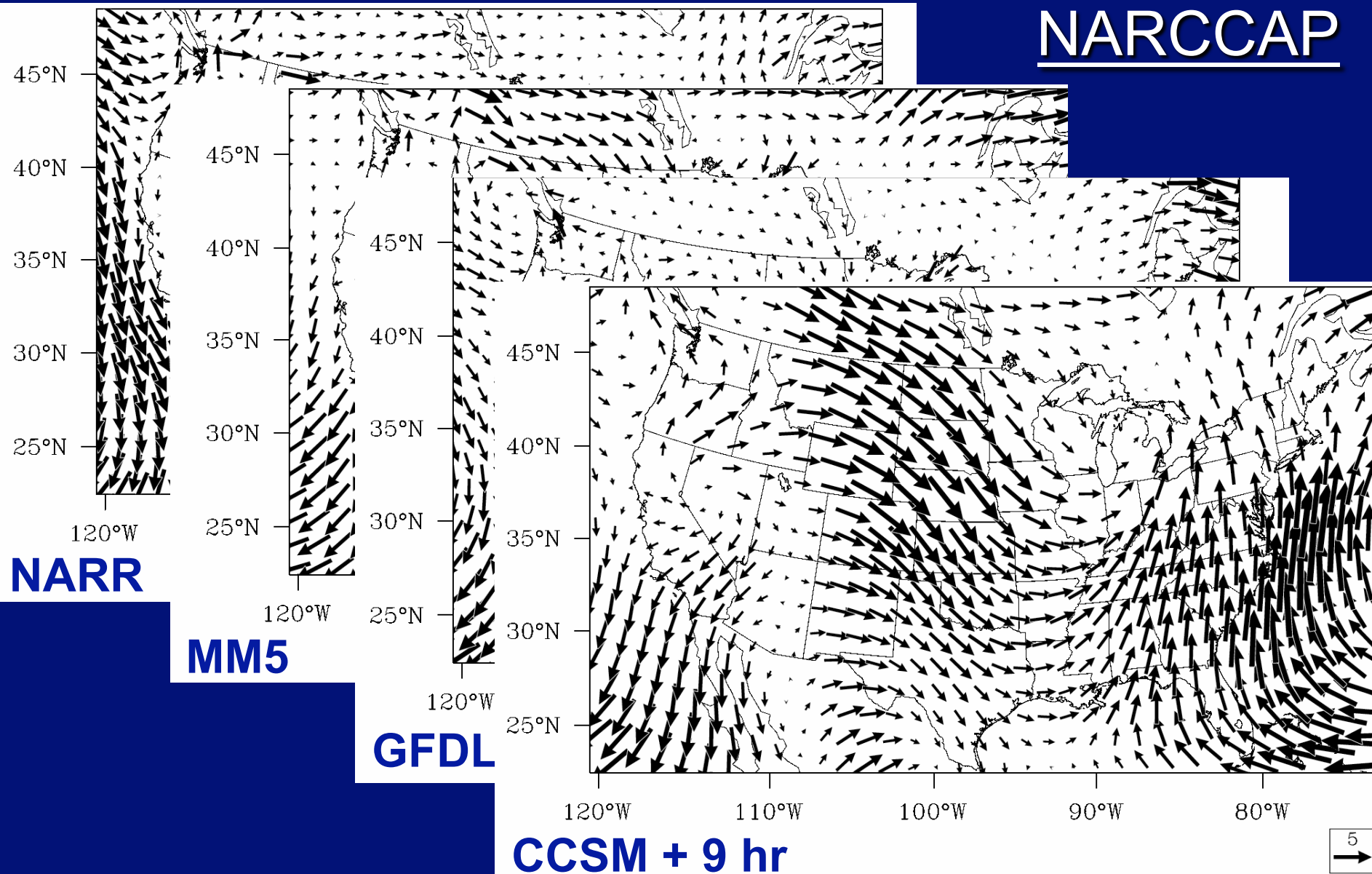


Composite Structure of Extreme Events - DJF



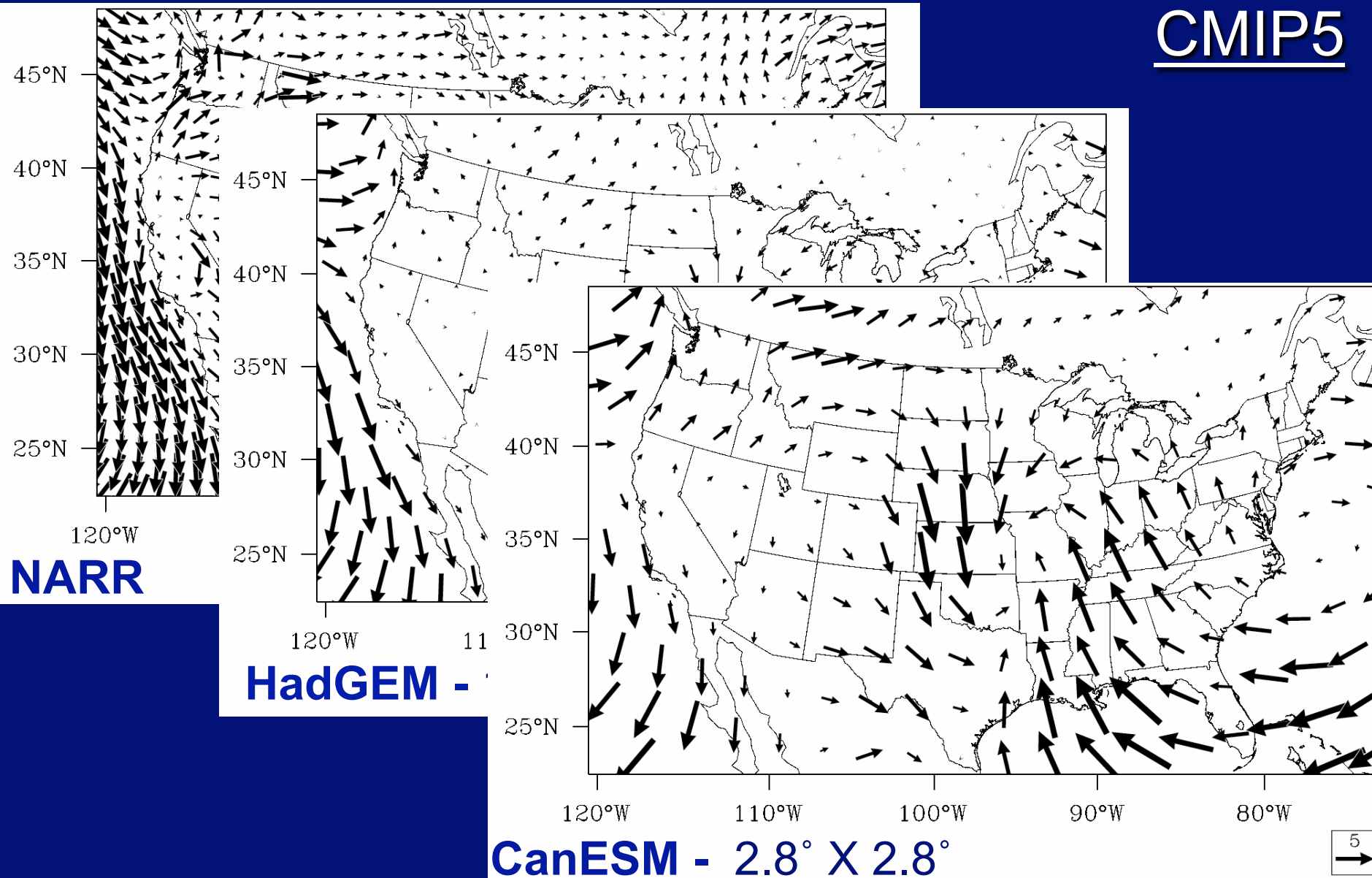
Composite Structure of Extreme Events - DJF

NARCCAP

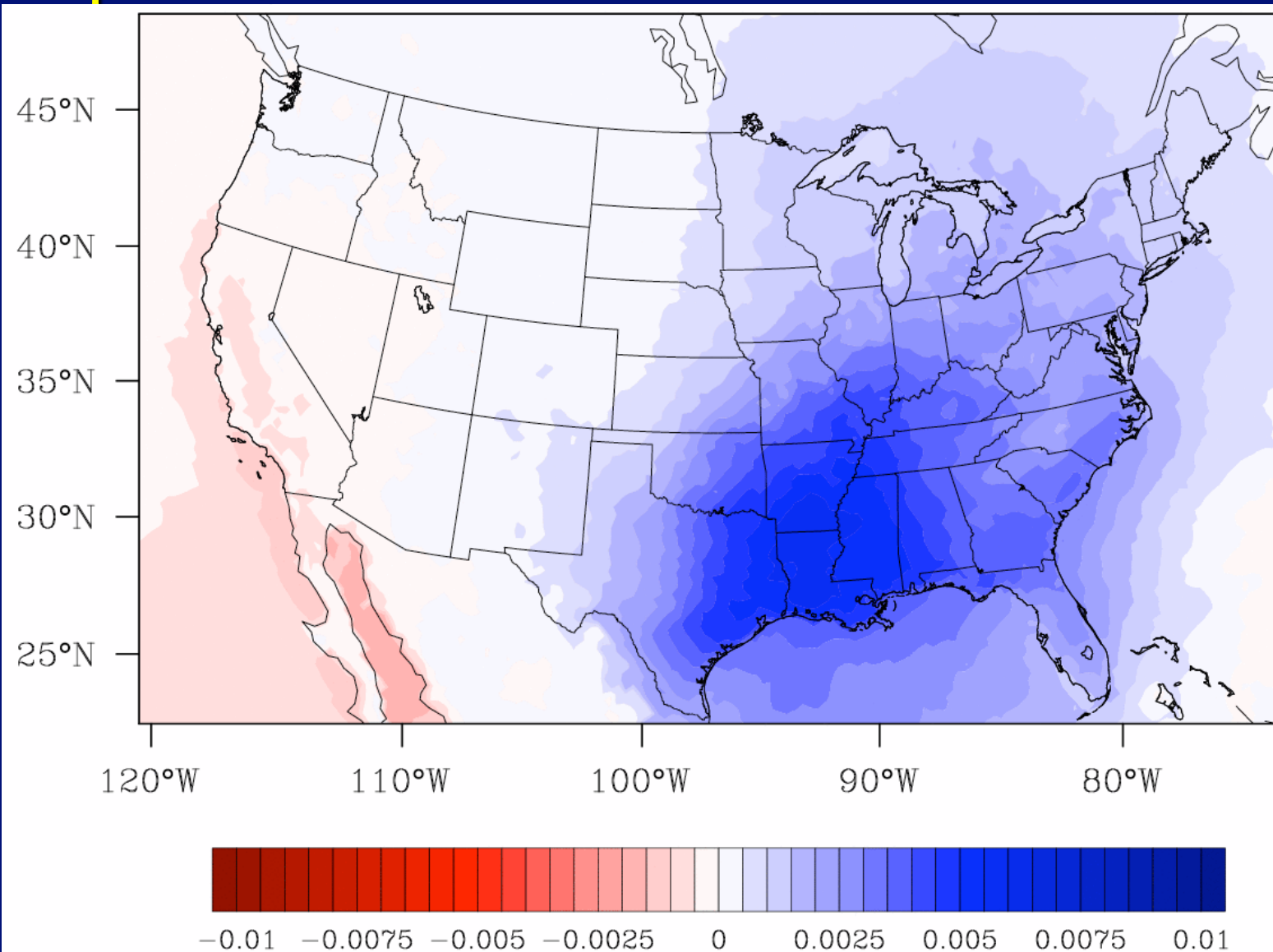


Composite Structure of Extreme Events - DJF

CMIP5



Composite Structure of Extreme Events - DJF

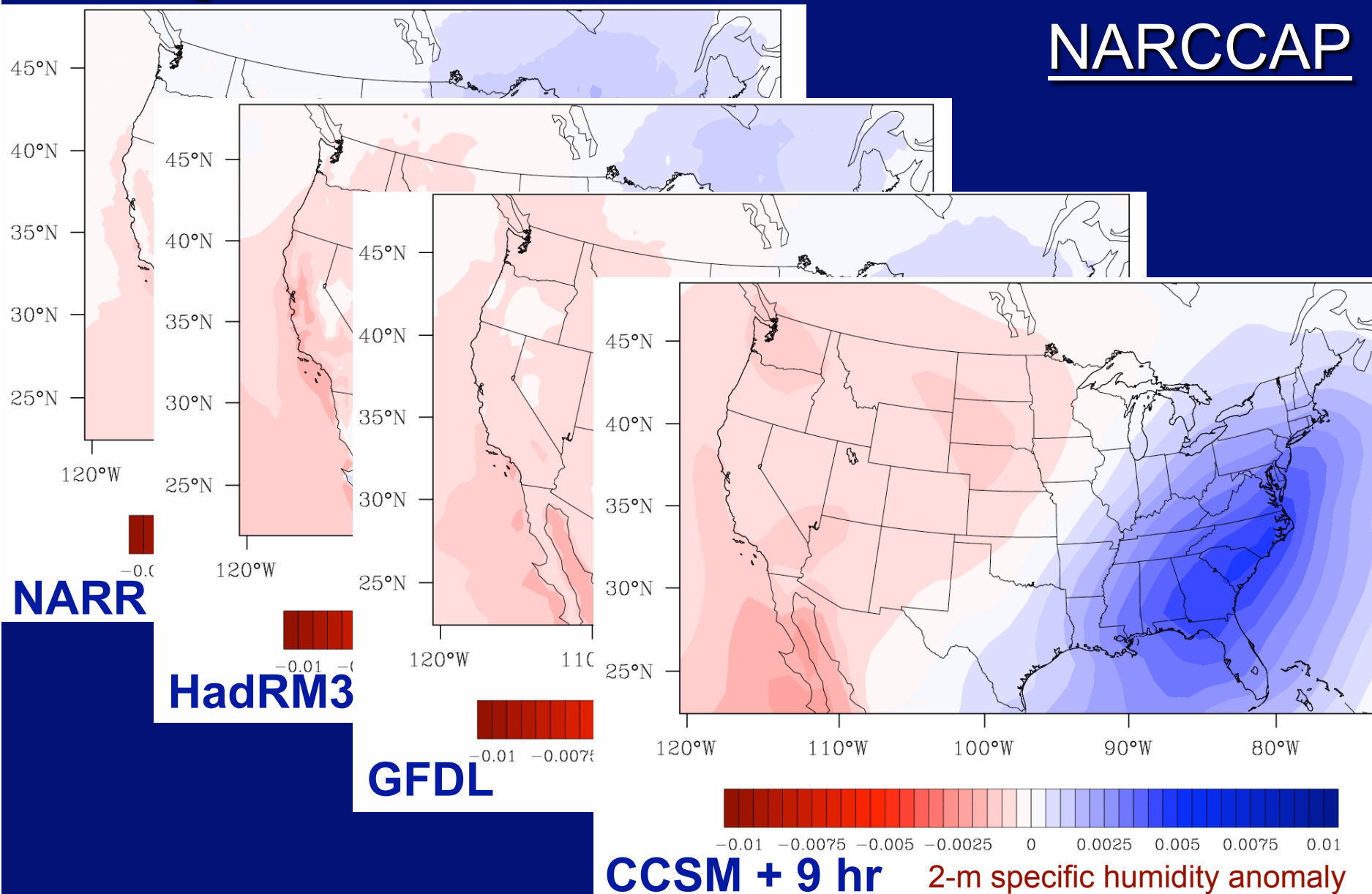


NARR

2-m specific humidity anomaly

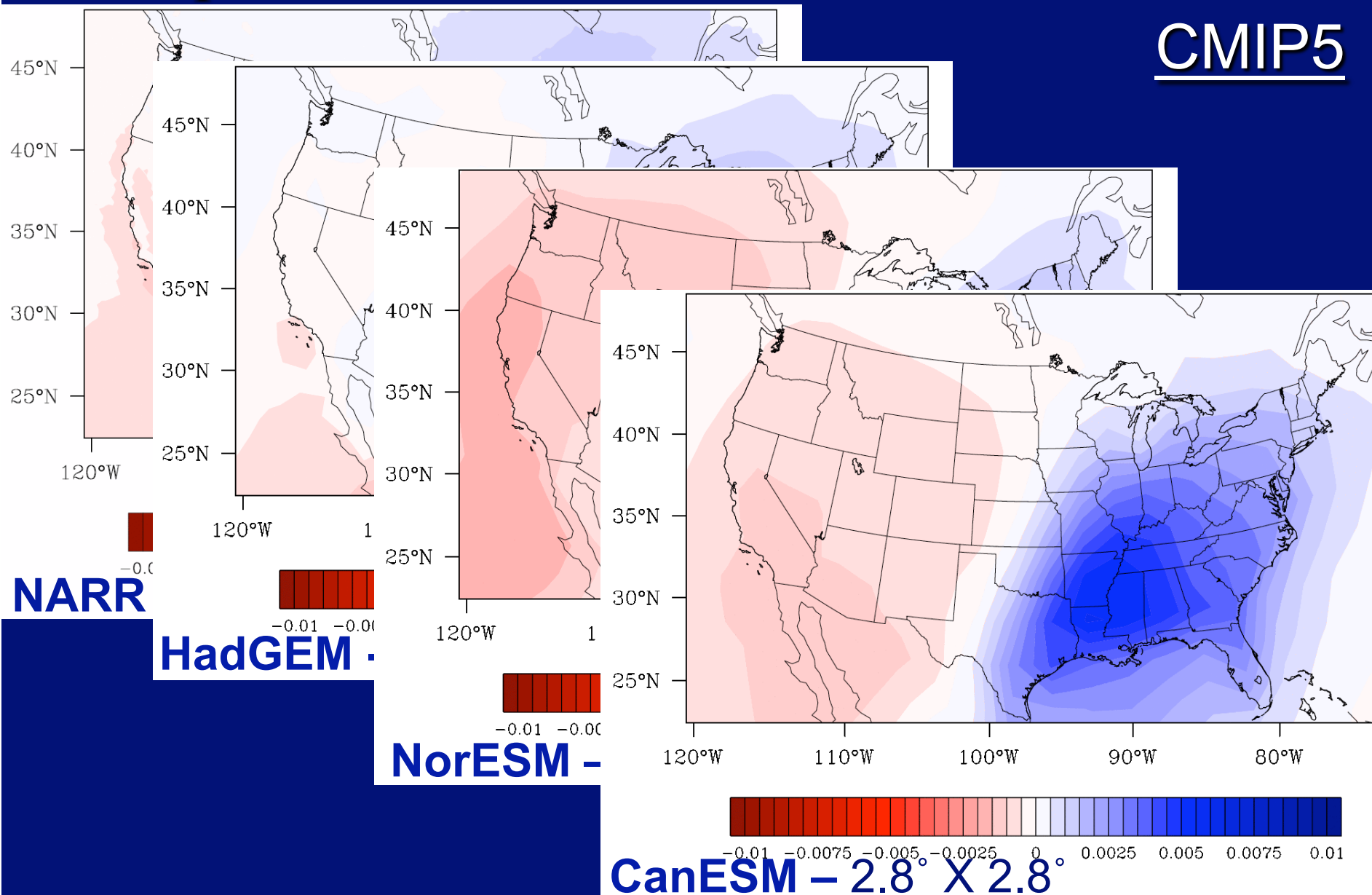
Composite Structure of Extreme Events - DJF

NARCCAP

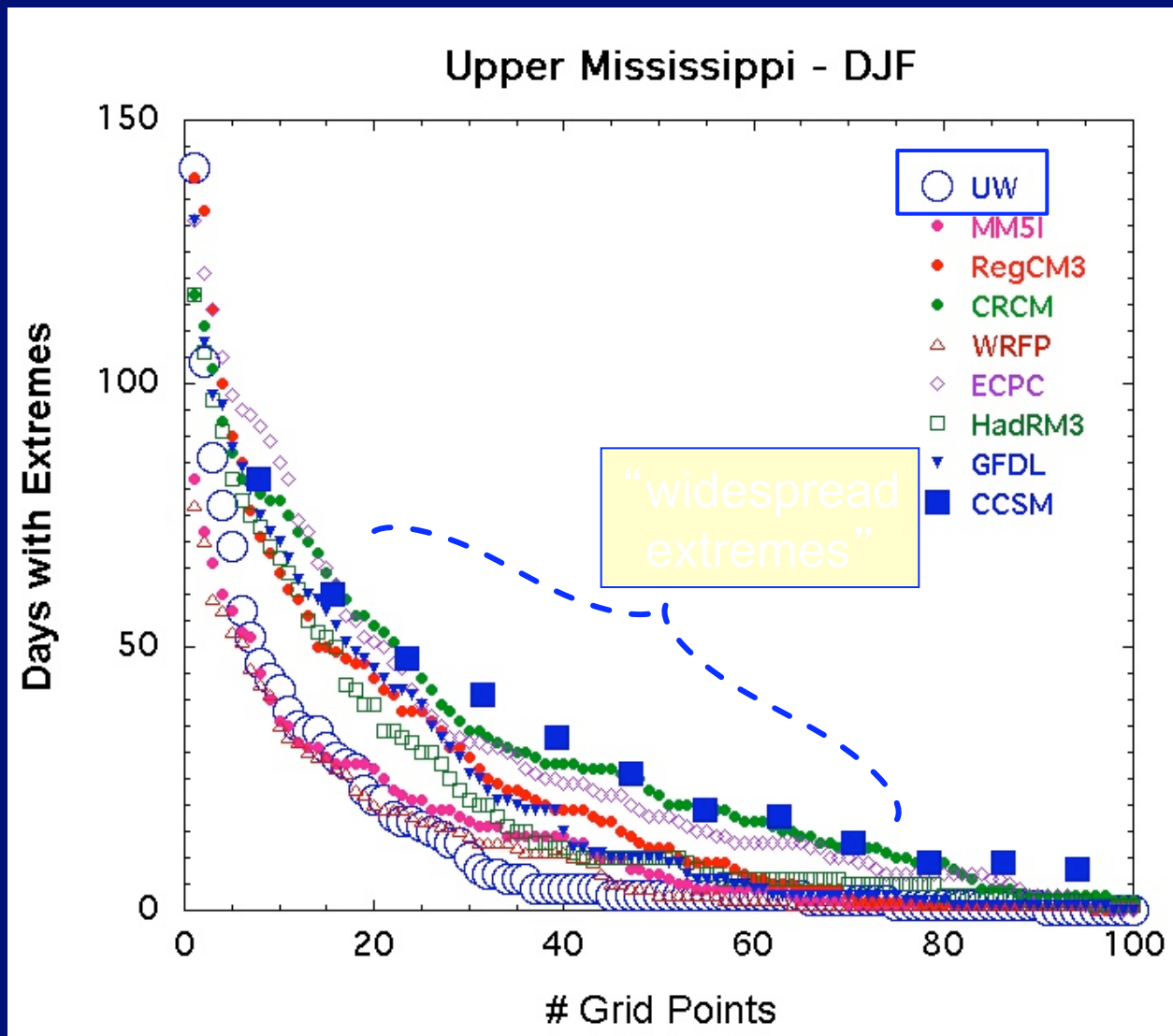


Composite Structure of Extreme Events - DJF

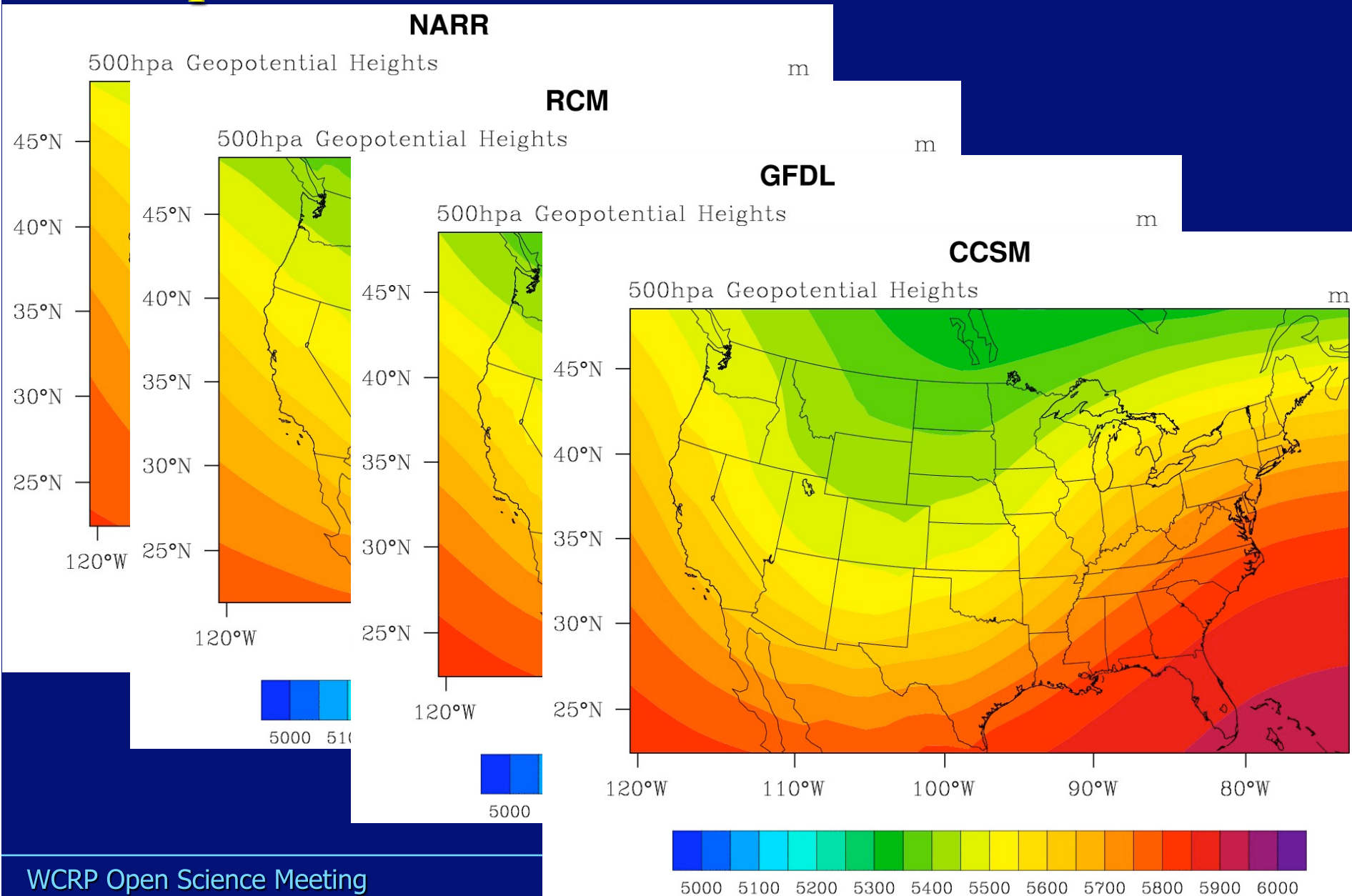
CMIP5



Days with Simultaneous Extremes on “N” Grid Points

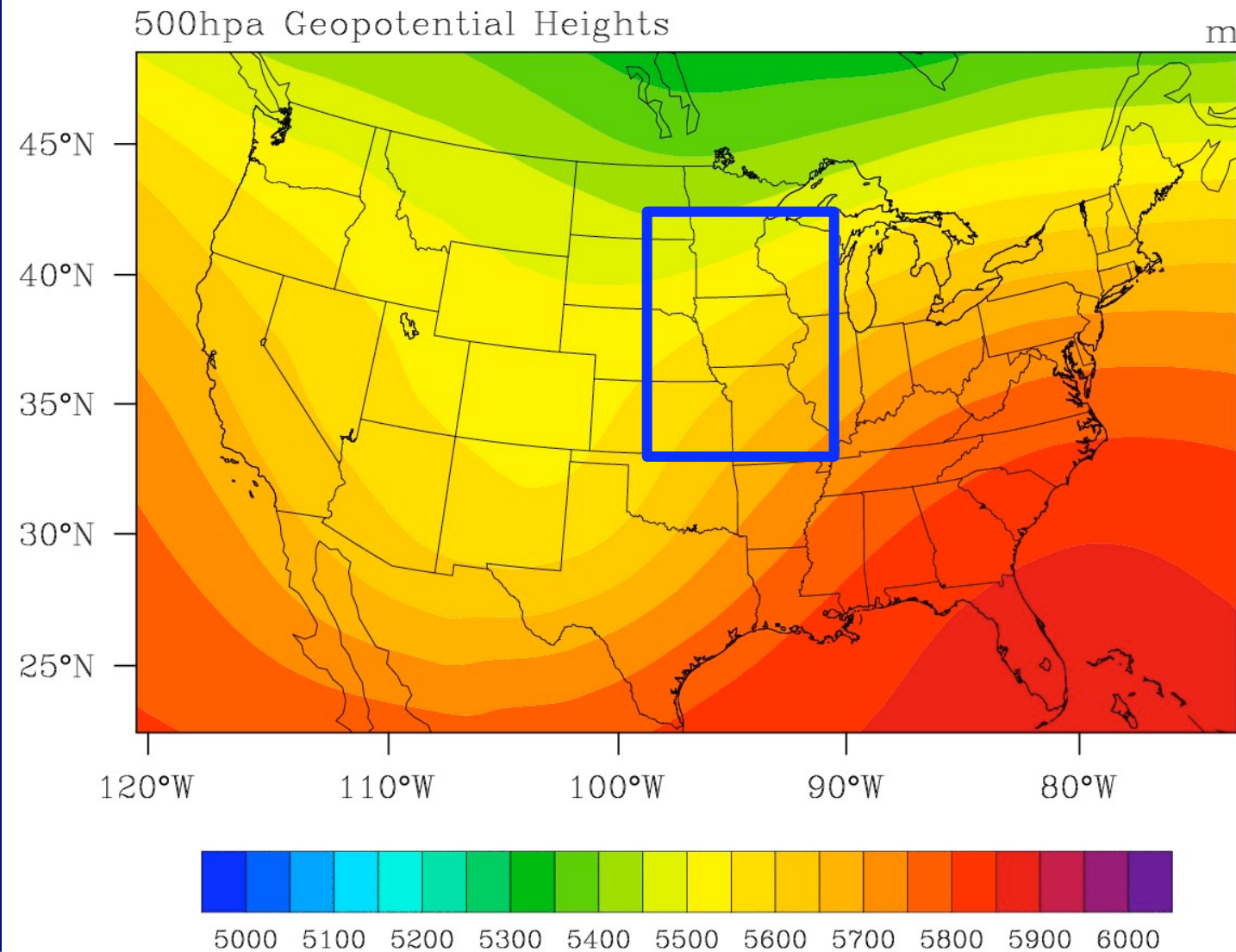


Composite Structure of Extreme Events - DJF

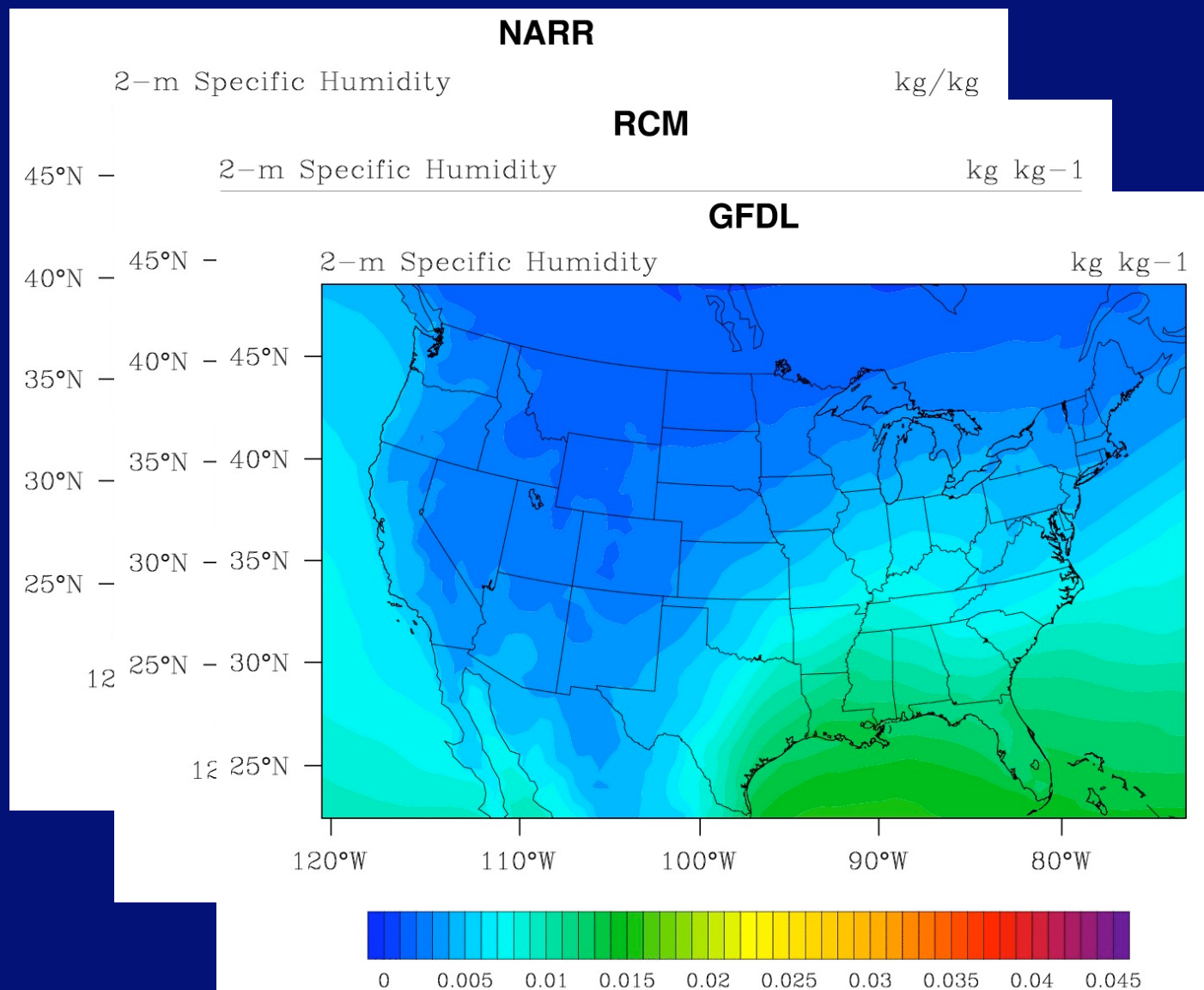


Composite Structure of Extreme Events

DI
NARR

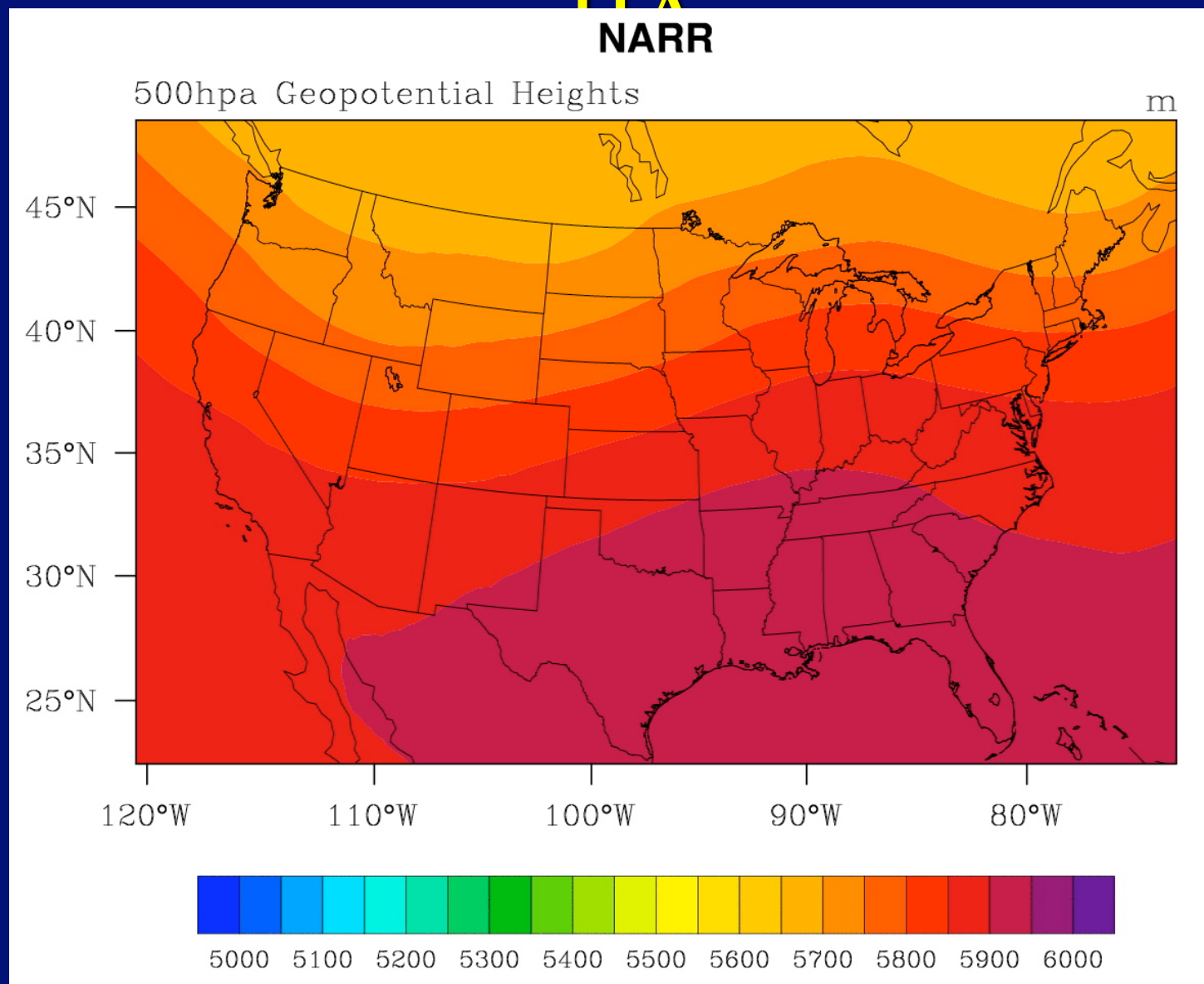


Composite Structure of Extreme Events - DJF

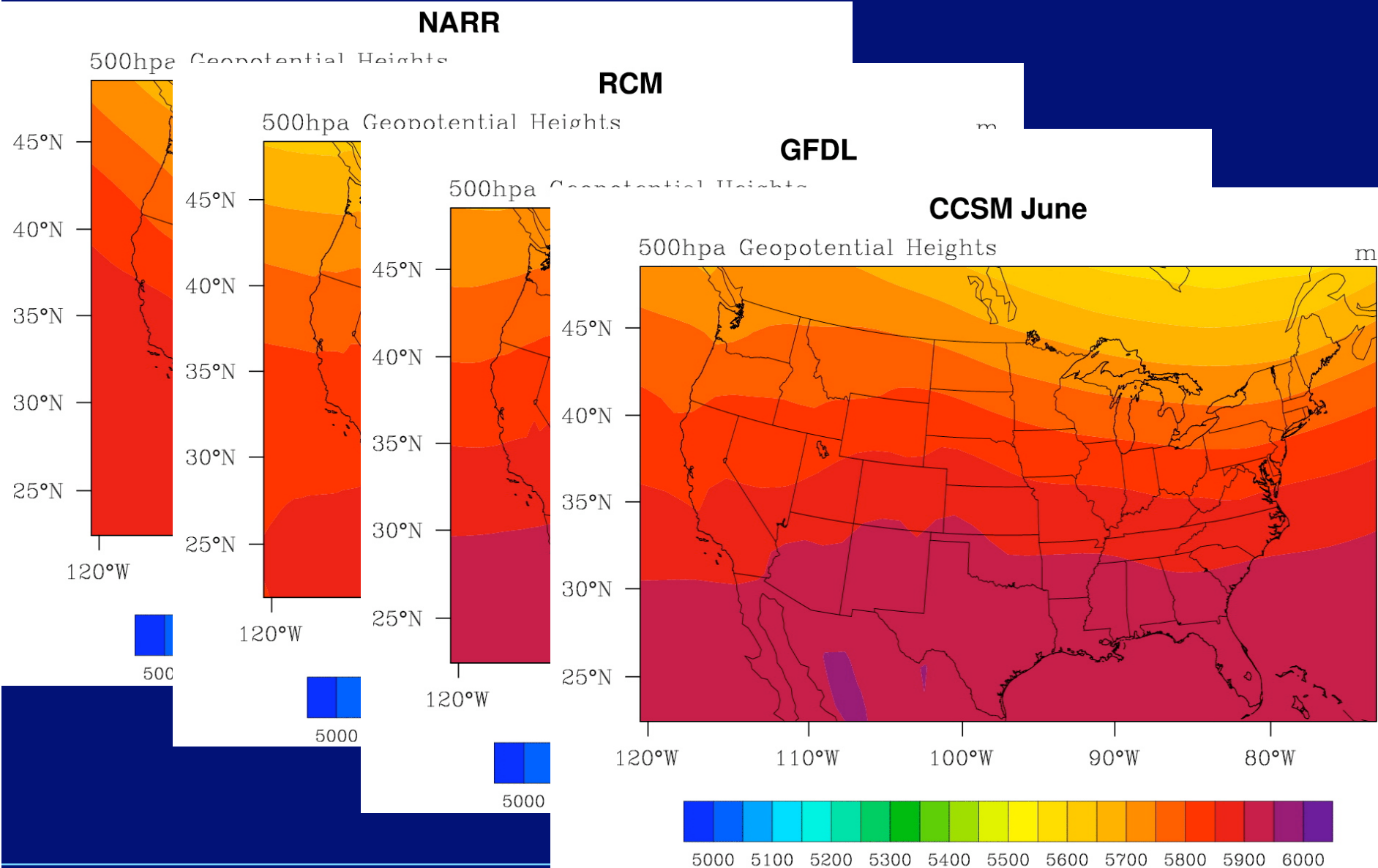


Composite Structure of Extreme Events

IIA
NARR



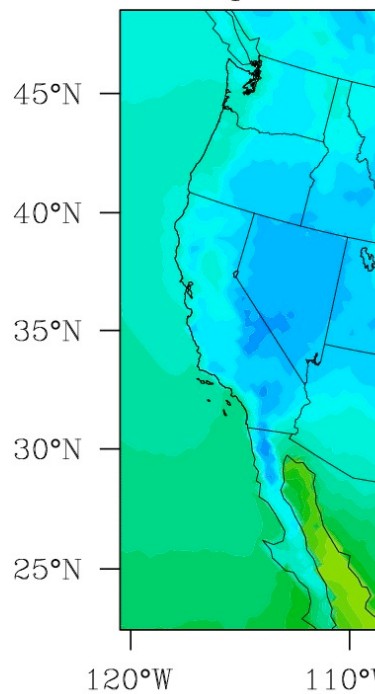
Composite Structure of Extreme Events - JJA



Composite Structure of Extreme Events - JJA

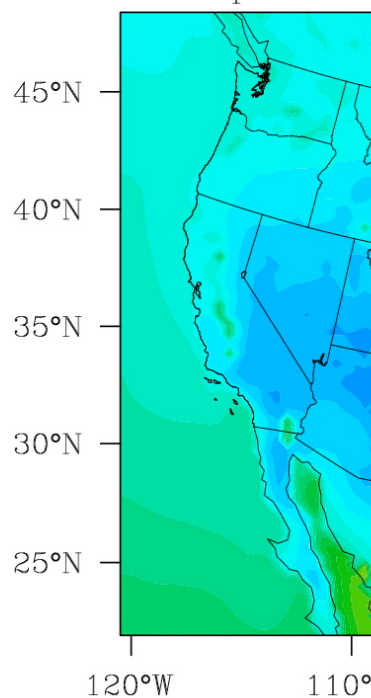
NARR

2-m Specific Humidity kg/kg



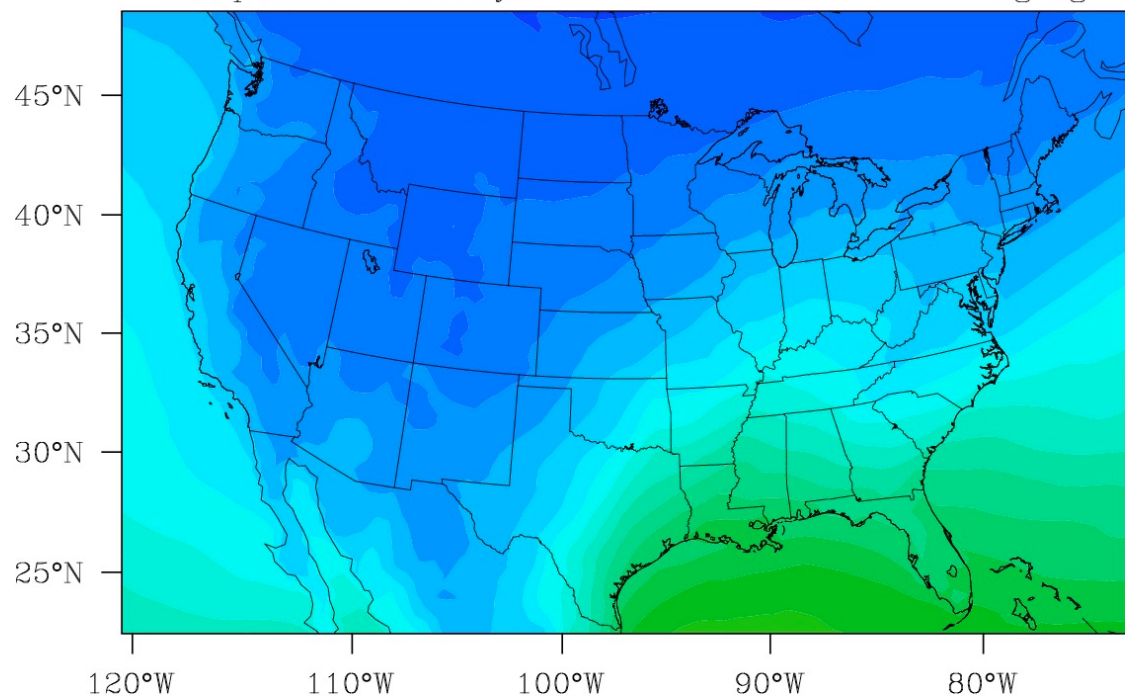
RCM

2-m Specific Humidity

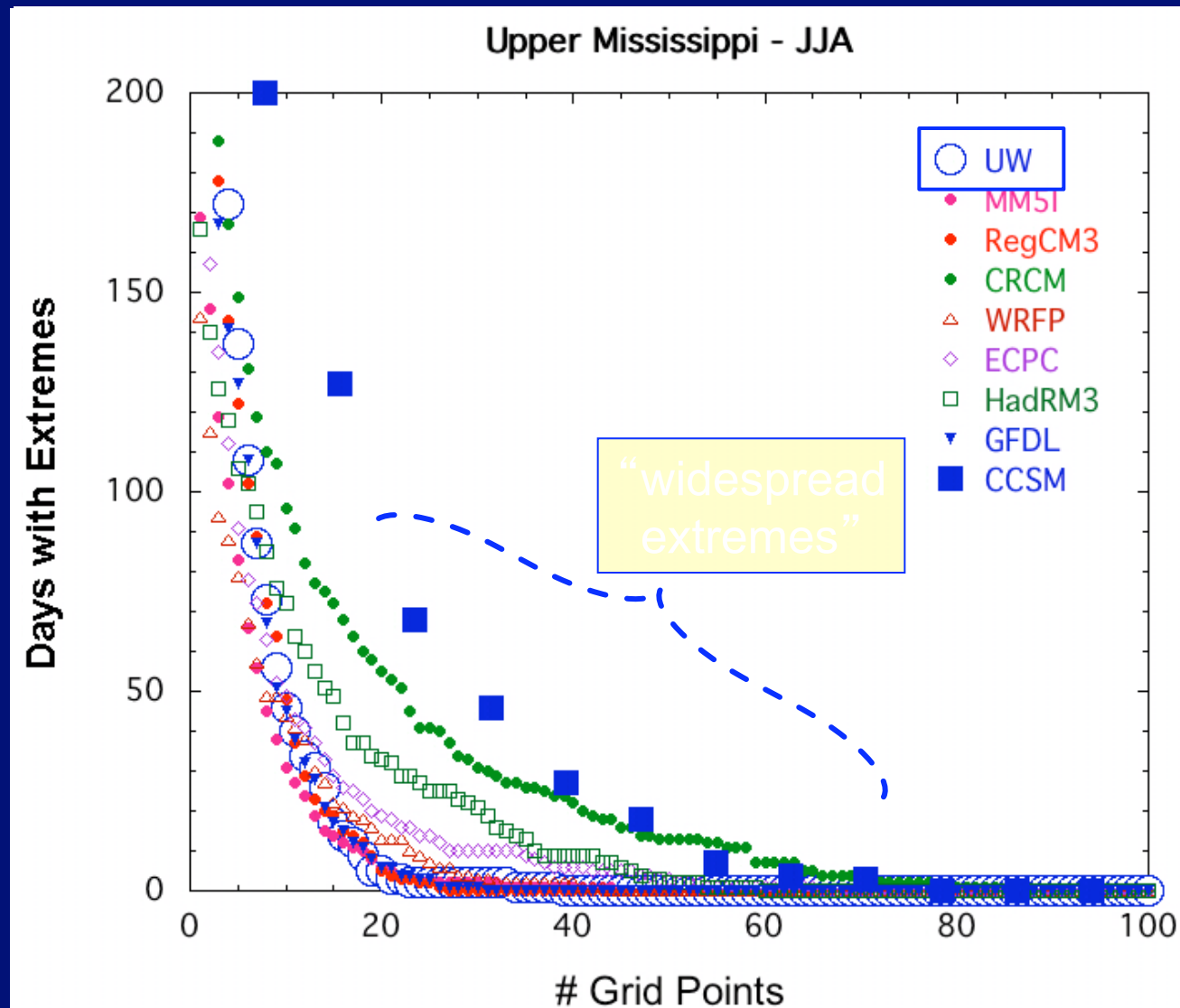


GFDL

2-m Specific Humidity



Days with Simultaneous Extremes on “N” Grid Points



Days with Simultaneous Extremes on “N” Grid Points

