What does the ClimEx large ensemble tell us about the future evolution of extreme precipitation?

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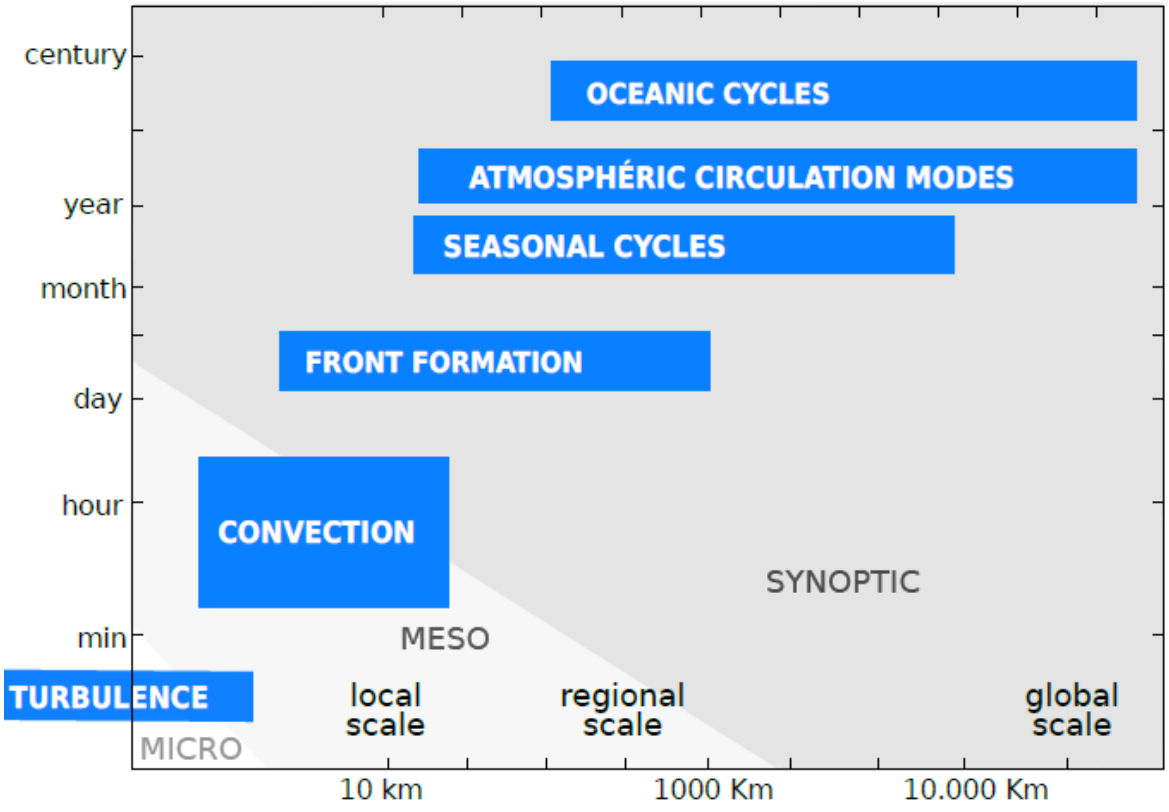
Three major issues with extreme precipitation

- Large spatiotemporal variability
- Available records are sparse and cover short periods
- Huge changes in future extreme precipitation

[Figure adapted from Westra et al., 2014]

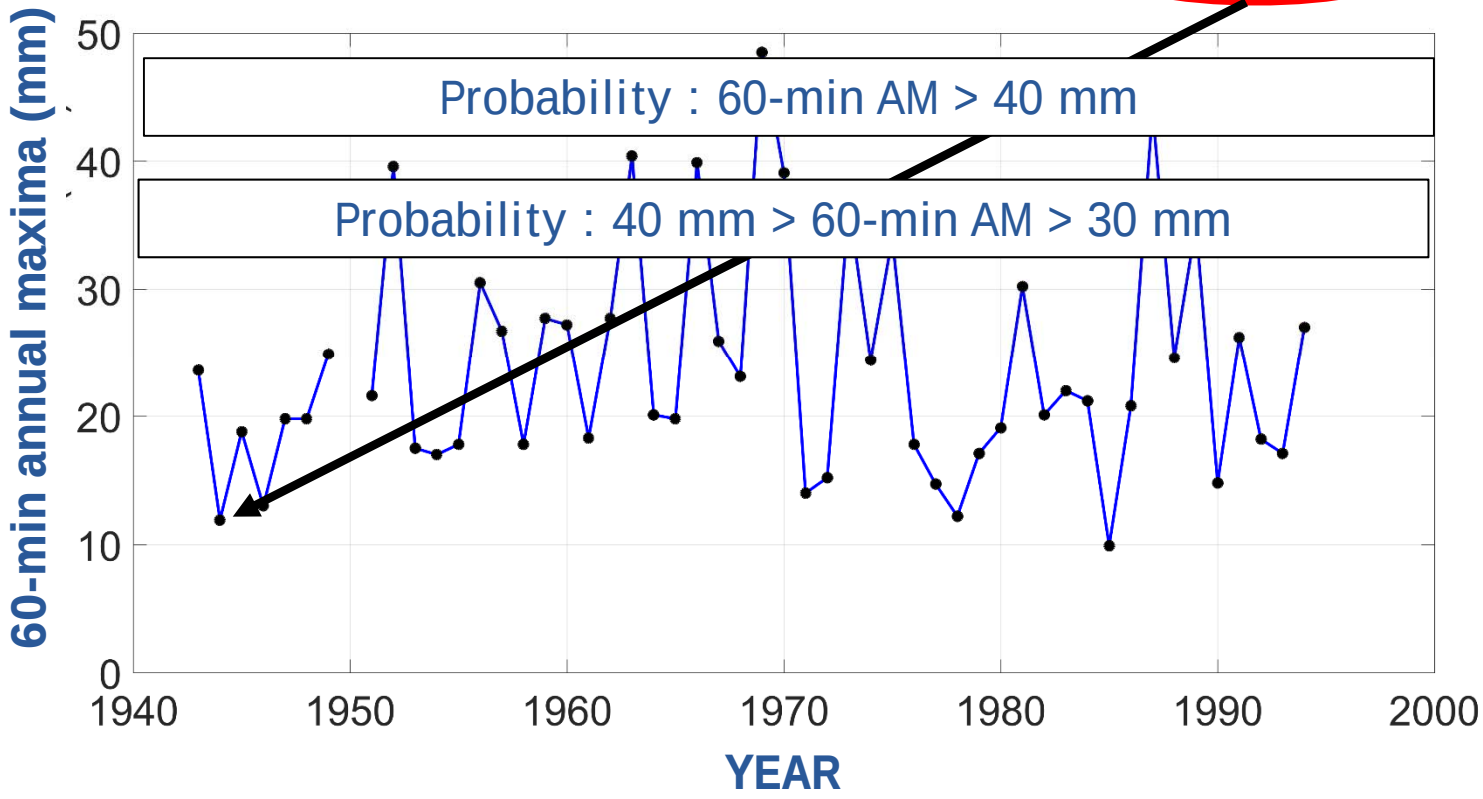


How do we define extreme precipitation?

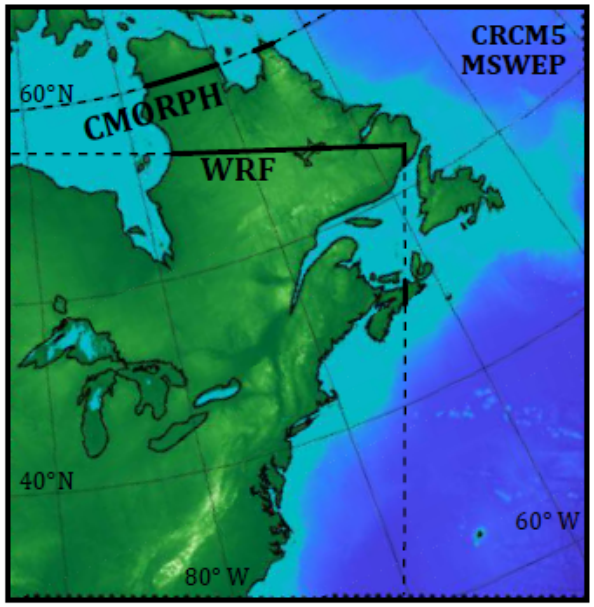
Recorded 15 min. rainfall series

...	2.0	1.4	2.3	2.3	3.0	2.8	2.6	2.7	2.2	1.7	...

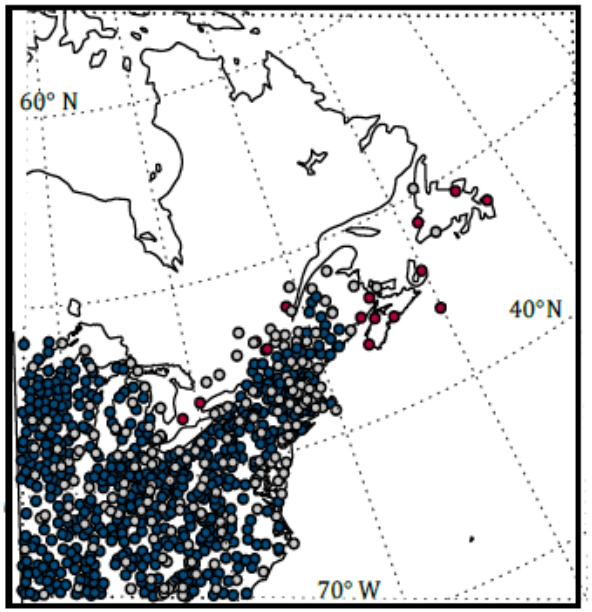
60-min annual maximum (AM) value = 11.1 mm



Comparison of the ClimEx reanalysis driven simulation with other datasets



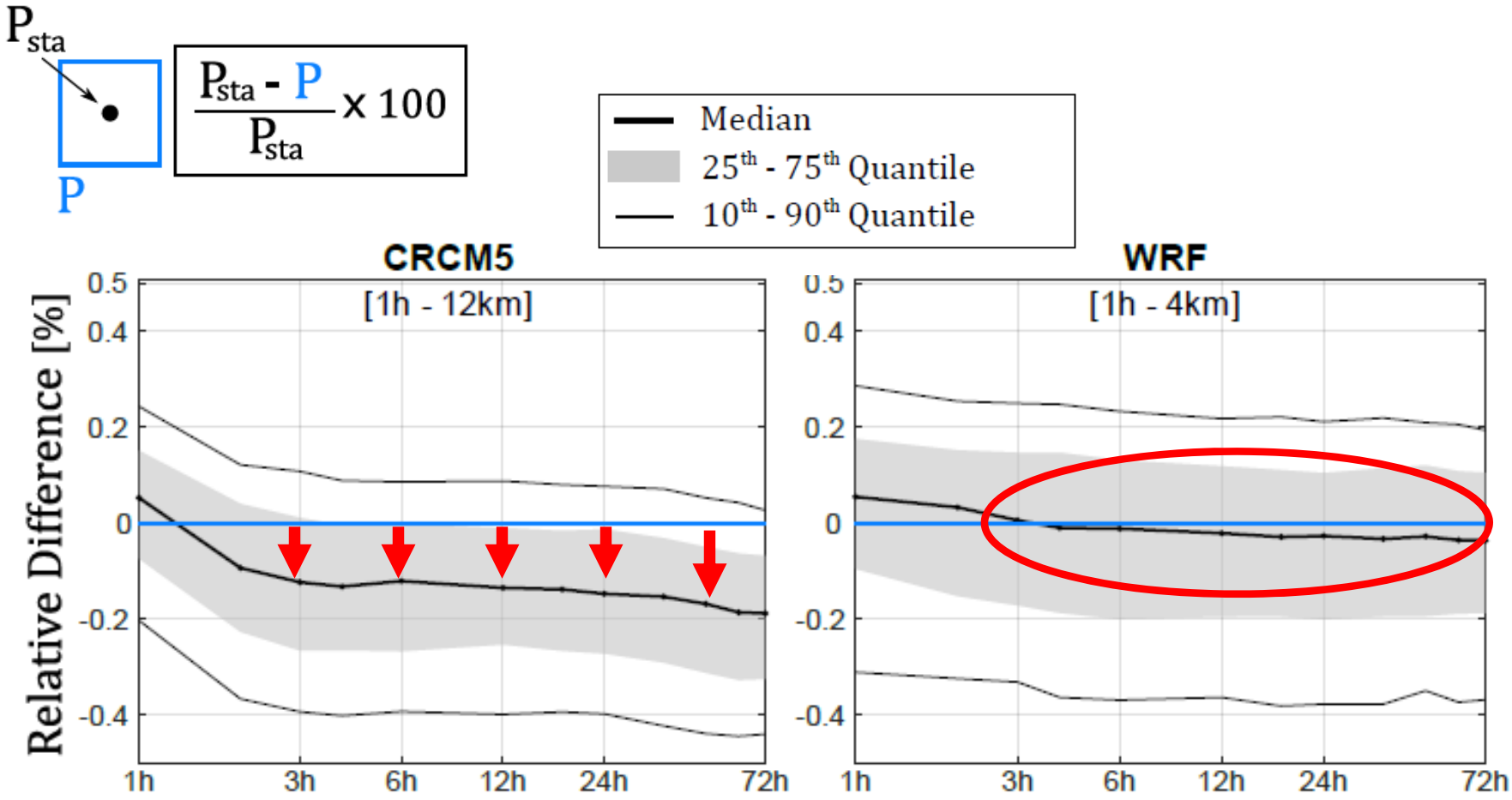
North American simulation domain



759 stations

- Weather Research and Forecasting (WRF) model
- Canadian Regional Climate Model (CRCM5)

Relative difference between recorded and simulated 1-h 10-yr annual maxima precipitation



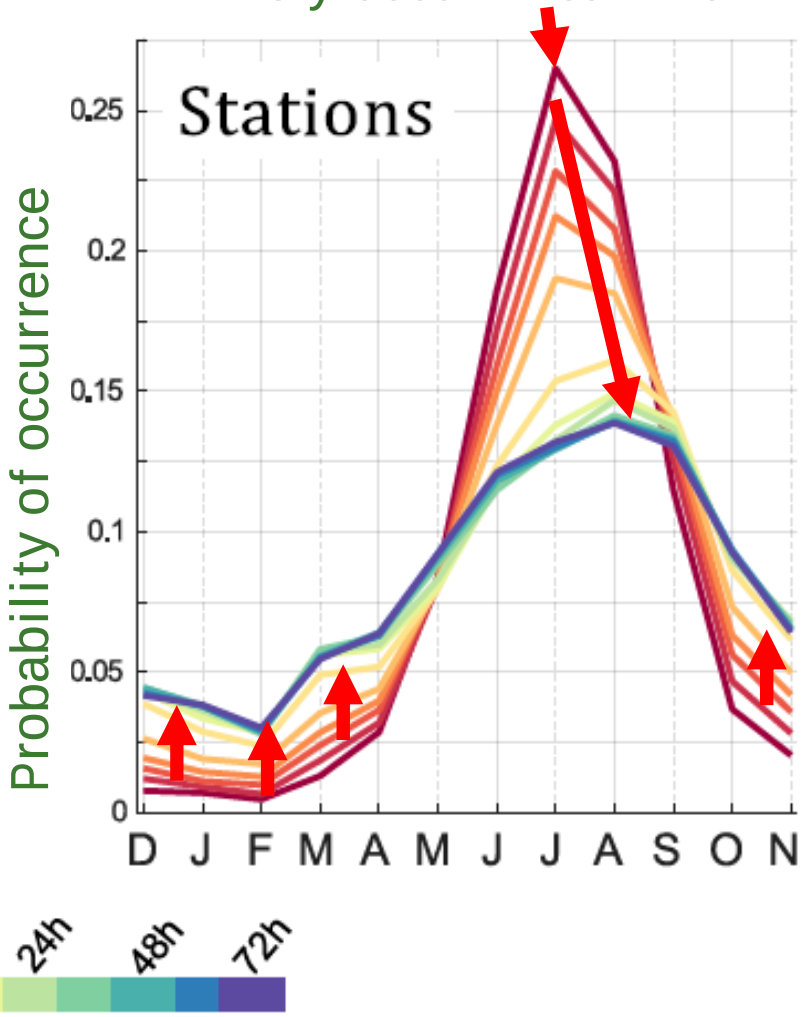
Overestimation of station values by ClimEx simulation

Fair agreement of station values with WRF simulation

Simulated and observed annual cycles

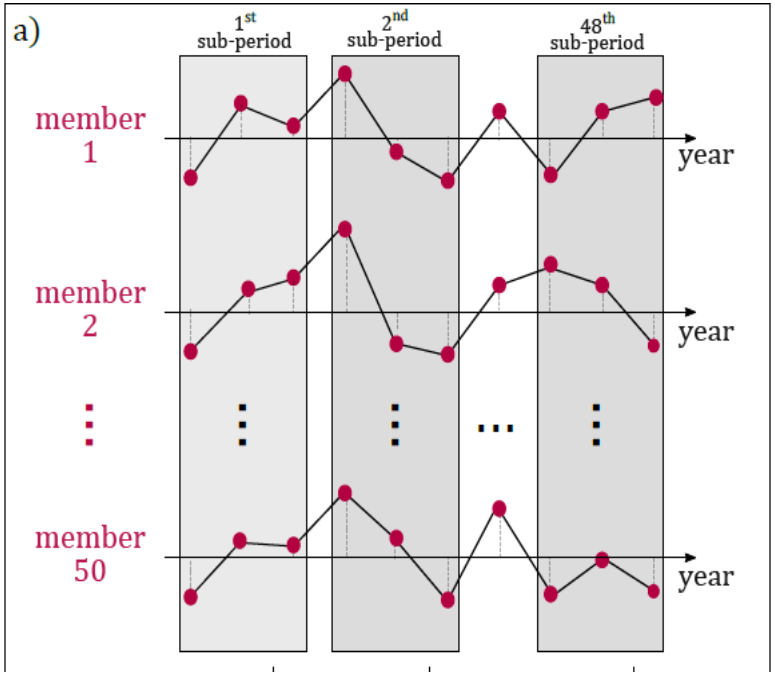
Underestimation probability of occurrence during summer

Short duration extremes more likely occur in summer



Combining the 50-member annual maxima series to assess future extreme precipitation

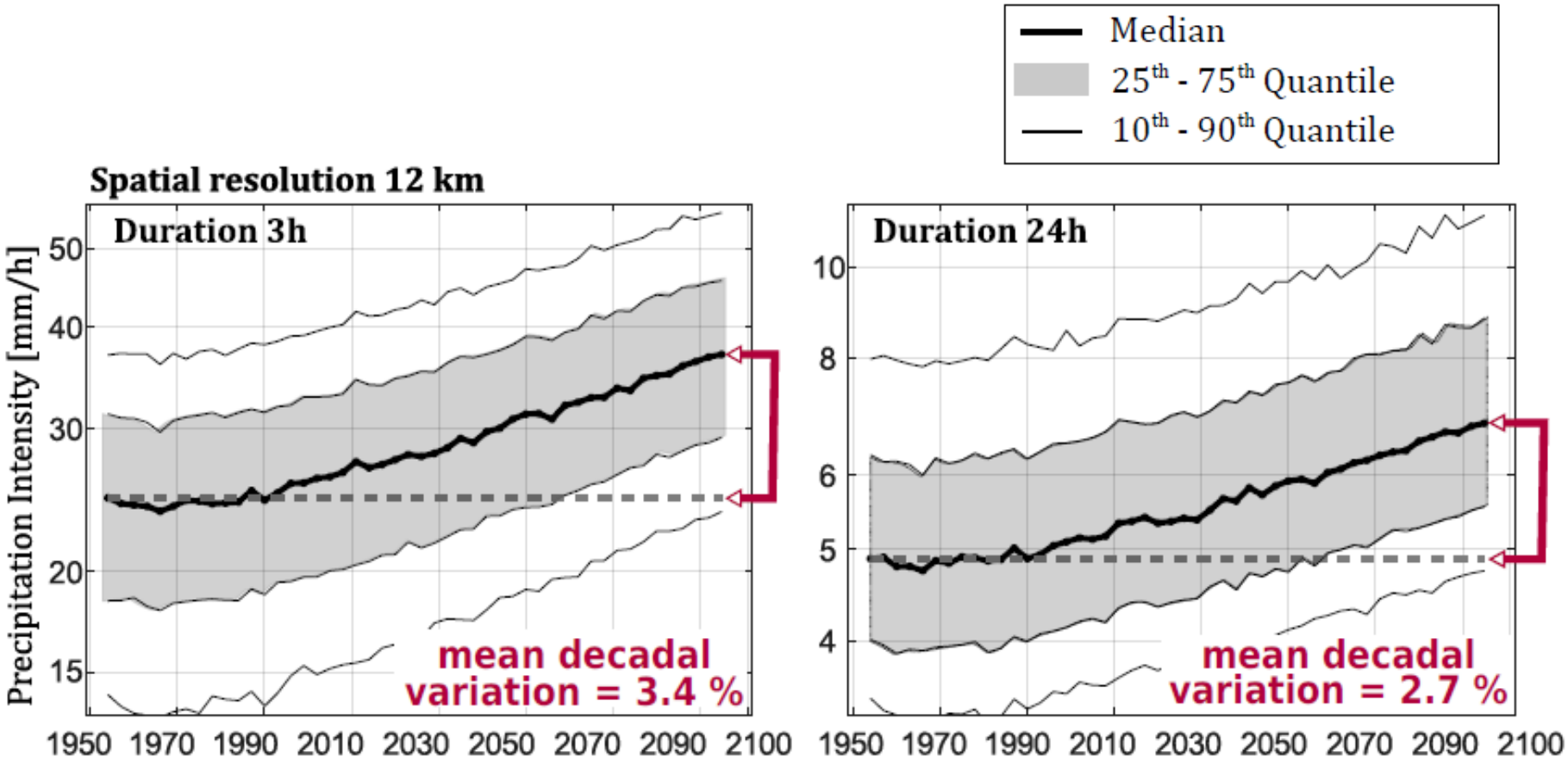
3 years X 50 members = 150 values for each sub-period



Estimation of the 100-yr annual maxima values

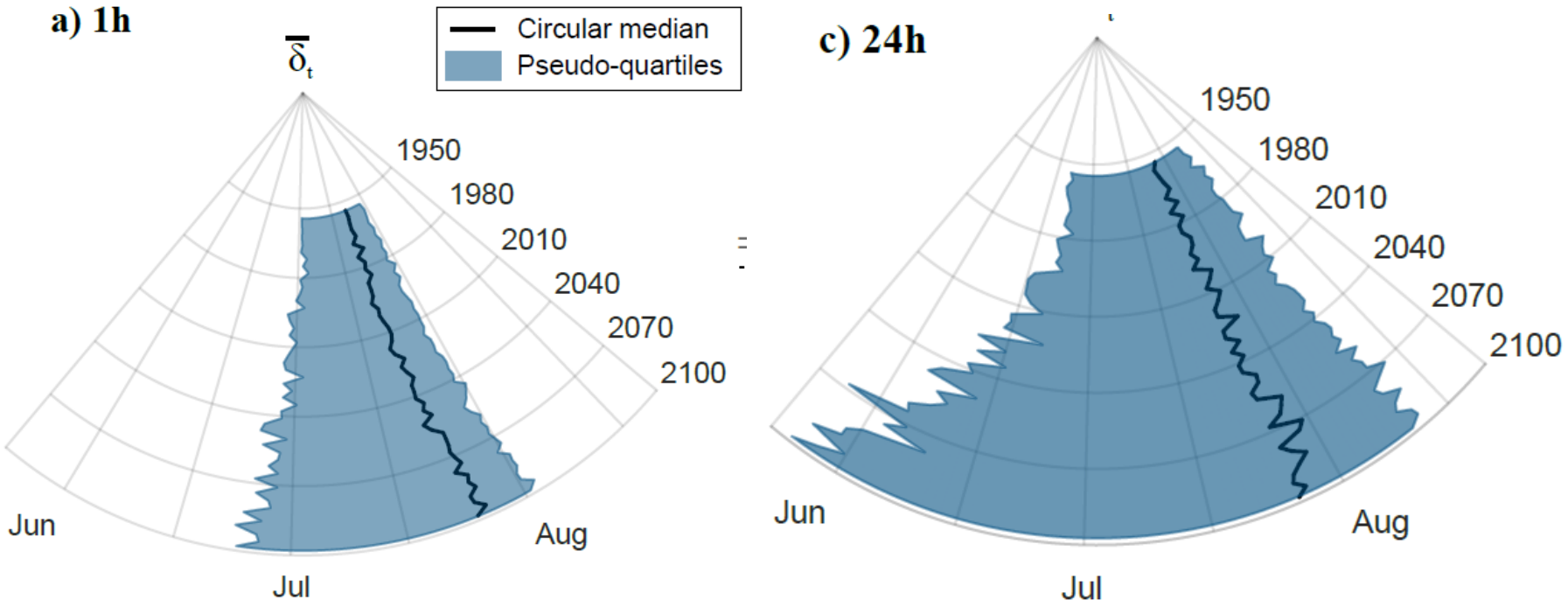
3-yr series of 100-yr annual maxima values

Future evolution of 3-h and 24-hr 100-yr return period extreme precipitation



- Significant increases for most grid points
- Largest increases for short durations and longer return periods

Future evolution of the annual cycle



Distribution of the mean date of occurrence of annual maxima

Key messages

Performance in historical climate

- CRCM5 overestimates observed annual maximum values for almost all durations – better performance for WRF
- Annual and daily (not shown) cycles adequately reproduced

Projected changes

- Highest extreme events are more affected
- Short duration extremes more affected
- Extension of the period over which extremes can occur