

Background

- Deep convections are associated with extreme weather events;
- Thermodynamic indices, such as Convective Available Potential Energy (CAPE) and Convective Inhibition (CIN), are used to determine the convective potential;
- General climate models have to parameterize deep convection due to their coarse grid spacing, which causes error and uncertainty.

Research Objective

Use 4-km convection-permitting Weather Research Forecasting (WRF) Model, to analyze the features of the convective indices and how they are related to extreme precipitation events under future climate condition.

Methodology

- 13-year simulation on Continental United States (2001-2013, CONUS) and 12-year simulation on Western Canada (2001-2012, WC);
- Current Climate simulation (CTRL):
Forced by 6-hourly ERA-Interim Reanalysis Data
- Future Climate simulation (PGW):

Pseudo Global Warming method

PGW = ERA-I + Δ CIMP5

- Study on summertime CAPE and CIN (June, July, August), classify the severity by their magnitude and analyze the change of frequency of convective events.

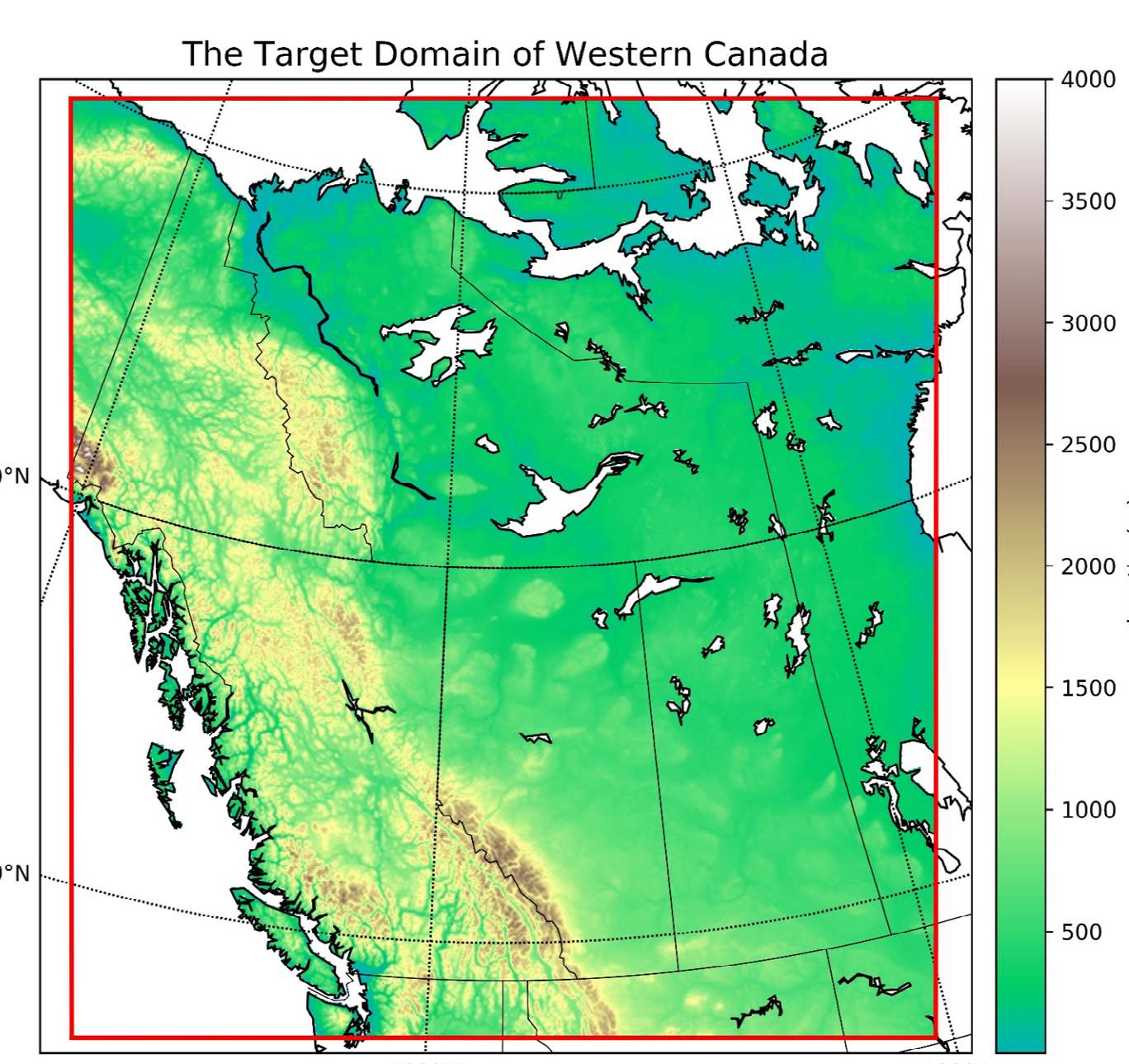
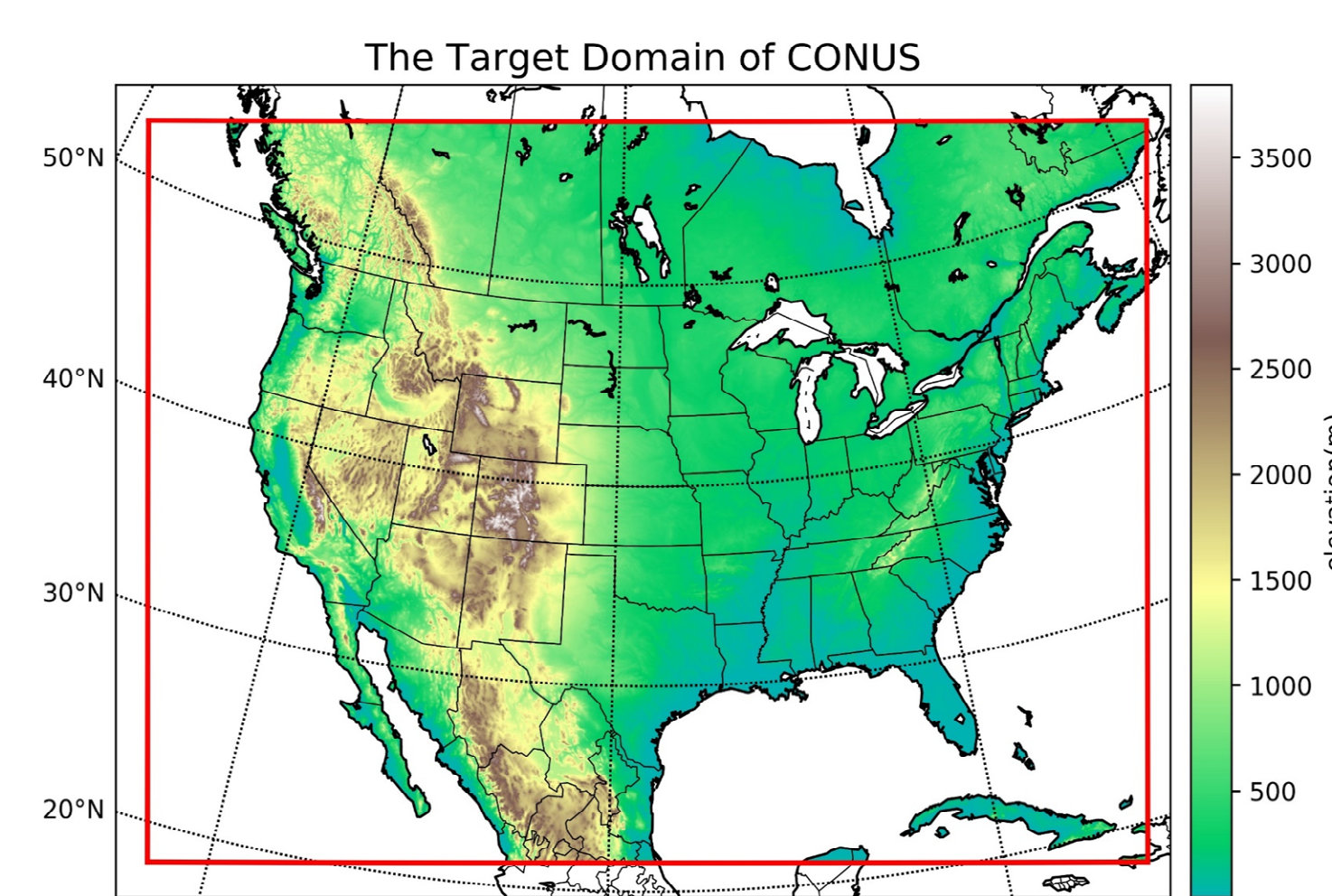
Classification of CAPE

0~100 J/kg: no convection;
100~1000 J/kg: weak;
1000~2500 J/kg: moderate;
>2500 J/kg: severe.

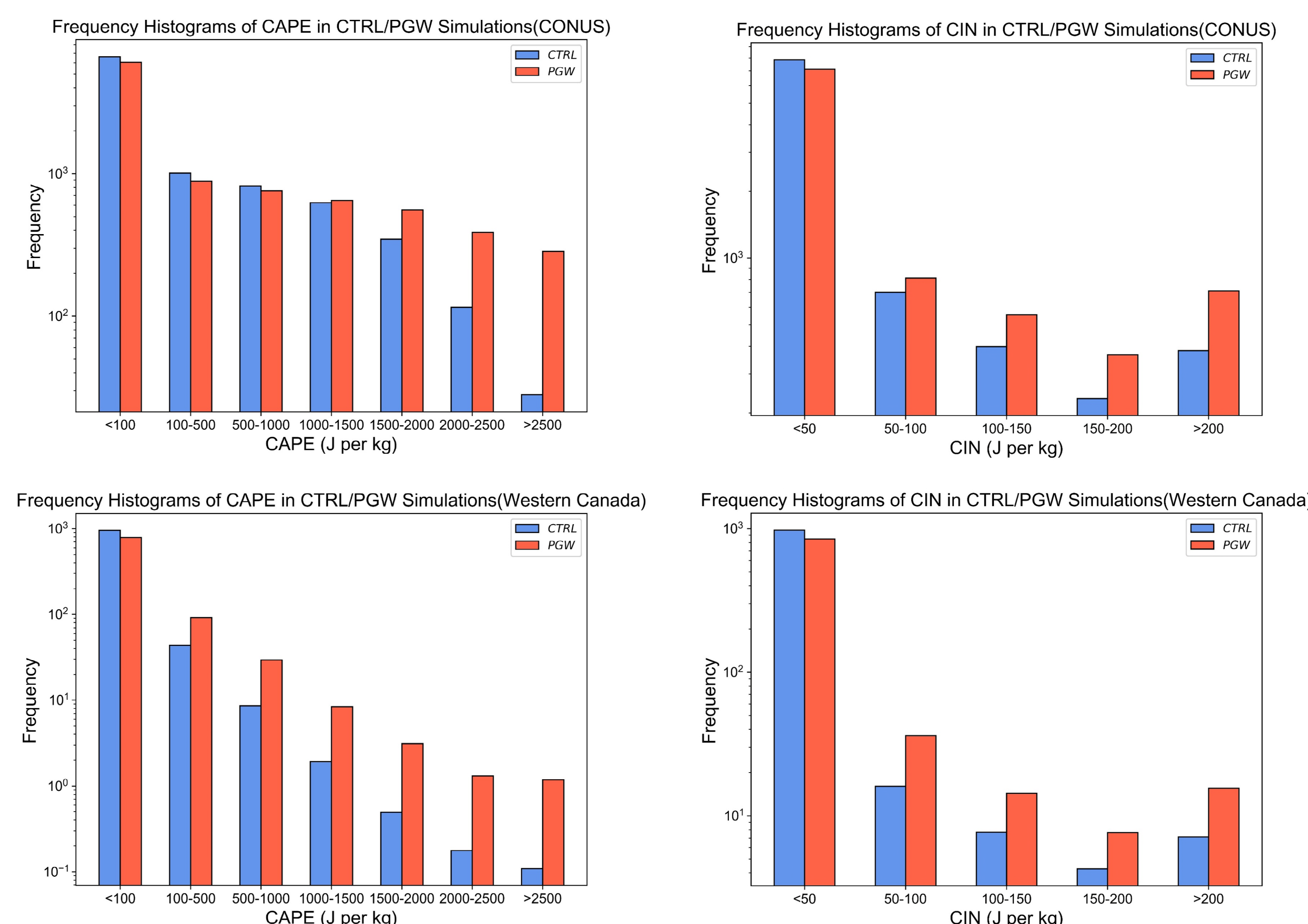
Classification of CIN

0~50 J/kg: weak cap;
50~200 J/kg: moderate cap;
>200 J/kg: severe cap.

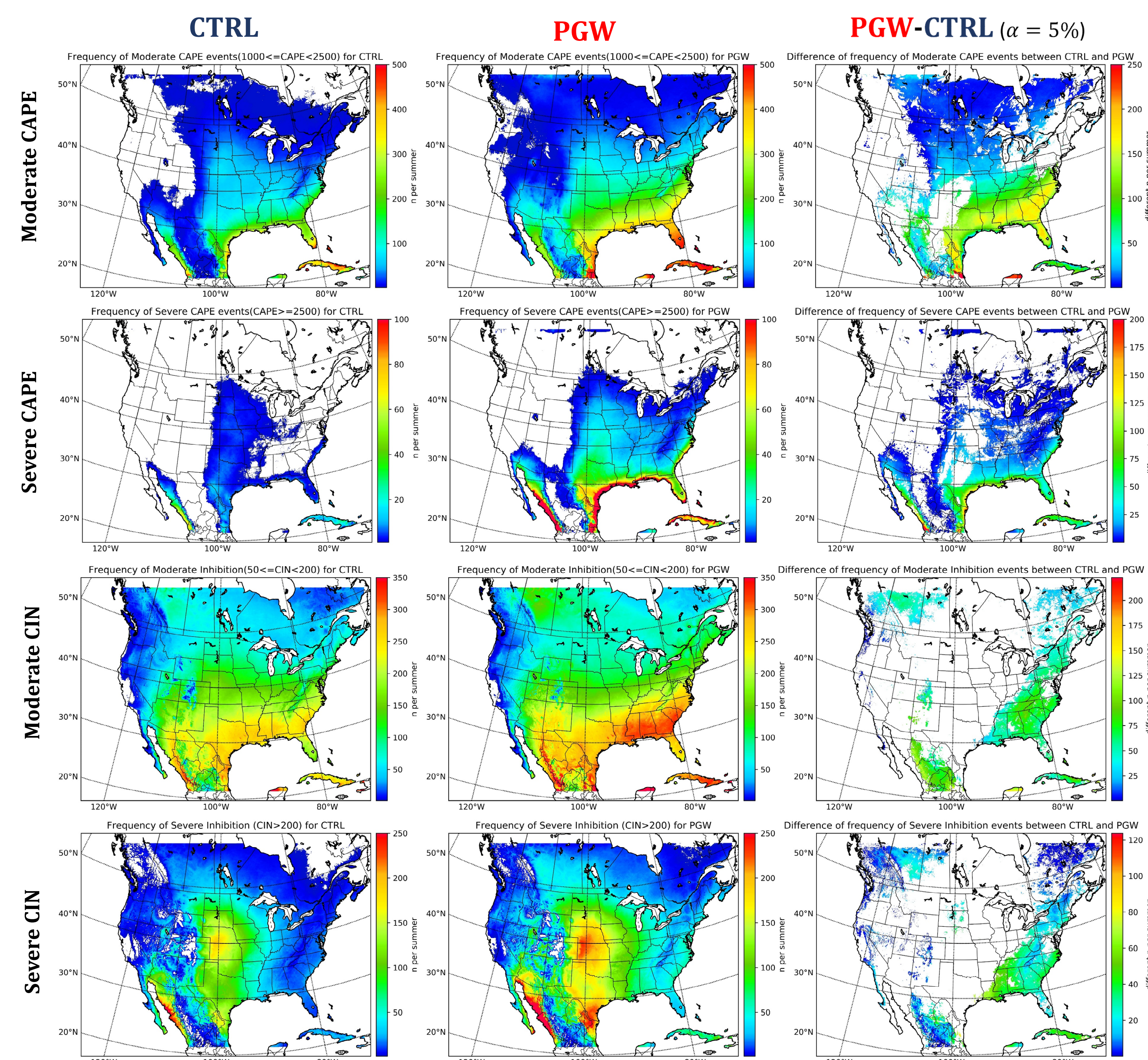
Study Area



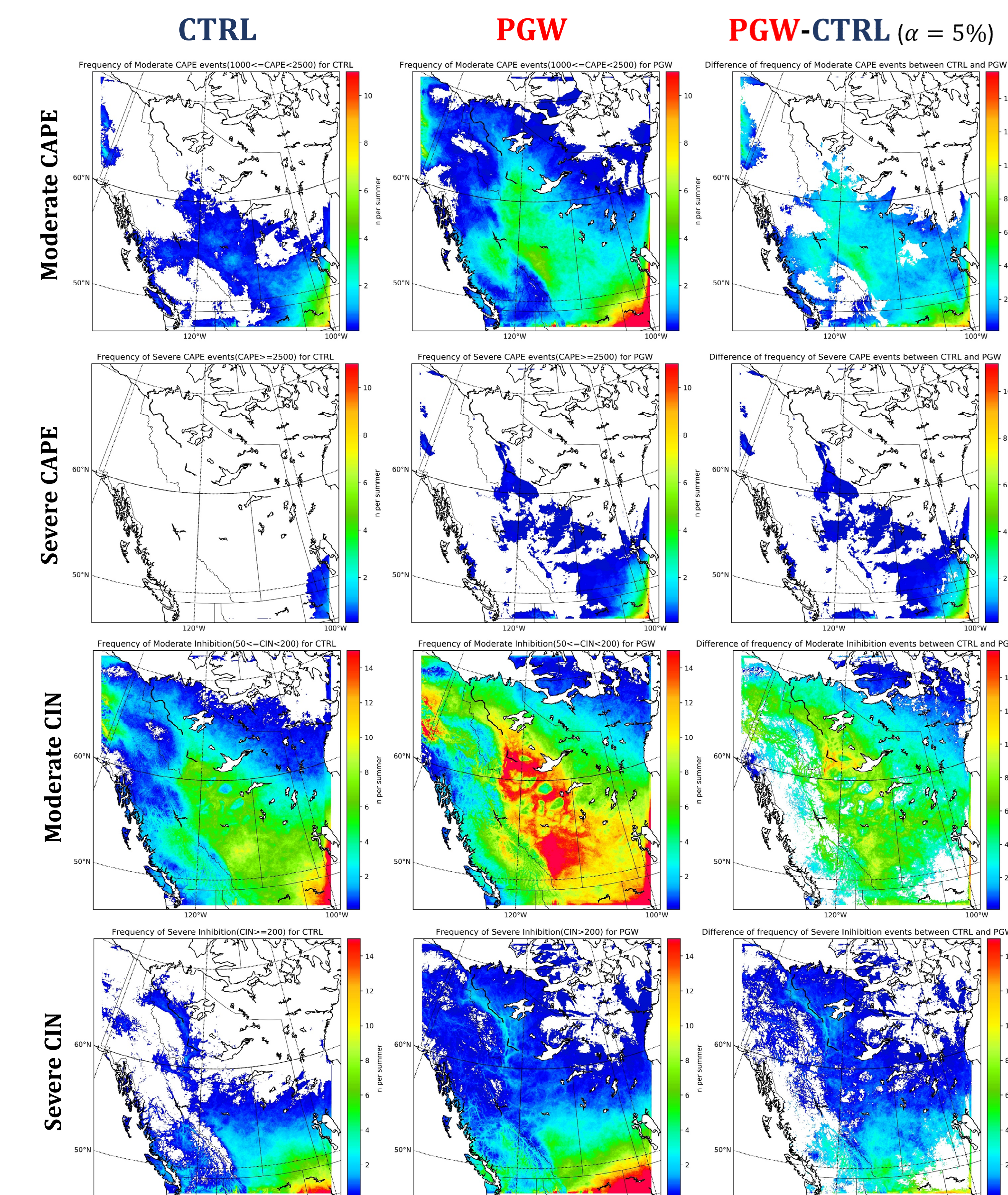
Frequency Histograms of CAPE and CIN



Occurrence of moderate/severe events for CONUS



Occurrence of moderate/severe events for WC



Conclusions

- Both CAPE and CIN show significant increase in PGW simulation
- In a warmer climate, the convective potential due to CAPE will increase significantly downstream of the Rockies, central and eastern US, and southern Canada;
- In the southeast US and Western Canada, the moderate and severe convective inhibition will occur more frequently. This may influence the convective population: weaker convections will be suppressed and convective energy will be stored which may increase the risk of extreme convections.