

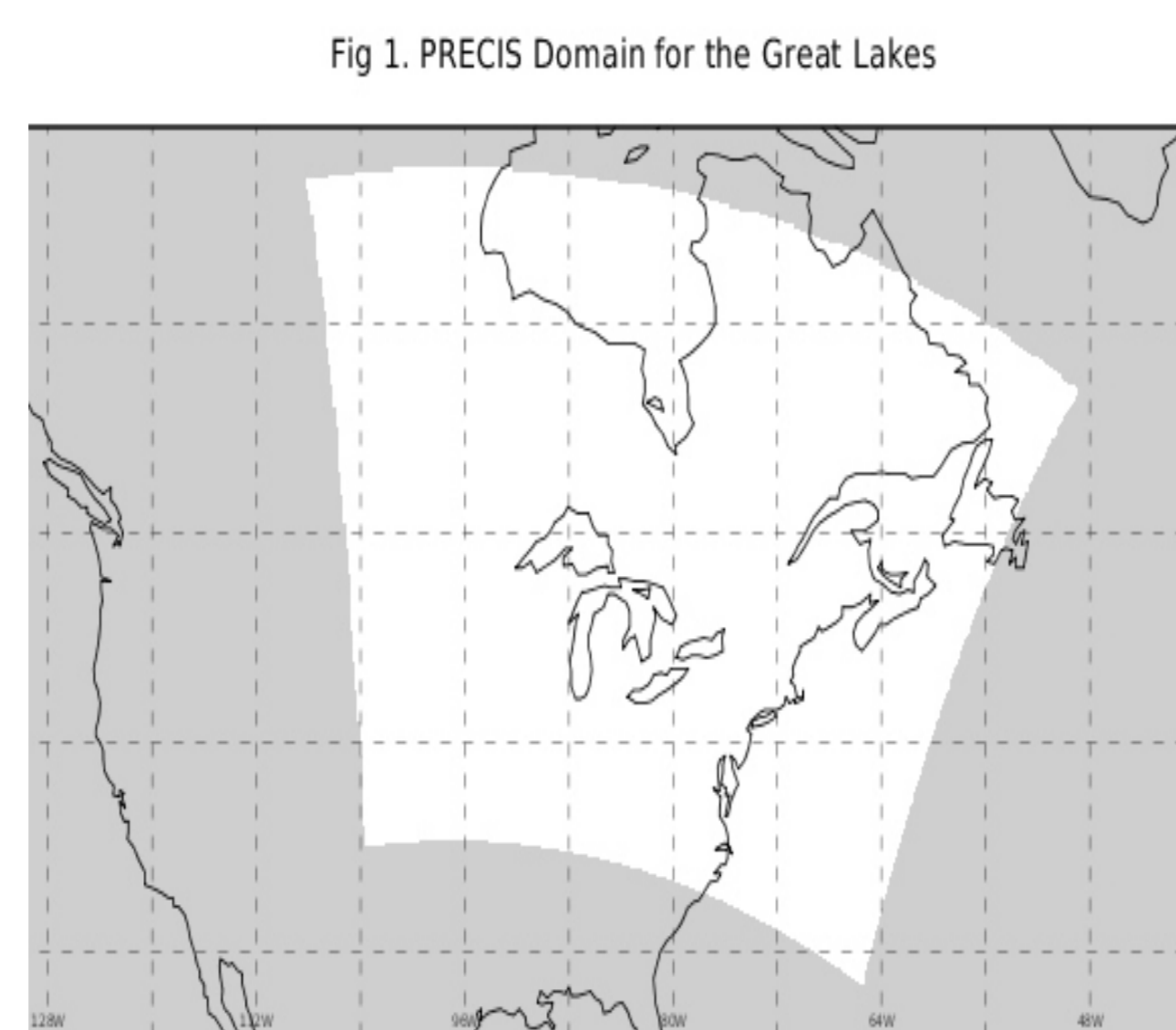
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Introduction

PRECIS— Providing REgional Climates for Impacts Studies

- ❖ A regional climate model system
- ❖ A dynamically downscaling tool to generate high resolution (50/25 km) climate change information from large-scale projections of a global general circulation model (GCM)
- ❖ Developed in Hadley Centre of Met Office, United Kingdom



Objectives:

Focusing on the Great Lakes region,

- ❖ Using observed grid data to validate and assess the performance of the PRECIS RCM
- ❖ Using validated PRECIS to predict high-resolution climate change scenarios
- ❖ Using perturbed physics ensemble (PPE) to explore the uncertainties in climate change scenarios projected from different model formulations
- ❖ Generating time series of climate variables in the future conditions driving a hydrodynamics model to assess the climate change impacts on lake thermal structures, circulation pattern and fish habitats.

Fig 2 Validation of Temperature for Winter (DJF) and Summer (JJA)

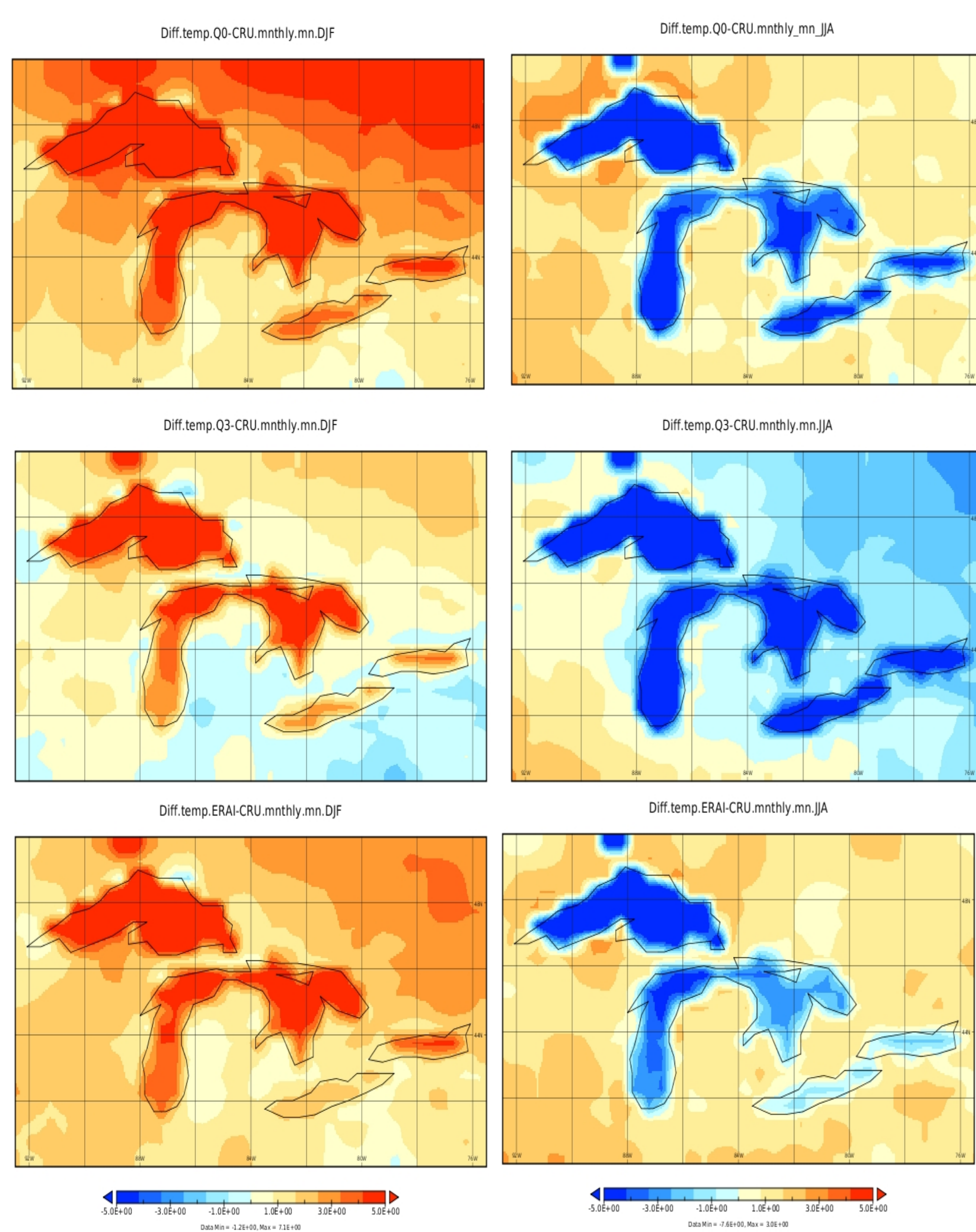


Fig 5 Projections of Temperature for Winter (DJF) and Summer (JJA) of 2050s

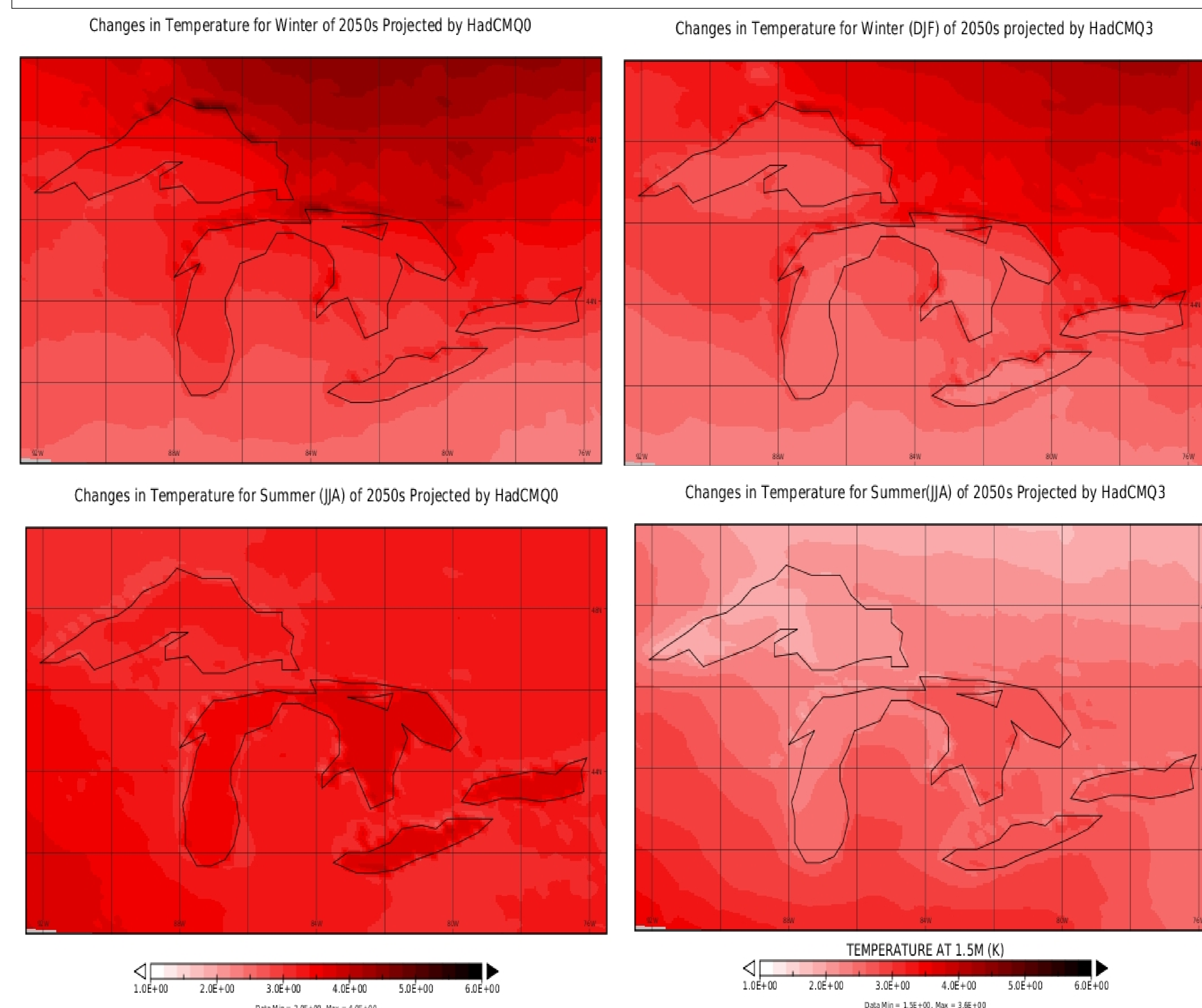
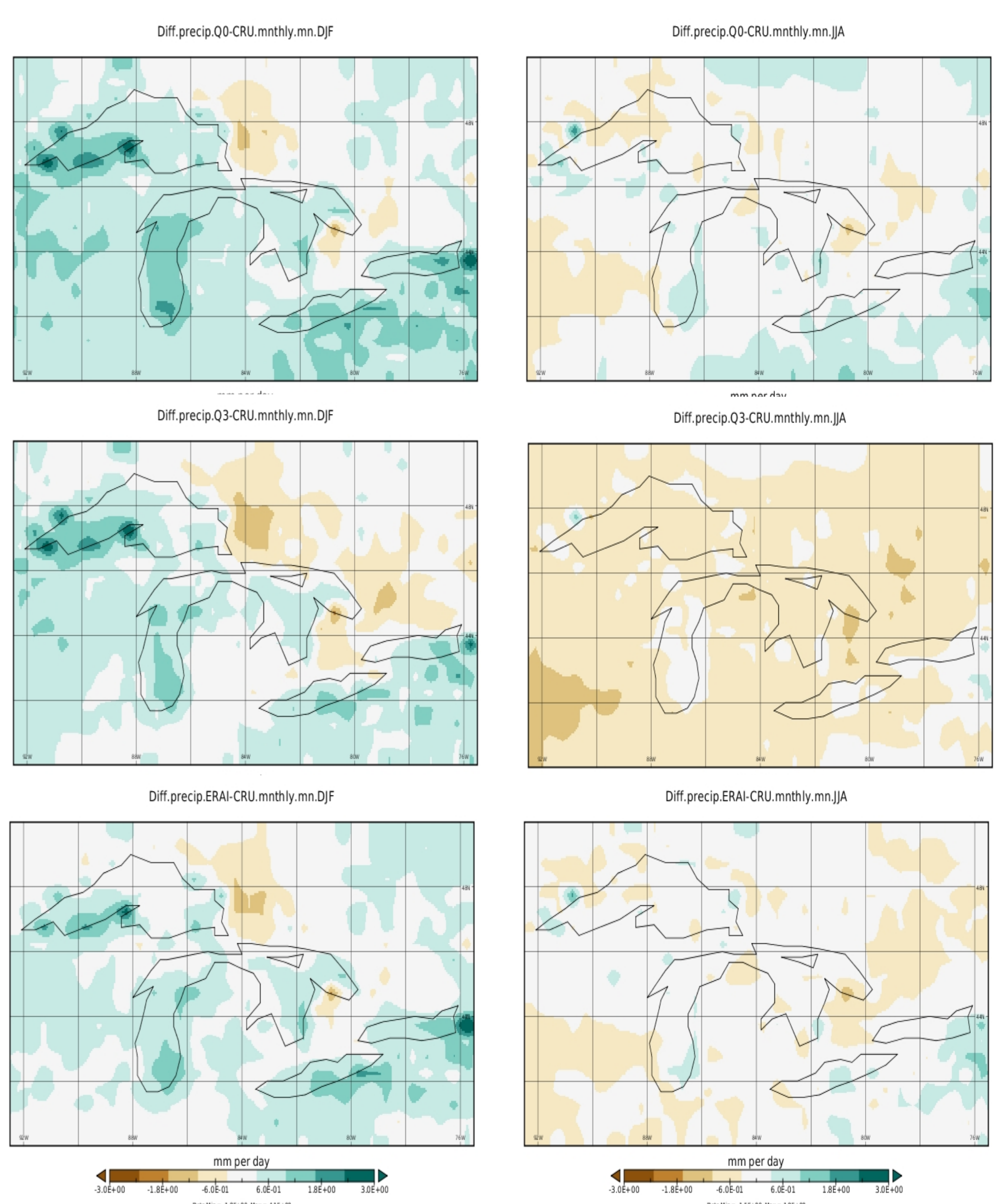


Fig 3 Validation of Precipitation for Winter (DJF) and Summer (JJA)



Methods

- ❖ Domain selection: 3 main influences-Arctic, Pacific and Atlantic air masses; avoiding the Rocky mountains to be in the western edge of the domain (Fig 1)
- ❖ Validation data set: monthly observations 50X50 km
 1. CRU (Climate Research Units)—temp, precip
 2. UOD (U of Delaware)—temp, precip
 3. ERA-interim (NCAR)—wind spd and dir
- ❖ PRECIS models—GCM boundaries
 1. ERA_interim re-analysis
 2. Two HadCMQ0 and 3(a subset of PPEs)
- ❖ Validation period: winter (DJF) and summer (JJA) of 1981-2010
- ❖ Projection period: DJF and JJA of 2040-2058/70

Fig 6. Projections of Precipitation for Winter (DJF) and Summer (JJA) of 2050s

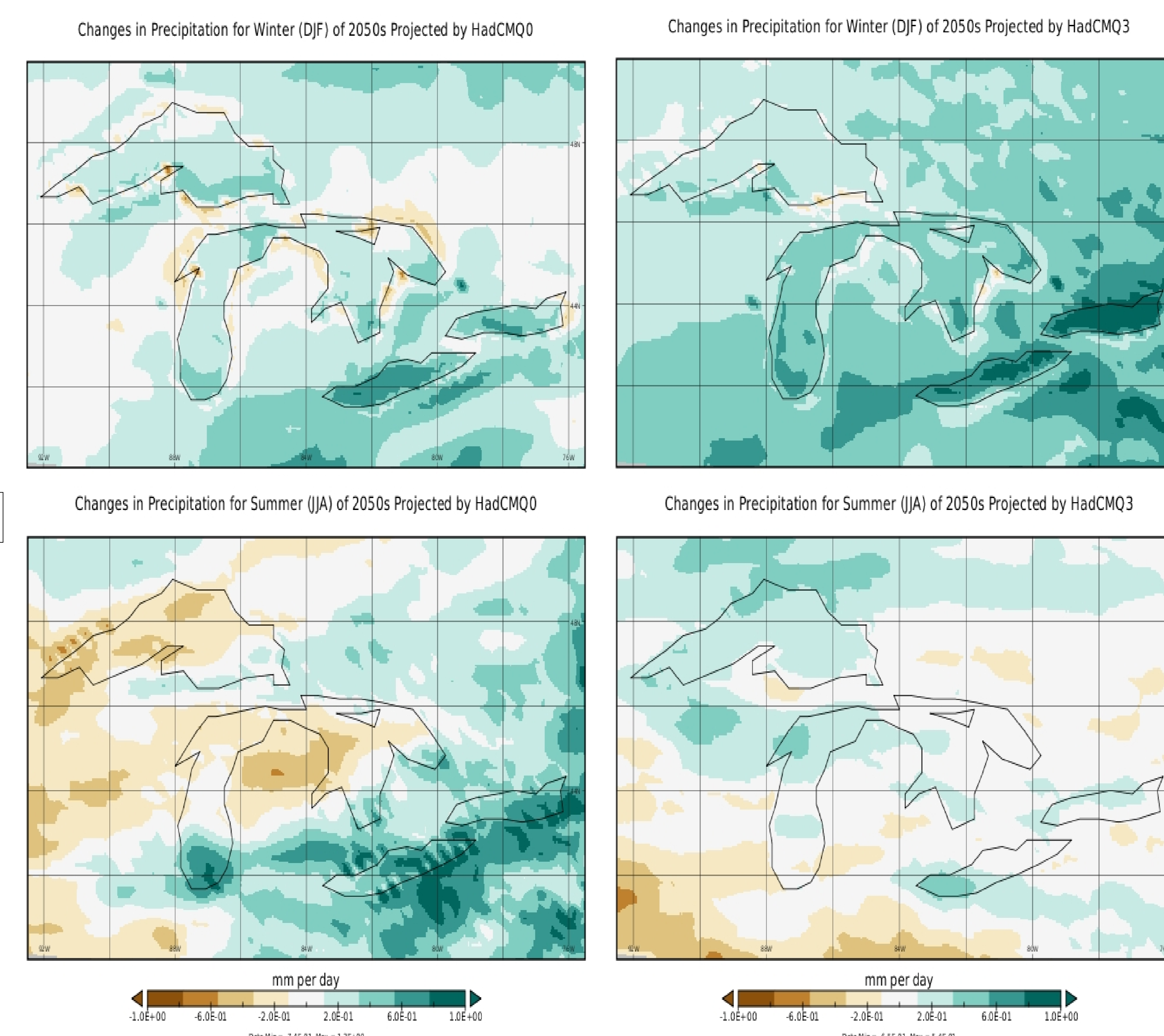
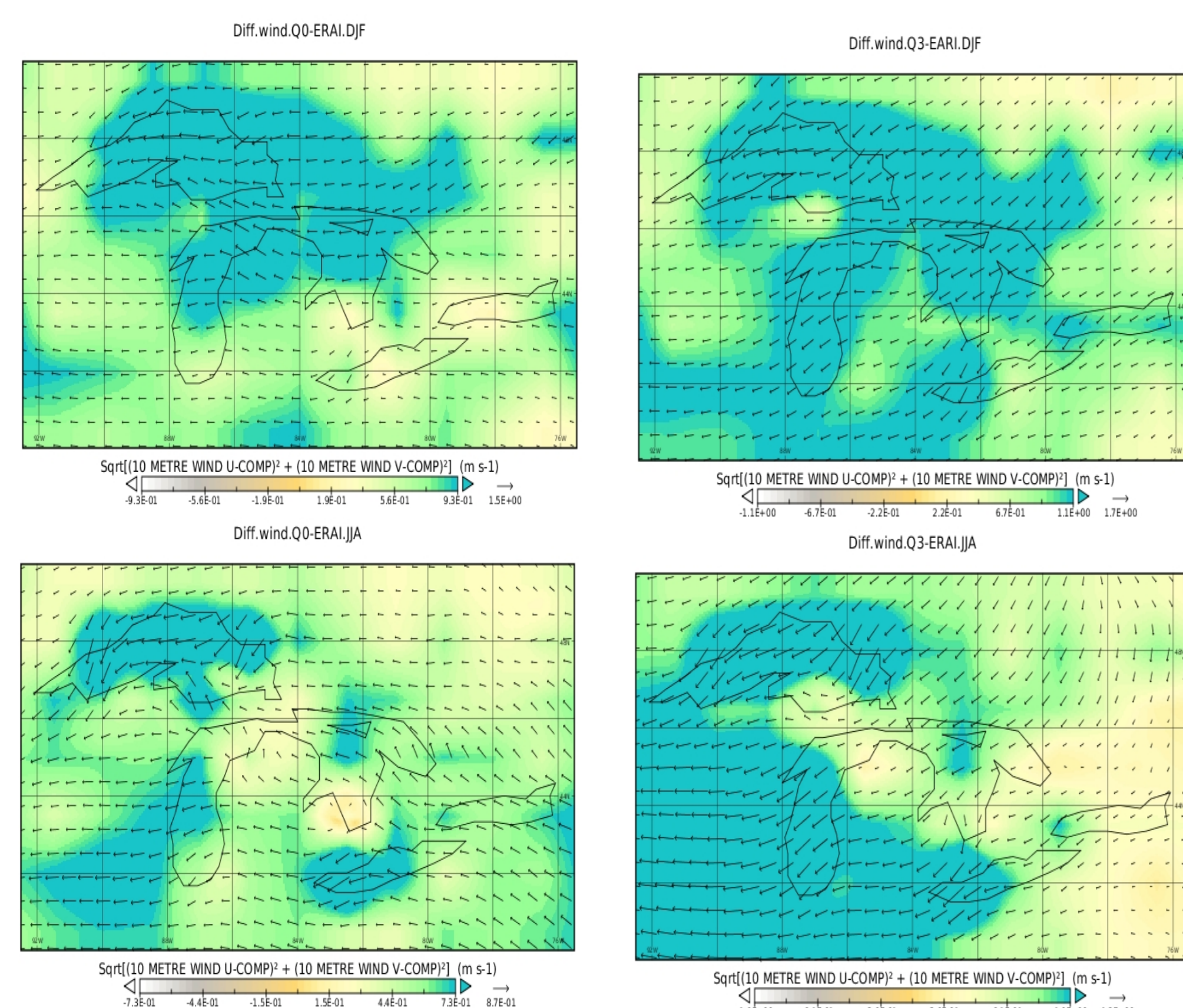


Fig 4 Validation of Wind for DJF and JJA



Results

- ❖ Validation: Fig 2 to Fig 4
 - T: DJF-model>obs; JJA-model<obs (Fig 2)
 - P: DJF-model wetter; JJA-model drier (Fig 3)
 - W: model predicted less strength of Westerlies than obs for both seasons (Fig 4)
- ❖ Projections (2050s): Fig 5 to Fig 6
 - T: S→N, $\delta T \uparrow$ for winter ($\sim 3.25^\circ$); $\delta T \downarrow$ for summer ($\sim 2.87^\circ$)
 - P: Winter, W→E $\delta P \uparrow$ Up_GL(0.4mm)<Lw_GL(1.0mm); Summer: Lw_GL P \uparrow (~ 0.7 mm), Up_GL P \uparrow (Q3-0.2mm), P \downarrow (Q0-0.3mm)

Discussion, Conclusions and Future Directions

- ❖ PRECIS performed well on the high resolution simulation of climate conditions for the Great Lakes region
- ❖ The Great Lakes were treated as water surface boundary in PRECIS simulation, but observation (i.e. CRU data) was derived through the interpolation among land-based weather stations (i.e. treated as land coverage).
- ❖ The discrepancy of PRECIS prediction vs CRU observations could result from the different treatment of the Great Lake surface boundary: higher T in winter and lower T in summer predicted by PRECIS than CRU
- ❖ PRECIS predicted a weaker lake-effect precipitation for the west of L. Superior and west/southwest of L. Huron likely due to weaker Westerlies predicted by the model
- ❖ Daily predictions will be processed to exam the frequency and magnitude of extreme climate events, e.g. strong winds, extreme heat and precipitation.