An assessment of the PRECIS Regional Climate Modelling System – Simulations over North America using PRECIS

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Introduction

PRECIS, Providing REgional Climates for Impacts Studies, is a regional climate modelling system developed by the Hadley Centre (Jones *et al*. 2003, Wilson *et al*. 2003). The PRECIS system is based on the latest RCM version developed at the Hadley Centre, and it has been designed to be user-friendly and easily implemented on any fast PC running a Linux system.

The PRECIS system has been tested over North America at the resolution of 0.44°, selecting different regions with different domain-sizes. The multi-years simulations of PRECIS were generated by applying lateral boundary conditions (dynamical atmospheric information) from ECMWF ReAnalysis data provided from 12/1978 to 05/1982. Seasonal means fields have been used for the different realizations.

Performances of PRECIS

a. Relative Speed of PRECIS

The monitoring of our PRECIS experiments identified a number of deficiencies. For example, the same CPU simultaneously runs the PRECIS simulation and PRECIS diagnostics, with at least 160 output variables of standard diagnostics. Consequently, the cocktail of diagnostics such as hourly mean/max/min surface and upper air, and daily mean/max/min surface and upper air diagnostics output in addition to standard climate meaning diagnostics is extremely demanding for the processor. As a result, the complete output diagnostic selection takes 15 times more time than other available selections (Fig. 1). Despite the sensitivity of the speed to diagnostic output selection and of course the domain size, the performance of the Intel Xeon 2.5Ghz Processor, i.e. our PRECIS environment, seems appropriate for PRECIS, faster than the standard Intel P4 processor.

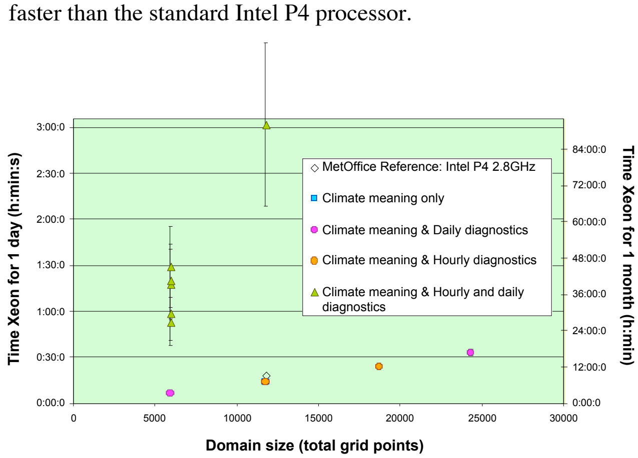

Fig. 1. Relative speed of Intel Xeon Processor 2.8Ghz running PRECIS related to diagnostic output selection and domain size.

b. Ability of PRECIS to simulate climate

CDAT (Climate Data Analysis Tools) is supplied with PRECIS to process the output data and visualize the results. Global datasets from the driving analyses (ERA) and observational datasets (CRU) are also supplied with PRECIS, i.e. global data as 3-month seasonal mean data for season (e.g. DJF: December to February, JJA: June to August) for the period from 12/1978 to 05/1982 (ERA dataset) or to 11/1982 (CRU dataset).

In order to evaluate our PRECIS experiments, these global data were regridded onto the three different grids used in our experimental setups: (A) Pan-Canada (180x135), Central-America and USA (135x110) and (C) eastern North America (79x75). Figures 2 and 3 show the comparison of 3-month seasonal mean data for winter and summer 1980 of PRECIS simulations at the resolution of 0.44° with ERA and CRU regridded datasets, i.e. the winter (DJF) and summer (JJA) mean Temperature at 1.5 m and Total Precipitation for the year 1980, after one-year (1979) spin-up. The added-value and the skill of PRECIS system, respectively 'PRECIS minus driving data' and 'PRECIS minus observational data', are also presented in Fig. 2 and 3.

Conclusion

Results obtained over the three different North American domains indicate a good ability of PRECIS at 0.44° to simulate the climate. The added-value of the high resolution is remarkable over topographic details such as the Rocky mountains, the Cordillera, the Arctic and Caribbean Islands. The general patterns of the screen temperature or the total precipitation are coherent with the observational datasets. Nevertheless, some differences do exist between PRECIS and the observations (e.g. seasonal CRU dataset). For example, PRECIS overestimates by 6°C the CRU temperature data over central USA for the summer 1980. But no conclusion can be made concerning the skill of PRECIS over Greenland or Canada/Arctic area because the observational data in this area are scattered and dubious quality.

References

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PRECIS web site : http://www.precis.org.uk

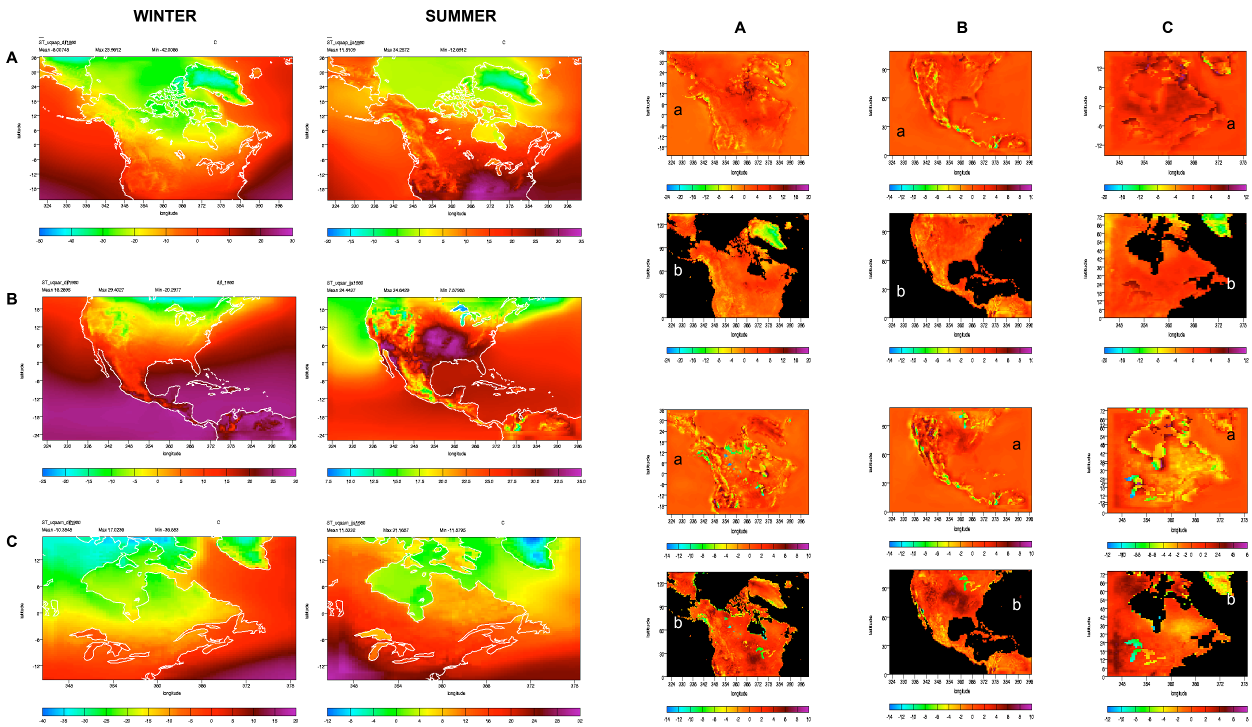

Fig. 2. Left panels: Winter (DJF) and Summer (JJA) mean temperature at 1.5m (°C) for the year 1980 as simulated by PRECIS, as nested data by ECMWF Reanalysis data (ERA), and analysed by CRU (Mitchell *et al*. 2004) for the three different domains, i.e. (A) Pan-Canada (180x135), (B) Central-America and USA (135x110) and (C) eastern North America (79x75). Right panel s: "PRECIS-ERA" (a) represents the added-value of the high resolution (0.44°), while "PRECIS-CRU" (b) presents the skill of PRECIS, for the three domains, A, B and C.

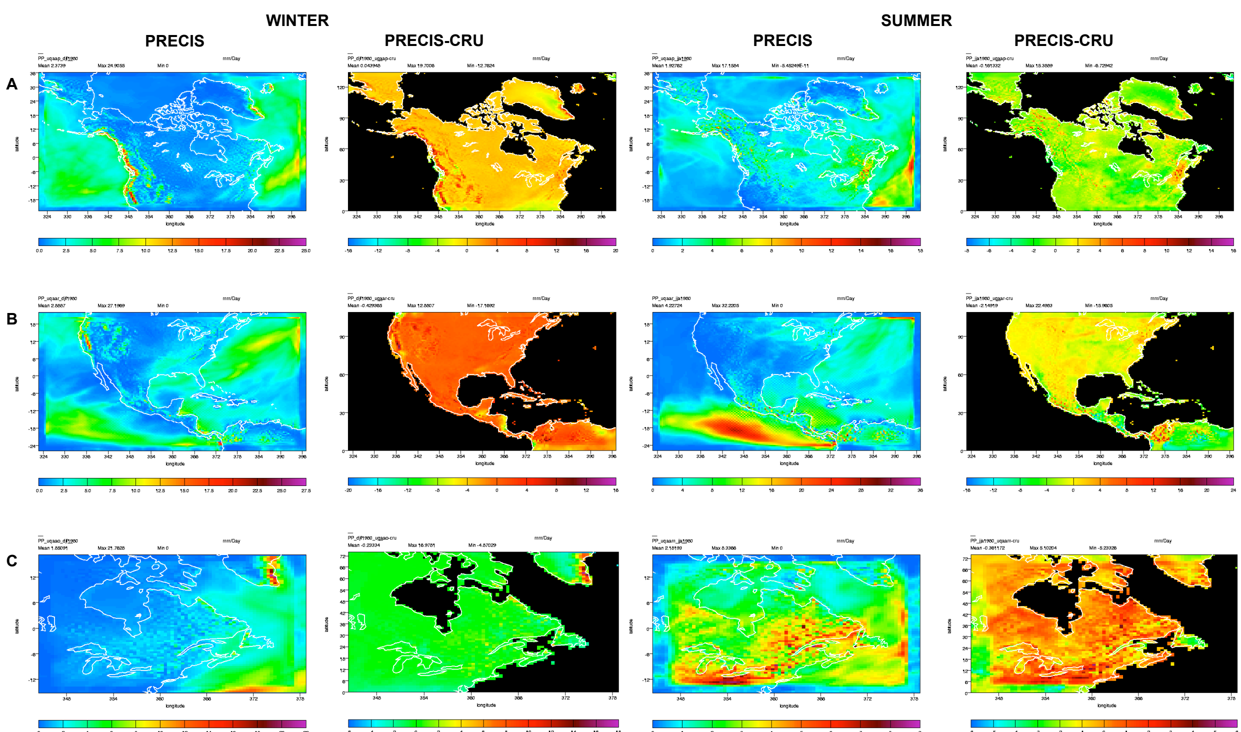

Fig. 3. Winter (DJF) and Summer (JJA) mean total precipitation rates (mm/day) for the year 1980 simulated by PRECIS and analysed by CRU (Mitchell *et al*. 2004) over the (A) pan-Canadian, the (B) central-America and USA, and (C) eastern North America domains. "PRECIS-CRU" represents the skill of PRECIS.

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