The surface climatology simulated by the Canadian Regional Climate Model (CRCM)

Yanjun Jiao[1], Daniel Caya[2] and Rene Laprise[1]

1. Department of Earth and Atmospheric Sciences,
University of Quebec at Montreal, Montreal, Quebec, Canada
2. Consortium Ouranos, Montreal, Quebec, Canada
email: jiao.yanjun@uqam.ca

The third generation of the Canadian Regional Climate Model (CRCM) (Caya and Laprise 1999) is evaluated through the comparisons with observed surface climatology. In this experimental configuration, the model domain (fig. 1) covers the entire Canadian territory and most of the United States with a total of 193x145 polar stereographic grid points at a 45km horizontal resolution and 29 Gal-Chen levels in the vertical. The model is nested by the one-way nesting method of Davies (1976) with 9 grid points in the sponge zone. The initial and lateral boundary conditions come from NCEP/NCAR re-analysis data and the surface forcings are prescribed with observed monthly mean sea surface temperature (SST) and sea ice concentration (SIC) from the Atmospheric Model Intercomparison Project (AMIP II). The simulation was started on January 1, 1987 and was run continuously for 5 years with 15-minute time steps. To prevent CRCM's large-scale deviate from its driving fields in the long-term simulation, a new spectral nudging technique is also introduced in this version of the model (Denis et al. 2002).

The monthly and seasonal mean results from the model's last four years of simulation were compared with observed screen surface temperature from the Climate Research Unit (CRU; New et al. 2000) and with global precipitation data (Xie and Arkin, 1996). Model results were also compared with the output from the CRCM's previous generation (Laprise et al, 2003).

Fig. 2 shows the domain-averaged monthly mean screen temperature over all land grid points between 30°N and 70°N latitudes. The agreement between CRCM simulation and CRU observation is quite good. The CRCM simulates very well the seasonal variability of screen temperature over the main continent of North America. Compare with the CRU observation, the model only shows a warm bias of less than 1°C during the warm seasons and the cold bias in winter seasons not more than 3°C.

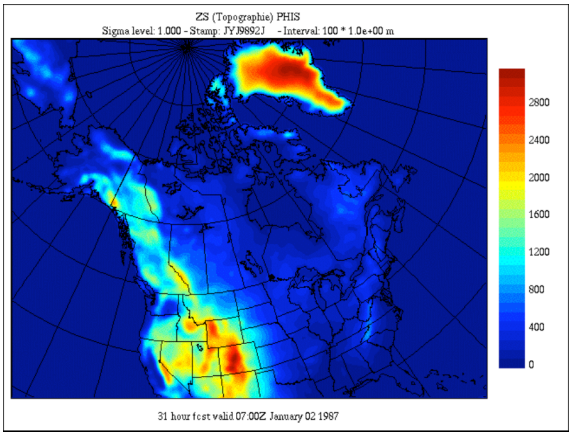

Fig. 1. CRCM model domain and topographic field (in meters).

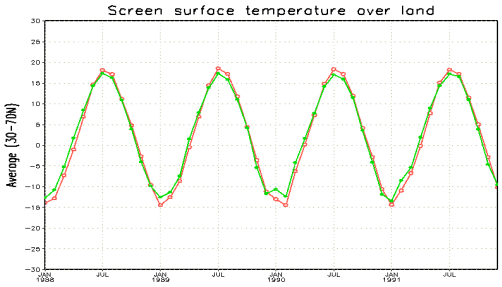

Fig. 2. Domain-averaged monthly mean screen temperature over main continent of North America (30°-70°N). (The red line with open circles is the CRCM simulation and the green line with dots is the CRU observation)

The seasonal precipitation simulated by the CRCM is consistent with Xie-Arkin observational data. For example, in winter (DJF) (Fig. 3), most of the land precipitation produced by the CRCM is right concentrated in a very narrow band along the West Coast, from Alaska to British Columbia, and reaching the Washington and Oregon states. Another broader precipitation zone is located over southeastern United States. Over the Western Pacific ocean and Northern Atlantic ocean, the precipitation pattern and amounts simulated by the CRCM are also in good agreement with observational data.

Finally, the comparison between the CRCM's second and third generation reveals that the model's performance has greatly improved (not shown).

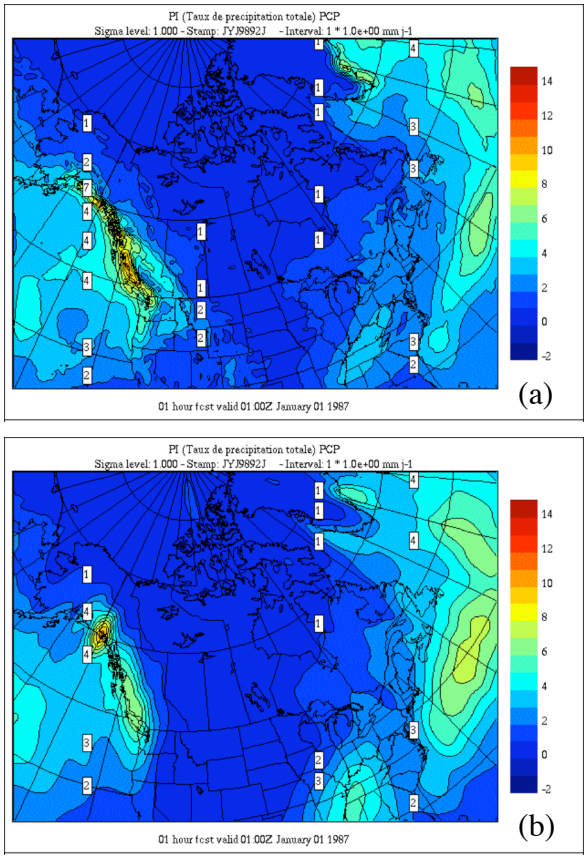

Fig. 3. Winter (DJF) mean precipitation rate (mm/day)(a) simulated by CRCM and (b) from Xie-Arkin observations. (9 grid points sponge zone is not included)

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