



## **Water cycle components in the Canadian Regional Climate Model (CRCM): a sensitivity study**

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The present study investigates the sensitivity of the water budget components simulated by the Canadian Regional Climate Model (CRCM) to the formulation of land surface processes lateral boundary and initial conditions. This evaluation is a contribution to the estimation of the uncertainty associated to RCMs' simulations.

Sensitivity analysis was carried out for climatological means, climatological annual cycles and interannual variability, over the period 1961-1999 for several North American River basins, selected to cover a wide range of climate conditions. Three pairs of simulations have been used: the first one was generated using two different land-surface schemes (LSSs): a simple Manabe-based and complex second-generation scheme; the simulations in the second pair differ in the driving data (NCEP/NCAR vs ERA40 reanalysis); and simulations in the third pair were started at different times. An evaluation of the simulated water budget components is carried out.

Results indicate that changes in climatological means and annual cycles of the water budget components resulting from different land surface parameterisations and from different lateral boundary conditions vary from basin to basin. Sensitivity to lateral boundary conditions was in general smaller than sensitivity to the LSS, although tended to be stronger for the northern basins. Interannual variability was not much affected by the change in LSS and driving data. Internal variability triggered by the non-linear nature of the climate model (i.e. change in initial conditions) does not significantly affect neither the 39-year climatology nor the climatological annual cycles and interannual variability. Comparison with observations suggests that while simple Manabe-based LSS may be adequate for simulations of climatological means, skilful

simulation of annual cycles require the use of a state of the art LSS.