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Energy cycle associated with Inter-member Variability in a large ensemble of simulations of the Canadian RCM (CRCM5)

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In an ensemble of high-resolution Regional Climate Model (RCM) simulations where different members are initialised at different times, the individual members provide different, but equally acceptable, weather sequences. In others words, RCM simulations exibit a kind of uncertainty called Internal Variability (or Inter-member Variability – IV), defined as the inter-member spread between members of the ensemble of simulations. Our recent studies reveal that RCM's IV can be associated with energy conversions similar to those taking place in weather systems.
By analogy with the classical work on global energetics of weather systems, a formulation of an energy cycle for IV has been developed that is applicable over limited-area domains. Prognostic equations for ensemble-mean kinetic energy and available enthalpy are decomposed into contributions due to ensemble-mean (EM) variables and those due to deviations from the ensemble mean (IV). Together these equations constitute an energy cycle for IV in ensemble simulations of a RCM.
By using a 50-member ensemble of one-year simulations that differ only in their initial conditions (IC) and performed with the fifth-generation of the Canadian RCM (CRCM5) over an eastern North America domain, we evaluate the various energy reservoirs of IV and exchange terms between reservoirs. Results show a remarkably close parallel between the energy conversions associated with IV in ensemble simulations of RCM and the energy conversions in weather systems.