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Numerical framework and performance of the new multiple phase cloud microphysics scheme in RegCM4.5 evaluated using the satellite simulator package COSP.

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We present the implementation and evaluation of a new parameterization scheme for stratiform cloud microphysics and precipitation within the regional climate model RegCM4. The new one-moment cloud microphysics scheme is built upon the implicit numerical framework recently developed and implemented into the ECMWF operational forecasting model and solves prognostically the cloud liquid water, the cloud ice, rain and snow mixing ratios. Respect to the pre-existing scheme, that diagnoses the fraction of ice as a function of temperature, the new parameterization's prognostic approach allows a proper treatment of mixed-phase clouds and a more physically realistic representation of cloud miscrophysics and
precipitation. Cloud properties are evaluated using the Cloud Feedback Model Intercomparison Project (CFMIP) Observational Simulator Package (COSP). CALIPSO, ISCCP and MISR observations are used to evaluate the modelled horizontal and vertical distributions of cloud cover, cloud optical depths and cloud radiative forcing for two seasons in tropical band mode using both the new and the previous cloud scheme. The new microphysics parameterization yields an improved simulation of cloud fields and in particular it removes the overestimation of upper level clouds characteristics of the previous scheme, increasing the agreement with
observations and leading to an amelioration of a long-standing problem in the RegCM system. The vertical cloud profile produced by the new scheme leads to a considerably improvement of the representation of the longwave and shortwave components of the cloud radiative forcing.