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Diurnal cycle of precipitation in the Korean Integrated Model (KIM) v3.1

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The reproducibility of diurnal cycle of precipitation has been addressed as one of the challenging issues in weather and climate simulations, commonly pointing out a phase shift problem occurring too early precipitation peak in the afternoon over land. The present study aims to diagnose the current status of the Korean Integrated Model (KIM) version 3.1, being developed as a global numerical weather prediction (NWP) system by Korea Institute of Atmospheric Prediction Systems (KIAPS), particularly in simulating precipitation and its diurnal cycle at a global scale. KIM v3.1 simulated results are assessed by mainly focusing on phase and amplitude biases in diurnal cycle of precipitation against Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA) observation and other operational forecasting systems such as Korea Meteorological Administration (KMA) Unified Model (UM) and European Centre for Medium-Range Weather Forecasts (ECMWF) Integrated Forecasting System (IFS). There is a better performance in simulating diurnal cycle of precipitation in KIM v3.1, particularly with closer afternoon peak over land to TMPA observation, than other operational models, KMA UM and ECMWF IFS. Delayed afternoon peak is evidently found over most of land area, showing closer spatial pattern for local time of precipitation peak with TMPA observation. Separated analysis of precipitation rate into frequency and intensity demonstrates that the better diurnal cycle of precipitation in KIM v3.1 should be attributable to closer phase of both frequency and intensity to TMPA observation (i.e. delayed frequency peak and in-phase intensity peak against the observation in the afternoon). Major factors affecting the late afternoon peak over land in KIM v3.1 will be discussed with relation to recent advances in convective parameterization scheme.