The radiation budget in the regional climate model RegCM4: simulation results from two different radiative schemes over the south-western Indian Ocean

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Abstract
One possible way to estimate the solar resource required by the solar industry, is to use Regional Climate Models, which provide a comprehensive and physically-based state-of-the-art description of the atmosphere and its interactions with the Earth's surface. In this study, the regional climate model RegCM4 is used to provide estimates of surface solar irradiation over the south-western Indian Ocean. The main objective of this study is to customize RegCM4 for solar resource assessment. As a first step, two radiative transfer schemes are tested and evaluated: (1) the radiation scheme of the NCAR Community Climate Model (CCM) Version 3 (default); (2) the newly implemented Rapid Radiation Transfer Model (RRTM), which utilizes the correlated-k approach to calculate long-wave and short-wave fluxes and heating rates. A one-year simulation for 2000 is performed with RegCM4-CCM and RegCM4-RRTM driven by initial and boundary conditions from ERA-Interim reanalyses. The domain extends from 0° S to 40° S and 0° E to 100° E, centred on Reunion with two different grid spacings: 20 km and 50 km. Convective precipitation is calculated with the Emanuel scheme. A preliminary comparison of the seasonal radiation budget at the surface and top–of–atmosphere during austral summer and winter from RegCM4-CCM and RegCM4-RRTM shows good qualitative agreement, though RegCM4-CCM tends to overestimate the radiative fluxes when compared to RegCM4-RRTM. To further analyse the behaviour of the radiation schemes, model outputs are then validated against available observation data. Depending on the radiation scheme test results, the next step is to perform simulations and validations on convection scheme and circulation parameters.