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Variability of the Surface Solar Radiation over Reunion island and its interaction with the synoptic, intraseasonal and interannual convective variability

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The impacts of large scale climate variabilities on the solar energy resource are widely investigated around the world, however their effects are not yet clear for Mascarene Islands (southwest Indian Ocean, SWIO) and needs to be addressed. In this study, surface solar radiation (SSR) classification and anomalies at the diurnal scale from SARA-E satellite product over Reunion Island are linked to the large scale climate variabilities in SWIO region. These climate variabilities include Tropical Cyclones (TCs) and the Tropical Temperate Troughs (TTTs) at the synoptic scale, the Madden-Julian Oscillation (MJO) at the intraseasonal scale, and the Indian Ocean Dipole (IOD), the Subtropical Indian Ocean Dipole (SIOD) and the El Niño–Southern Oscillation (ENSO) at the interannual scale. We identified the variability of SSR at various time scales where both local processes and the large scale convective variabilities play important roles. At the synoptic and intraseasonal timescales, the local variability of SSR over Reunion shows a significant association with TCs, TTTs and the MJO. The sign and amplitude of SSR diurnal anomaly are found to be correlated with the enhanced- / depressed- convective phase and amplitude of these events. The SSR anomaly is strongly altered with the presence of nearby TCs, with a value of up to about 30% of climatology, although at low occurrence; TTTs and MJO have relatively weaker impact, with a value of about 13% and 5% respectively. At the interannual timescale, IOD, SIOD and ENSO have relatively much less importance on local SSR variability. The daily total solar energy density has been calculated for all these variabilities to provide useful information for energy applications.