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ENSO surface longwave radiation forcing over the tropical Pacific

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Abstract. We have studied the spatial and temporal variation of the surface longwave radiation (downwelling and net) over a 21-year period in the tropical and subtropical Pacific Ocean (40 S–40 N, 90 E–75 W). The fluxes were computed using a deterministic model for atmospheric radiation transfer, along with satellite data from the ISCCP-D2 database and reanalysis data from NCEP/NCAR (acronyms explained in main text), for the key atmospheric and surface input parameters. An excellent correlation was found between the downwelling longwave radiation (DLR) anomaly and the Niño-3.4 index time-series, over the Niño-3.4 region located in the central Pacific. A high anti-correlation was also found over the western Pacific (15–0 S, 105–130 E). There is convincing evidence that the time series of the mean downwelling longwave radiation anomaly in the western Pacific precedes that in the Niño-3.4 region by 3–4 months. Thus, the downwelling longwave radiation anomaly is a complementary index to the SST anomaly for the study of ENSO events and can be used to asses whether or not El Niño or La Niña conditions prevail. Over the Niño-3.4 region, the mean DLR anomaly values range from +20 Wm^{-2} during El Niño episodes to −20 Wm^{-2} during La Niña events, while over the western Pacific (15–0 S, 105–130 E) these values range from −15 Wm^{-2} to +10 Wm^{-2}, respectively. The long- term average (1984–2004) distribution of the net downwelling longwave radiation at the surface over the tropical and subtropical Pacific for the three month period November-December-January shows a net thermal cooling of the ocean surface. When El Niño conditions prevail, the thermal radiative cooling in the central and south-eastern tropical Pacific becomes weaker by 10 Wm^{-2} south of the equator in the central Pacific (7–0 S, 160–120 W) for the three-month period of NDJ, because the DLR increase is larger than the increase in surface thermal emission. In contrast, the thermal radiative cooling over Indonesia is enhanced by 10 Wm^{-2} during the early (August–September–October) El Niño phase.

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