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Global distribution of Earth's surface shortwave radiation budget

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Abstract. The monthly mean shortwave (SW) radiation budget at the Earth's surface (SRB) was computed on 2.5-degree longitude-latitude resolution for the 17-year period from 1984 to 2000, using a radiative transfer model accounting for the key physical parameters that determine the surface SRB, and long-term climatological data from the International Satellite Cloud Climatology Project (ISCCP-D2). The model input data were supplemented by data from the National Centers for Environmental Prediction - National Center for Atmospheric Research (NCEP-NCAR) and European Center for Medium Range Weather Forecasts (ECMWF) Global Reanalysis projects, and other global data bases such as TIROS Operational Vertical Sounder (TOVS) and Global Aerosol Data Set (GADS). The model surface radiative fluxes were validated against surface measurements from 22 stations of the Baseline Surface Radiation Network (BSRN) covering the years 1992-2000, and from 700 stations of the Global Energy Balance Archive (GEBA), covering the period 1984-2000. The model is in good agreement with BSRN and GEBA, with a negative bias of 14 and 6.5 Wm⁻², respectively. The model is able to reproduce interesting features of the seasonal and geographical variation of the surface SW fluxes at global scale. Based on the 17-year average model results, the global mean SW downward surface radiation (DSR) is equal to 171.6 Wm⁻², whereas the net downward (or absorbed) surface SW radiation is equal to 149.4 Wm⁻², values that correspond to 50.2 and 43.7% of the incoming SW radiation at the top of the Earth's atmosphere. These values involve a long-term surface albedo equal to 12.9%. Significant increasing trends in DSR and net DSR fluxes were found, equal to 4.1 and 3.7 Wm⁻², respectively, over the 1984-2000 period (equivalent to 2.4 and 2.2 Wm⁻² per decade), indicating an increasing surface solar radiative heating. This surface SW radiative heating is primarily attributed to clouds, especially low-level, and secondarily to other parameters such as total precipitable water. The surface solar heating occurs mainly in the period starting from the early 1990s, in contrast to decreasing trend in DSR through the late 1980s. The computed global mean DSR and net DSR flux anomalies were found to range within ±8 and ±6 Wm⁻², respectively, with signals from El

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Niño and La Niña events, and the Pinatubo eruption, whereas significant positive anomalies have occurred in the period 1992-2000.

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