Atmos. Chem. Phys., 4, 127-142, 2004
www.atmos-chem-phys.net/4/127/2004/

Ten-year global distribution of downwelling longwave radiation

K. G. Pavlakis[1], D. Hatzidimitriou[1,2], C. Matsoukas[1], E. Drakakis[1,3], N. Hatzianastassiou[1,4], and I. Vardavas[1,2]
[1]Foundation for Research and Technology-Hellas, Heraklion, Crete, Greece
[2]Department of Physics, University of Crete, Heraklion, Crete, Greece
[3]Department of Electrical Engineering, Technological Educational Institute of Crete, Greece
[4]Department of Physics, University of Ioannina, Greece

Abstract. Downwelling longwave fluxes, DLFs, have been derived for each month over a ten year period (1984-1993), on a global scale with a spatial resolution of 2.5x2.5 degrees and a monthly temporal resolution. The fluxes were computed using a deterministic model for atmospheric radiation transfer, along with satellite and reanalysis data for the key atmospheric input parameters, i.e. cloud properties, and specific humidity and temperature profiles. The cloud climatologies were taken from the latest released and improved International Satellite Climatology Project D2 series. Specific humidity and temperature vertical profiles were taken from three different reanalysis datasets; NCEP/NCAR, GEOS, and ECMWF (acronyms explained in main text). DLFs were computed for each reanalysis dataset, with differences reaching values as high as 30 Wm^{-2} in specific regions, particularly over high altitude areas and deserts. However, globally, the agreement is good, with the rms of the difference between the DLFs derived from the different reanalysis datasets ranging from 5 to 7 Wm^{-2}. The results are presented as geographical distributions and as time series of hemispheric and global averages. The DLF time series based on the different reanalysis datasets show similar seasonal and inter-annual variations, and similar anomalies related to the 86/87 El Niño and 89/90 La Niña events. The global ten-year average of the DLF was found to be between 342.2 Wm^{-2} and 344.3 Wm^{-2}, depending on the dataset. We also conducted a detailed sensitivity analysis of the calculated DLFs to the key input data. Plots are given that can be used to obtain a quick assessment of the sensitivity of the DLF to each of the three key climatic quantities, for specific climatic conditions corresponding to different regions of the globe. Our model downwelling fluxes are validated against available data from ground-based stations distributed over the globe, as given by the Baseline Surface Radiation Network. There is a negative bias of the model fluxes when compared against BSRN fluxes, ranging from -7 to -9 Wm^{-2}, mostly caused by low cloud amount differences between the station and satellite measurements, particularly in cold climates. Finally, we compare our model results with those of other deterministic models and general circulation models.

Final Revised Paper (PDF, 1729 KB) Discussion Paper (ACPD)

Citation: Pavlakis, K. G., Hatzidimitriou, D., Matsoukas, C., Drakakis, E., Hatzianastassiou, N., and Vardavas, I.: Ten-year global distribution of downwelling longwave radiation, Atmos. Chem. Phys., 4, 127-142, 2004. Bibtex EndNote Reference Manager