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Atmospheric Downwelling Longwave Radiation during overcast conditions. Simulations and measurements at Girona, Spain.

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Abstract:
Clouds play an important role in the terrestrial radiative budget and therefore in the climate change, given their ability to absorb solar radiation and also to absorb and emit longwave radiation toward the space and the terrestrial surface. The study of longwave radiation in presence of clouds can help us to understand better the climatic system, and recognize their importance in the current climate change. Agreement between measurements and simulations can help us to understand much better their radiative behavior.

In this study we show a comparison between measurements and calculations using the unidimensional radiative transfer model SBDART (Ricchiazzi et al, 1998) under overcast sky conditions. Measurements were taken from the radiometric and meteorological station at the University of Girona, Spain (41.96 N 2.83 E 110 m a.s.l.). Downward Longwave Radiation, DLR, was measured using a pyrgeometer CG1 by Kipp & Zonen. To determine the cloud fraction, and subsequently select overcast cases, we used the algorithm APCADA (Dürr and Philipona, 2004) from one year dataset of measurements of DLR, temperature and relative humidity.

DLR has a strong dependence on atmospheric vertical profiles (mainly on temperature and water vapor content). Since there are no soundings available at the same site, we used the vertical profile from a gridded analysis (provided by the European Centre for Medium-Range Weather Forecasts,ECMWF).

Cloud base height (CBH) was included into calculations by using the measurements taken by a ceilometer CL31 by Vaisala. This CBH was compared with an estimation based on ECMWF profiles, setting the cloud base where the relative humidity is higher than a threshold of 95% (RH95). The effective radius of cloud droplets and liquid water path was fixed from typical values (Stephens, 1978).

Three different modeling cases were analyzed, depending on the use of the CBH from the ceilometer or from applying the RH95 threshold in ECMWF profiles, and also depending on the use or not of the in situ meteorological data in the first level of the profile. The agreement between measurements and calculations was better when using ceilometer data and screen level measurements. Furthermore, when some rainy cases were removed from the selected overcast days, the agreement further improved up to 4.1 ± 2.6 Wm-2.

References:

Dürr, B., and R. Philipona (2004), Automatic cloud amount detection by surface longwave downward radiation measurements, J. Geophys. Res., 109, D05201, doi:10.1029/2003JD004182.

Ricchiazzi, P., S. Yang, C. Gautier, and D. Sowle (1998). SBDART: A research and teaching software tool for plane-parallel radiative transfer in the Earth's atmosphere. Bull. Amer. Meteorol. Soc., 9, 2101-2114.

Stephens, G. L. (1978), Radiation Profiles in Extended Water Clouds. I: Theory. J. Atms. Sci. 35, 2111-2122.