Comparison of current methods to determine the downwelling atmospheric irradiance in the thermal infrared

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Land surface temperature (LST) is an important parameter in the study of phenomena like fire risk, evapotranspiration fluxes or climate change evolution. Some sensors onboard satellites provide LST data from large areas of the Earth. To check the reliability of these products, validation field campaigns are usually made. During the field campaigns, there are two essential factors to take into account. The first one is the efficiency to take radiation measurements from the studied surface, since the satellite overpass takes few seconds. The second factor is to determine as well the downwelling atmospheric irradiance (F_{sky}) in that short period of time, since it is the key parameter for removing the surface reflected radiation from the surface measurements. Several methods to accurately determinate F_{sky}, in a short period of time are analyzed along this paper to evaluate which is the best method. With this aim, an experimental campaign was carried out using thermal radiometers CIMEL Electronique model CE312, which have four spectral bands in the 8-14 µm spectral window. Direct measurements of F_{sky} were taken following the method described by the diffusive approximation as well as using a diffuse reflectance panel for the thermal infrared. Further, simulated values of F_{sky} were obtained for comparisons by means of considering both radiosounding data from the studied area, and atmospheric profiles from the National Center for Environment Prediction (NCEP), into a radiative transfer code (RTC). The results conclude that the fastest and most reliable method to obtain F_{sky} is to make measurements with a diffuse reflectance panel in the zenithal range from nadir view to 50°, at about 80-90 cm far from the radiometer. In that way, the measurements offer a relative error for F_{sky} of about 6%.

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