IRS2012-185-1
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

How well do we understand the Earth's radiation budget and the role of clouds ?

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(for sessions 1 or 8; oral preferred)

Satellite observations capture seasonally varying global maps of solar and infrared radiative fluxes at the top of the atmosphere. Associated to these observations are also offered complementary radiative flux maps for the atmosphere and for the surface from simulations. These products involve ancillary data for the atmospheric environment (e.g. clouds, aerosol, trace-gases) and surface properties (e.g. albedo, temperature, emissivity). These ancillary data differ in value and consistency and influence the individual radiative flux properties and especially those flux properties created by differences of large numbers. To demonstrate observational uncertainty and impacts of assumptions to ancillary data, seasonal maps of multi-annual satellite-data are inter-compared, involving multi-annual data by CERES (2000-2003) and multi-decadal data by ISCCP (1984-2004) and GEWEX-SRB (1984-2004). In addition, corresponding simulated radiative flux maps by global models of the IPCC 4th assessment (1990-1999) are examined. Although these models are forced to match the annual global average at the top of the atmosphere of satellite observations, their global distribution of patterns in modelling is not identical to those of satellite observations. The deviations are very strong in some regions and are caused mainly by misrepresentations of cloud properties in modelling. Aside from clouds, however, also applied ancillary data influence the results and create diversity in global modelling. It will be demonstrated that for some radiative properties the diversity for clear-sky radiative fluxes (which is caused by ancillary data) is almost as large as the diversity for all-sky (with clouds) radiative fluxes. The investigated radiative flux properties address ratios and differences for added insights into the representation of clouds and ancillary data. These properties include cloud effects (on clear-sky fluxes), solar transmission, IR-greenhouse effect, net-fluxes and atmospheric divergence. The diversity for these products also varies in time. This indicates a lack of temporal consistency for at least some of the applied ancillary data. Thus, in their current shape many flux properties of these data-sets are unfit for trend-analyses. To elevate the usefulness of these climatological data-sets, a complete reanalysis with more accurate and more consistent ancillary data is required.
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