Title: Development of new 3-hourly, global, long-term, multisatellite-based TOA-to-surface radiative flux profile data product with high horizontal resolution and homogeneous quality

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Since the early 1980's, we have been developing the capability to calculate global radiative fluxes from multisatellite-based data products describing the properties of clouds, the atmosphere and the surface. This work culminated in the first radiative flux profile product, ISCCP-FD, which is based on the NASA Goddard Institute for Space Studies (GISS) radiative transfer model for its climate GCM SI2000 and the International Satellite Cloud Climatology Project (ISCCP) D-series cloud climatology, together with several other satellite-based data products. This product contains global, TOA-to-surface radiative flux profiles (5 levels) at 280-km intervals, every 3 hours for 24 years (currently 1983 – 2007). It includes all broadband, upward and downward, SW and LW fluxes for all-, clear- and overcast-sky. However, our and many other authors’ evaluation studies indicate that there are still some problems with using this product for the more subtle tasks of monitoring and investigating climate variations and change. Most of the problems appear to be caused by the input datasets but there are also a few deficiencies of the radiative transfer model that have been noted. The leading problems known are: (1) algorithm-change-induced inhomogeneities in the atmospheric temperature-humidity dataset, (2) poor characterization of aerosols and their variations, (3) too crude representation of cloud vertical structure, (4) absence of weak solar absorption by some gas species in the SI2000 radiative transfer model, and (5) poor specification of land surface properties (albedo and emissivity). In addition, FD uses the current ISCCP products based on sparsely sampled (about 30 km intervals) satellite images, which limits the spatial resolution achievable because of sampling noise. The Global Energy and Water Experiment (GEWEX) is now undertaking a reprocessing of all of its global data products, including ISCCP, to reduce the magnitude of these problems. Other new, improved data products have become available. Several NOAA and NASA funded efforts contribute to this work. For ISCCP, this includes comparing radiance calibration to more recent standards, refining the atmospheric properties dataset and processing a version of the radiance data with 10-km sampling. Moreover, the GISS climate GCM has been updated to ModelE with various improvements including more accurate treatment of greenhouse gases in its radiation code.
Given all of the above, we propose to extract the new radiation code from GISS GCM ModelE, to incorporate more recent improvements, to make the necessary modifications to use improved input datasets, to modernize and document this version of the code, and to produce a new flux profile data product for the whole period 1983 – 2010. The goals are to make the radiation code more flexible and capable of handling an even wider variety and more detailed input datasets and to produce a climate-quality version with better spatial resolution, better homogeneity and better accuracy. The new code will be tested and the new product evaluated by a similar broad set of comparisons against more direct observations (ERBE, CERES, BSRN) and by more detailed calculations (Line-By-Line and vector doubling-adding). In addition, we will improve all the supporting information so that the new product, along with its production code, can be released to the community (possibly by delivery to the NOAA National Climatic Data Center). The target is to reduce flux uncertainties of ISCCP-FD by 2 – 5 W/m² at top-of-atmosphere (TOA) and by 3 – 7 W/m² at the surface with sufficient homogeneity and stability for climate studies. The project is relevant to the FY 2011 priority TCDR associated with both the focus areas of the CDRP and will require 3 years to accomplish.