Global and Regional Radiation Budgets of the NCEP CFS Reanalysis

Thomas P. Ackerman
Joint Institute for the Study of the Atmosphere and Ocean and
Department of Atmospheric Sciences
University of Washington, Seattle, WA

Laura M. Hinkelman
Joint Institute for the Study of the Atmosphere and Ocean,
University of Washington, Seattle, WA

Chen Zhang
Department of Atmospheric Sciences
University of Washington, Seattle, WA

It is unclear to what extent reanalysis products reproduce the radiation balance of the atmosphere and how model cloud properties affect the fidelity of these radiative fluxes. This question applies to both the global scale and also regional scales. In this project, we compare results from the NCEP Climate Forecast System Reanalysis (CFS-R) with CERES data at the top of atmosphere and the CERES Synoptic Radiative Fluxes and Clouds (SYN) product fluxes at the earth surface. The data are available as global daily and monthly gridded sets so comparisons are carried out for both timeframes, which is the standard test of model radiation budgets. In addition, a new product is available at 3-hourly time intervals. As time permits, we will examine whether these higher temporal resolution data can be used to identify the source of discrepancies between the data and model output. Regional radiation budget studies are initially carried out in the vicinity of the ARM Southern Great Plains and Darwin, Australia sites. These sites were chosen because we have previous experience with data analysis there and have applied our classification scheme described below to these locations.

There is considerable new cloud data available from NASA instruments including MODIS, MISR and CloudSat that provide information on cloud fraction, cloud top height and cloud optical depth. Cloud fraction data are readily available from the CFS-R, so our analysis currently focuses on this variable. As time permits, we intend to move to comparisons of cloud top height and optical depth. The latter is particularly problematic to recover from the reanalysis.

Our research group has developed a synoptic classification method that sorts synoptic events selected every 3 or 6 hours for multiple years into clusters of similar events. The method relies on having profiles of cloud occurrence from a millimeter radar, so is currently restricted to the relatively few sites that have a continuously operating mm cloud radar. We apply this classification technique to the CFS reanalysis at both the ARM SGP and Darwin TWP sites to produce clusters of similar states. We then compile distributions of quantities such as radiation, precipitation and cloud properties for each cluster and compare them to measured data at the ARM sites. Results of these comparisons are used to evaluate the performance of the CFS-R cloud and radiation parameterizations.

Corresponding Author:

Name: Thomas P. Ackerman
Organization: Joint Institute for the Study of the Atmosphere and Ocean,
University of Washington

Address: JISAO, Box 355672
University of Washington
Seattle, WA, 98195-4235
United State of America
E-mail Address: tpa2@uw.edu