

## **Results for Task 22 Subtask C - Use of MERRA to contribute to improving cloud and convection parameterizations.**

The task was to create cases with sets of boundary conditions derived from the Modern Era Retrospective-analysis for Research and Applications (MERRA) to run with GMAO's Single Column Model (SCM) based on GEOS-5. These cases were chosen for periods and locations where intensive observational field campaigns (e.g. those of the Atmospheric Radiation Measurement program) gathered data sufficient to provide uninterrupted times series for SCM boundary conditions. The data from the field campaigns are used to populate files that the SCM uses for configuration and forcing. To compare MERRA data to those of the field campaigns and to develop tools to easily create SCM data sets, parallel cases were created using data from MERRA at the same times and locations as the field campaigns.

### **Changes made to GEOS-5 and other software**

At this time any new case requires changes to the SCM source code in the compile-time parameters, which are eventually incorporated into the production model version. The ability to run all of the cases created in this task will be included in the Fortuna 2.2 release of GEOS-5.

As all of the cases introduced in this task incorporate MERRA data, certain code modifications specific to MERRA were made. Chief among these is the inclusion of analysis increments for horizontal advection of temperature and water content, with the run-time option of adding these to the respective dynamic horizontal advection terms at each time-step in the DatmoDyn gridded component. IDL scripts extract the data from the chosen geographical grid point in the MERRA data files to create the driving data file and the necessary configuration and initial condition files for the SCM, and the inclusion of analysis increments required modification of these as well.

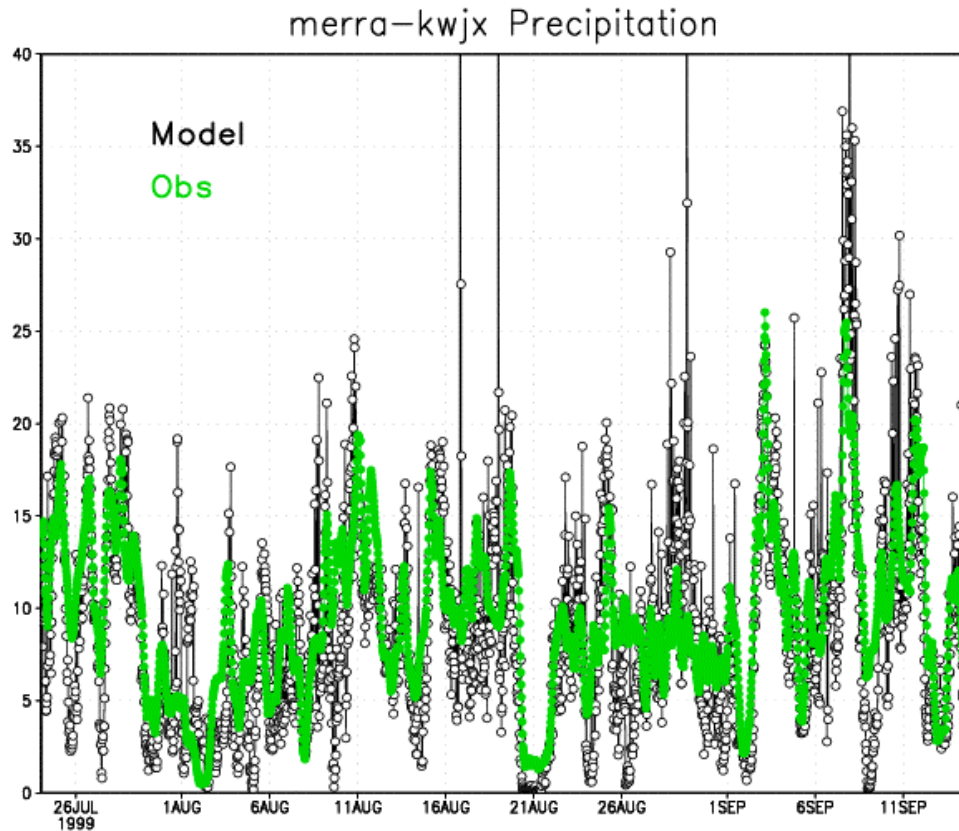
Another addition in functionality is the new application of the SST boundary conditions normally used in GEOS-5 runs, replacing the static value previously used for the SCM.

### **MERRA cases created**

Field Campaign	Geographic Location	Starting Date	Ending Date	Data File
SCSMEX/NESA	21N 117E	05/01/1998	06/30/1998	merra_scsmex.dat
TWP-ICE	12S 131E	01/19/2006	02/11/2006	merra_twp.dat
KWAJEX	9N 167E	07/24/1999	09/14/1999	merra_kwjx.dat
TRMM-LBA	11S 62W	01/24/1999	02/28/1999	merra_trmm.dat
NAMMA	16N 24W	07/19/2006	07/22/2006	merra_namma.dat
NAME-CORA	24N 108W	07/28/2004	08/11/2004	merra_namecore.dat
NAME-AZNM	33N 110W	07/28/2004	08/11/2004	merra_nameaznm.dat

### **Results**

All of the selected cases run and produce analyzable results. Output of the SCM forced with MERRA from the time and location of KWAJEX experiment, with comparisons to MERRA, are shown below. Examining precipitation, the SCM appears to capture most events with some overshoots:



*Precipitation (mm/day) in SCM with forcing from MERRA replicating the KWAJEX experiment. "Obs" denotes MERRA data, "Model" SCM output*

The MERRA cases created have been useful for testing the GEOS-5 SCM for use in model intercomparison projects. Outside users such as Wei-Kuo Tao (NASA Code 613) and Minghua Zhang (SUNY) have also expressed interest in using the MERRA-based SCM driving data sets.

**Data Availability**

The data and readme file are available on the data portal in the NASA Center for Climate Simulation (NCCS). (See [ftp://G5\\_cld@dataportal.nccs.nasa.gov/](ftp://G5_cld@dataportal.nccs.nasa.gov/) but leave the password blank.)