

Building the software infrastructure to enable usage of satellite observations for climate change research

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NASA satellite observations represent a wealth of information about the state and dynamics of the Earth system that has been thus far under-used in the study of global climate change, especially at the regional levels. Historically, some of the barriers that have prevented a more thorough utilization of these data include the difference in data and metadata formats with respect to the output of climate models, the different structure of the data coverage (swath versus global grids versus regional spatial extents), and the fact that observations of different physical fields are stored and served by different systems without a common paradigm for users to find, download and analyze the data. The Jet Propulsion Laboratory (JPL), in collaboration with the Program for Model Diagnostics and Intercomparison (PCMDI), has been researching and developing distributed computing infrastructures to support inter-comparison of satellite observations with climate model output. This includes the ability to access, prepare and share data for a wide variety of platforms and applications including the Coupled Model Inter-comparison Project phase 5 (CMIP5) supporting the International Panel on Climate Change 5th Assessment Report (IPCC-AR5), as well as analysis for other regional and global scale climate model evaluation. JPL's Climate Data Exchange (CDX) project provides a set of building blocks to support capture, access and transformation of satellite observations from remote data centers. CDX is built on Apache OODT, a technology platform that provides the data services for many of these functions. The purpose of CDX is to enhance what already exists: rather than developing new systems, it provides a middleware layer to integrate existing systems already in place. Recently JPL has led insertion of NASA satellite observations, including data from the AIRS, TES and MLS missions, into the Earth System Grid Federation (ESGF), a software infrastructure that unifies multiple-agency data systems to support AR5. We have integrated the ESGF and CDX software stacks as part of our recent efforts to expose NASA satellite data. The integration of CDX, in addition to publishing data to the ESGF, allows for model and satellite data to be accessed across the computing grid so dynamic analysis can be performed. In addition, JPL has been developing a software framework for regional modeling evaluation called the Regional Climate Model and Evaluation System (RCMES). RCMES provides services to integrate measurements from heterogeneous satellite observations and to compare those measurements against regional scale models. RCMES leverages CDX to pull in satellite data, extract key parameters and construct a large parametric database of climate model outputs and observation data. The database, dubbed "RCMED", feeds a set of web-based computational services called "RCMET". RCMET allows climate model outputs and observational data to be extracted and processed using a common grid, for measurement parameters from model and observation to be compared side-by-side, and ultimately to allow for decision-support at the regional levels.