Climate Model Diagnostic Analyzer Web-Service

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The latest Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report stressed the need for the comprehensive and innovative evaluation of climate models with newly available global observations. The traditional approach to climate model evaluation, which compares a single parameter at a time, identifies symptomatic model biases and errors but fails to diagnose the model problems. The model diagnosis process requires physics-based multi-variable comparisons that typically involve large-volume and heterogeneous datasets, making them both computationally- and data-intensive.

To address these challenges, we are developing a parallel, distributed web-service system that enables the physics-based multi-variable model performance evaluations and diagnoses through the comprehensive and synergistic use of multiple observational data, reanalysis data, and model outputs. We have developed a methodology to transform an existing science application code into a web service using a Python wrapper interface and Python web service frameworks (i.e., Flask, Gunicorn, and Tornado). The web-service system, called Climate Model Diagnostic Analyzer (CMDA), currently supports (1) all the datasets from Obs4MIPs and a few ocean datasets from NOAA and Argo, which can serve as observation-based reference data for model evaluation (2) many of CMIP5 model outputs covering a broad range of atmosphere, ocean, and land variables from the CMIP5 specific historical runs and AMIP runs.

Analysis capabilities currently supported by CMDA are (1) the calculation of annual and seasonal means of physical variables, (2) the calculation of time evolution of the means in any specified geographical region, (3) the calculation of correlation between two variables, and (4) the calculation of difference between two variables. A web user interface is chosen for CMDA because it not only lowers the learning curve and removes the adoption barrier of the tool but also enables instantaneous use, avoiding the hassle of local software installation and environment incompatability.

CMDA is planned to be used as an educational tool for the summer school organized by JPL’s Center for Climate Science in September, 2013. The requirements of the educational tool are defined with the interaction with the school organizers, and CMDA is customized to meet the requirements accordingly. The tool needs to be production quality for 30 some simultanenous users. The summer school will thus serve as a valuable testbed for the tool development, preparing CMDA to serve the Earth-science modeling and model-analysis community at the end of the project.

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