Web-Service Oriented Climate Model Diagnostic Analyzer

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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 is the comparison of 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, which typically involve large-volume and heterogeneous datasets, and computationally demanding and data-intensive operations.

To address these challenges, we are developing a parallel, distributed web-service oriented information 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-driven interface and Python-driven web service tools (i.e. Flask, Gunicorn, and Tornado). The web-service oriented 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) calculation of difference between two variables. A web-browser based user interface is chosen for CMDA because it not only lowers the learning curve and the adoption barrier of the tool but also enables instantaneous use without the hassle of local installation and compatibility issues.

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 summer school will serve as a valuable testbed for the development of CMDA, which should serve the Earth-science modeling and model-analysis community at the final stage.

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