

ADCME: ARM Diagnostics for Climate Model Evaluation

The ARM Diagnostics for Climate Model Evaluation (ADCME, Zhang et al. 2017) constitutes the core content of the ARM data-oriented diagnostics package — a *Python-based* diagnostic package that aims to facilitate the use of ARM data sets in climate model evaluation. Two types of data sets are included in the ADCME: 1) long-term high frequency observational data for representative climatology computation and 2) the Coupled Model Intercomparison Project (CMIP5) climate model simulation data sets acting as a reference for other models to compare with. The observational data are collected from multiple ARM instrument data streams and value-added product (VAP) data streams available at ARM permanent research sites (SGP, TWP, and NSA), including cloud fraction, temperature, relative humidity, cloud liquid water path, total column water vapor, precipitation, sensible and latent heat fluxes, and radiative fluxes. For SGP, the majority of the observational fields are from the ARM continuous forcing data version 1 (Xie et al. 2004), which attempts to determine the spatial average for a region of approximately 3° latitude-longitude centered at the SGP central facility. Other data sources of observed quantities include Best-Estimate Fluxes from EBBR Measurements and Bulk Aerodynamics Calculations (BAEBBR), Quality Controlled Eddy Correlation Flux Measurement (QCECOR), Active Remote Sensing of Clouds (ARSCL), Multifilter Rotating Shadowband Radiometer (MFRSR), ARM Cloud Retrieval Ensemble Data (ACRED) and Soil Water and Temperature System (SWATS).

Currently, data in ADCME are used to support the basic diagnostics, which include commonly used metrics for mean climate and diurnal and seasonal variability of selected important geophysical cloud and precipitation related quantities. The ARM data-oriented diagnostics package serves as an easy entry point for climate modelers to compare their models with ARM observations (Zhang et al. 2018). Datasets to support process-oriented diagnostics, such as convection onset metrics, are being developed.

The ARM data included in this product have gone through stringent data quality control and represent the ‘best’ estimate of the selected quantities. As noted above, multiple ARM instrument data streams and VAP data streams are involved in this data product. We recommend that users read the references on each observational data product and contact the relevant ARM Engineering or the ARM Translators for more information on the data limitation/uncertainties.

References:

- Xie, S, R. Cederwall, and M. Zhang, 2004: Developing long-term single-column model/cloud system-resolving model forcing data using numerical weather prediction products constrained by surface and top-of-the-atmosphere observation. *JGR-Atmospheres*, **109(D1)**, doi:10.1029/2003jd004045.
- Zhang, C., and S. Xie, 2017: ARM Data-Oriented Metrics and Diagnostics Package for Climate Model Evaluation Value-Added Product. ARM Climate Research Facility. DOE/SC-ARM-TR-202.
- Zhang, C., S. Xie, S. Klein, H. Ma, S. Tang, K. V. Weverberg, C. Morcrette, and J. Petch, 2018: CAUSES: Diagnosis of the Summertime Warm Bias in CMIP5 Climate Models at the ARM Southern Great Plains Site. *JGR-Atmospheres*, **123(6)**, doi:10.1002/2017JD027200.