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OFFLINE EVALUATION OF SIX SURFACE LAYER PARAMETERIZATION SCHEMES AGAINST OBSERVATIONS AT THE ARM SGP SITE

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ABSTRACT

Surface momentum, sensible heat and latent heat fluxes are critical for atmospheric processes such as clouds and precipitation formation, and are parameterized in models of various scales. However, direct evaluation of the parameterization schemes for these surface fluxes using observations is limited. This study takes advantage of the long-term observations of surface fluxes collected by the DOE (Department of Energy) ARM (Atmospheric Radiation Measurement) program at the Southern Great Plains (SGP) site to evaluate the surface layer parameterization schemes commonly used in the Weather Research and Forecasting (WRF) model and global climate models (GCMs). Effort has also been made to quantify the uncertainty/discrepancy between the ARM measurements based on the EC (Eddy Correlation) and EBBR (Energy Balance Bowen Ratio) methods. To minimize potential feedback influences resulting from online evaluation, the 'offline' mode is used to evaluate the surface layer parameterization schemes. The turbulent fluxes are calculated by the schemes using the corresponding measurements of mean meteorological quantities as inputs, and the parameterized turbulent fluxes are evaluated against the concurrent measurements of surface turbulent fluxes. The results show that the momentum flux is parameterized best, and all the schemes parameterize the friction velocity very well compared to the EC observations. The MM5 scheme is the best to parameterize the sensible heat flux compared to the EC observations, while the Eta scheme is the worst. The three schemes used in the GCMs are relatively better to parameterize the latent heat flux, while the three schemes used in the WRF model are worse. The results are valuable for understanding and improving parameterization of turbulent fluxes in particular, and atmospheric boundary layer processes in general.