Characterization of Errors In Various Moisture Roughness Length Parameterizations

Mark A Bourassa[1] and Joshua Griffin[1,2]

1. Dept. of Meteorology & Center for Ocean-Atmospheric Prediction Studies, Florida State University, Tallahassee, FL 32306-2840; mbourassa@fsu.edu

2. Atmospheric Technology Service Company, Ronald Reagan Ballistic Missile Defense Test Site, Kwajalein Atoll, Republic of the Marshall Islands

Often the parameterization of the moisture roughness length is not seen as being important, as long as the parameterization seems reasonable; that is, it is within the rather considerable bounds of error for the data sets used to determine the parameterization. However, the choice of parameterization does influence height adjustments of humidity and calculations of turbulent heat fluxes. This study focuses on the calculation of the latent heat fluxes using different parameterizations of roughness length. Five roughness length parameterizations are examined herein. These parameterizations include wall theory; the Clayson, Fairall, Curry parameterization; the Liu, Katsaros, Businger parameterization; Zilitinkevich parameterization; and the COARE3.0 parameterization. Latent heat fluxes are calculated from each parameterization of the moisture roughness length and are compared to observed turbulent heat flux values. The bulk latent heat flux estimates have a much better signal to noise than the sensible heat fluxes, and are therefore the focus of the comparison to observations. This comparison indicates how to improve the proportionality in the above roughness length parameterizations, which are causing modeled turbulent heat flux magnitudes to be too large in four of the five parameterizations. The modeled turbulent heat fluxes are evaluated again after the modification of the parameterizations. Significant improvements in both the bias and the root mean square error (RMSE) are seen. Three parameterizations see roughly the same improvements of around $17 Wm^{-2}$ in the bias and roughly $10 Wm^{-2}$ in the RMSE.