

High-Resolution Modeling of the Dust and Water Cycles with the NASA Ames Mars Global Climate Model

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NASA's Mars Climate Modeling Center at Ames Research Center is currently undergoing an exciting period of growth in personnel, modeling capabilities, and science productivity. We are transitioning from our legacy Arakawa C-grid finite-difference dynamical core to the NOAA/GFDL cubed-sphere finite-volume dynamical core for simulating the climate of Mars in a global framework. This highly parallelized core is scalable and flexible, which allows for significant improvements in the horizontal and vertical resolutions of our simulations. We have implemented the Ames water ice cloud microphysics package described in Haberle et al. (2018) into this new dynamical core. We will present high-resolution simulations of the dust and water cycles that show that sub-degree horizontal resolution improves the agreement between the vertical distribution of dust and water ice and observations. In particular, both water ice clouds and dust are transported to higher altitudes due to stronger topographic circulations at high resolution. Preliminary results suggest that high-resolution global modeling is needed to properly capture critical features of the dust and water cycles, and thus the current Mars climate.