Geophysical Research Abstracts, Vol. 9, 04582, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04582

Simulations of the Martian Water Cycle with the Ames General Circulation Model: Comparison with Mars Express PFS/LW Observations

R. Haberle (1), F. Montmessin (2), M.A. Kahre (1), and J. Schaeffer (3)

(1) NASA/Ames Research Center, Moffett Field, CA USA (2) Service d'Aeronomie, Paris, France (3) Raytheon QSSS, Palo Alto, CA USA (Robert.M.Haberle@nasa.gov / Phone: 650-604-5491)

Observations of atmospheric water vapor by the Long Wave channels of the Planetary Fourier Spectrometer instrument (PFS/LW) aboard Mars Express reveal a much drier - by almost a factor of two - atmosphere than observed previously by the Mars Global Surveyor Thermal Emission Spectrometer (TES) and the Viking Mars Atmospheric Water Detector (MAWD) (Fouchet et al., Icarus, submitted, 2007). The PFS/LW observations also suggest that at low latitudes atmospheric water vapor is not uniformly mixed below the hygropause. Instead, water vapor appears to be concentrated in the lower atmosphere. Here we use the latest version of the NASA/Ames Mars General Circulation Model (GCM), which runs with a moment/order cloud microphysics scheme, to interpret these observations. We first explore the mechanisms by which the model can simulate a drier atmosphere than observed by TES and MAWD. The possibilities include adjustments to the water sublimation flux off the north residual cap, and/or an increase in predicted cloud particle sizes. In this work, we focus on the sublimation flux by changing the cap albedo and/or the fractional area of active sublimation. A higher albedo and a smaller sublimation area will reduce the flux, with the viability of these depending on how well the model reproduces cap temperatures and the fraction of dark lanes implied within the cap. We also examine the role of small-scale vertical mixing in controlling the distribution of low latitude water vapor. Fouchet et al. suggest the observed distribution implies a regolith source, since the GCM of Montmessin et al. (JGR, 2004), which does not include a regolith source, predicts a nearly uniform distribution. Our GCM also predicts a nearly uniform vertical distribution and it too does not have a regolith source. However, it is possible that

the models overestimate vertical mixing by small-scale (turbulent) processes. Thus, the PFS/LW data provide important constraints for GCMs on how they treat polar cap sublimation properties and vertical mixing in the atmosphere.