Updating Mars-GRAM to Increase the Accuracy of Sensitivity Studies at Large Optical Depths

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The Mars Global Reference Atmospheric Model (Mars-GRAM) is an engineering-level atmospheric model widely used for diverse mission applications. Mars-GRAM's perturbation modeling capability is commonly used, in a Monte-Carlo mode, to perform high fidelity engineering end-to-end simulations for entry, descent, and landing (EDL). During the Mars Science Laboratory (MSL) site selection process, it was discovered that Mars-GRAM, when used for sensitivity studies for MapYear=0 and large optical depth values such as tau=3, is less than realistic. From the surface to 80 km altitude, Mars-GRAM is based on the NASA Ames Mars General Circulation Model (MGCM). MGCM results that were used for Mars-GRAM with MapYear set to 0 were from a MGCM run with a fixed value of tau=3 for the entire year at all locations. This has resulted in an imprecise atmospheric density at all altitudes. As a preliminary fix to this pressure-density problem, density factor values were determined for tau=0.3, 1 and 3 that will adjust the input values of MGCM MapYear 0 pressure and density to achieve a better match of Mars-GRAM MapYear 0 with Thermal Emission Spectrometer (TES) observations for MapYears 1 and 2 at comparable dust loading. Currently, these density factors are fixed values for all latitudes and Ls. Results will be presented from work being done to derive better multipliers by including variation with latitude and/or Ls by comparison of MapYear 0 output directly against TES limb data. The addition of these more precise density factors to Mars-GRAM 2005 Release 1.4 will improve the results of the sensitivity studies done for large optical depths.