THE SECOND GENERATION OF THE GLOBAL MARS MULTISCALE MODEL (GM3). A. Akingunola[1], J. C. McConnell[2], J. Kaminski[2], F. R. Farahnaz[2], D. Wu[2], [1]Graduate Programme in Physics and Astronomy, York University, Toronto, Canada (deji@nimbus.yorku.ca), [2]Centre for Research in Space Science and Engineering, York University, Toronto, Canada (jack@nimbus.yorku.ca).

Introduction: We present the second generation of the Global Mars multiscale model (GM3v2), based on the updated dynamical core of the Canadian operational weather forecast Global Environment Multiscale (GEM) model. The vertical resolution near the surface has been refined, accompanied with new parameterizations to better simulate physical processes near the surface (multi-layer soil scheme, boundary layer parameterization, etc.). The inclusion of of orograpghic gravity wave drag and CO_2 condensation/sublimation parameterization, as well as improved radiative transfer calculations has led to better simulation of the atmospheric dynamical circulation by the model. In addition, water cycle and chemical modelling are now well represented in the model.

Overview of the Model Dynamics: GEM's dynamical core described in Cote et al. (1998) and Moudden and McConnell (2005), have been modularized to provide 'interfaces' for physics, chemistry, data assimilation, and a generic coupling modules. In model comprises of 102 levels extending to above 120 km, and typically runs at a 64 x 36 horizontal resolution in global uniform mode.

Physical Processes: The physics module is comprised of the calculation of the radiative fluxes from the absorption in the 15-um band of CO^2 gas, the absorption and scattering by atmospheric dust, as well the non-LTE cooling. A multilayer soil scheme and the Monin-Obhukov similarity theory is used in calculating the evolution of the subsurface and surface temperatures, and other surface parameters such as the surface friction velocity. A non-local diffusion scheme is used to paramterize sub-grid scale turbulent mixing in the boundary layer. Orographic gravity wave scheme based on work of McFarlane and McLandress (1997), is used in the model. The launching height for the gravity waves is calculated using orographic variances derived from the MOLA dataset. CO_2 condensation schemes loosely based on Forget et al. (1998) is also included. Water vapour and water ice processes (Akingunola and McConnell, 2008) are also treated in the physics module, and integrated with the chemistry module when chemical modelling is enabled in the model.

Chemical Modelling: The current chemical scheme is a simplified version of the original scheme of Moudden and McConnell (2007). It involves CO, water, HOx, Ox and NOx chemistry. For NO we note that there is thermospheric production from the ionization of N_2 and subsequent reactions. As in Moudden and McConnell we have used a N and N(^{2}D) source function based on the work of Jane Fox to calculate NO densities and also NO emission based on recombination. We are exploring polar night time chemistry in which H, O and NO are brought down from the thermosphere to the upper troposphere/mesosphere

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Current Work: Presently we are adding dust lifting schemes which are thermal and wind based. For the latter case we are using the DEAD model. The model will be used in implementing a microphysical water ice cloud scheme and improve heating due to dust..

Mesoscale simulations of wind, water vapour and water ice around the phoenix lander site are also been carried out.

References: Use the brief numbered style common in many abstracts, e.g., [1], [2], etc. References should then appear in numerical order in the reference list, and should use the following abbreviated style:

1] Cote J. S. et al. (1998) *Mon. Wea. Rev., 126,* 1397 1418. [2] Moudden Y. and J. C. McConnell (2005) *JGR, 110,* doi:10.1029/2004JE002354. [3] McLandress C. and N.A. McFarlane (1993) *J. Atmos. Sci., 50,* 297 320. [4] Forget F. et al. (1998) *Icarus*, 131, 301 - 316. [5] Akingunola A. and J. C. McConnell (2008) *Mars Water Cycle Workshop.* [6] Lopez-Valverde, et al. (1998) *JGR, 103,* 16,799-16,812. [7] Moudden Y. and J. C. McConnell (2007) *Icarus, 188,* 18–34. [8] Akingunola, A. (2008) *PhD thesis*, York University, Canada.