GCM AND SGCM STUDIES OF TRANSIENT BAROCLINIC EDDIES AND TOPOGRAPHY IN THE MARTIAN ATMOSPHERE. J. R. Barnes and M. Matheson, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR, 97331, barnes@oce.orst.edu

It has been known since the Viking Lander observations that transient baroclinic eddies are a major component of the general circulation of the Martian atmosphere in winter midlatitudes. To date these remain the only solid detection of these atmospheric weather systems; the MGS TES experiment should be able to provide excellent observations of these eddies (as well as quasi-stationary eddies) above the surface, and the MCO PMIRR experiment should soon begin to further expand the observational database for this very important component of the circulation.

Studies with atmospheric GCM's have shown that the amplitudes of the transient eddies in the southern hemisphere during winter are considerably smaller than in the northern hemisphere winter (the eddies are essentially not present during summer). Sensitivity experiments have indicated that differences in the topography between the two hemispheres are responsible in large part for the suppression of the southern hemisphere eddy activity. Until very recently this topography has been rather uncertain, though. The MGS MOLA experiment has now produced a global topographic dataset (at 1 degree resolution) which is much more accurate than the previous ones. It is thus very much of interest to use this topography dataset in atmospheric GCM's to examine the transient eddy amplitudes and properties in the two hemispheres of Mars.

We have been using both state-of-the-art GCM's (the NASA-Ames Mars GCM) and so-called SGCM's (simplified GCM's) to study the transient eddies and the effects of the very large Martian topography upon them. The SGCM's have highly simplified physics by comparison with the full GCM's, and thus allow the essential dynamical processes related to the transient eddies to be isolated more readily.

The model experiments to date with the new MOLA topography show that the transient eddies in the southern hemisphere in winter are still substantially weaker than those in the north, but not as much weaker as with the previous topographic datasets. Surface amplitudes are smaller by factors of ~ 3 in middle latitudes, with upper level amplitudes being reduced by somewhat smaller factors. The eddy amplitudes in the north are slightly smaller than with the previous topographic data, while those in the south are significantly larger. The biggest difference in the eddies between the two hemispheres is in their heat fluxes: meridional heat fluxes are roughly an order of magnitude smaller in the south than in the north.

It appears from preliminary sensitivity experiments that it is the zonally asymmetric (eddy) component of the topography in the south that is responsible for a strong stabilization of the southern eddies. The southern eddy topography is dominated by a very large wavenumber 1 component in midlatitudes, which acts to force a very large-amplitude wavenumber 1 quasi-stationary disturbance during winter. The eddy topography in the northern hemisphere is not nearly as stabilizing to the baroclinic eddies as that in the south, and it is not clear at present why this is the case. The large zonally averaged topography in the south appears to be fairly strongly *destabilizing* to the baroclinic eddies, but its effects are overwhelmed by those of the zonally asymmetric topography in this hemisphere. In addition to strongly affecting the amplitudes and fluxes of the transient eddies, the topography appears to have an important influence on the dominant zonal wavenumbers and periods of the eddies. In the absence of the (variable) topography, eddies of the largest zonal scales and longest periods - wavenumber 1 and periods of ~ 6-8 sols and longer - are strongly dominant, whereas with topography shorter-scale (higher wavenumber) and shorter period eddies become much more prominent. The latter is much more in accord with the available observational data.

The baroclinic eddies remain to be detected in the southern hemisphere of Mars, but it should be possible to do this with TES data in the near future. Then the data can begin to be compared with the GCM results, providing a strong test of the ability of these models to simulate the effects of the very large topography on the atmospheric circulation and climate.