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Influence of the surface on the atmospheric circulation of Mars (as revealed from the General Circulation Model of the Martian Atmosphere - MAOAM)

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Unlike on Earth where 3/4 of the surface is covered by oceans, the Martian surface has rougher topography with greater magnitudes of mountains and valleys. The Martian atmosphere is less dense at the surface compared to the terrestrial one. The planetary boundary layer is significantly shallower on Mars than on the Earth. These differences indicate that the Martian atmosphere should be very sensitive to the forcing from the surface.

Results of numerical experiments with the General Circulation Model of the Martian Atmosphere (MAOAM) show the sensitivity of the zonal mean circulation to the surface properties. Planetary waves of different scales are generated by the flow over the orography as well as by inhomogeneous reaction of the surface to the solar heating. They propagate upward and horizontally according to the selective transmission properties of the atmosphere and redistribute wave momentum and energy. Breaking waves provide a torque on the mean zonal circulation.

We will present results of the numerical simulations showing the sensitivity of the polar night jet to the orography, the inhomogeneous thermal inertia and the surface albedo. Excited by the surface, eddies are analyzed using the Eliassen-Palm flux technique, and the mechanism of wave driving.

Keywords: Mars; general circulation model; atmospheric dynamics; MAOAM; orography; surface properties; planetary waves; energy transport; momentum transport; mean zonal circulation; thermal inertia; surface albedo; eddies; Eliassen-Palm flux technique