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Dust vortices at Earth and Mars: similarity, gas and dust dynamics, electrification.

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Dust vortices generated over heated surface as a result of convective instability are frequent events for Earth and Mars. The processes in these spectacular structures called also dust devils at both planets have much in common with discrepancies concerning gravity, atmospheric density and composition. Many observations and measurements of size, wind velocities, and electric field in the dust vortices were made in the Earth's atmosphere. About Martian vortices people know much less, observations are very limited. We use similarity theory to predict the parameters of the Martian vortices based on the parameters of the Earth dust vortices. In the Martian atmosphere the dust devils have the prominent effect on the atmospheric dust upload. Dust grains trapped by the vortex collide with each other, which leads to their charging due to the triboelectric effect. The vertical flow lifts dust grains up, thereby leading to space charge separation and electric field generation. We calculate electric fields generated by the vortices by solving Poisson's equation and the charge continuity equation with allowance for the finite conductivity of the atmosphere. The model of dynamics of gas and dust in the dust vortex is proposed. We analyze the motion of charged dust grains in the vortex for the conditions of the Earth's and Martian atmospheres with allowance for the electric field. The work is supported by the Russian Science Foundation (project No 18-72-00119).