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Dust grain capture by Rossby vortices in Earth's atmosphere

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The effect of capture of dust grains by Rossby vortices in Earth's atmosphere is investigated. Numerical experiments modeling behavior of spherical particles in Rossby vortices are carried out. Trajectories of dust grains are presented for different sizes of the grains. It is shown that small particles (with the sizes not exceeding 100 micrometer) can exist in the vortex during two weeks or longer. This allows such particles to propagate together with the vortex for long distances exceeding 10000 km. If the vortex crosses the latitudes of about 30 degrees where the altitudes of the tropopause vary between 11 km and 16 km, then the effect of the capture of dust grains by Rossby vortices can result in transport of dust grains from the troposphere into the stratosphere. A possibility of such mechanism of transport of dust grains from the troposphere into the stratosphere is discussed from the viewpoint of explanation of an appearance of dust grains in the stratosphere during the periods of forest fires. This study was supported by the Division of Earth Sciences, Russian Academy of Sciences (the basic research program "Nanoparticles in Natural and Technogenic Systems"), by the Russian Foundation for Basic Research (project no. 06-05-64826-à), and by the Russian Science Support Foundation (the program "Doctors of Science of the Russian Academy of Sciences").