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One-dimensional microphysical model of H_2O cloud formation in the Martian atmosphere based on the approximation of fractional eddy diffusion

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Abstract

The objective of this work is to develop and test the new scheme of eddy diffusion based on the approximation of fractional derivative and to implement it into the classical one-dimensional microphysical model [1]. Within the one-dimensional model, substitution of the classical eddy diffusion for the fractional one allows us to take into account a number of processes integrally, including classical eddy diffusion, Hadley cell and large-scale transport.

To estimate vertical component of fractional diffusion, an effective numerical scheme was developed. This approach allows us to vary not only the profile of eddy diffusion coefficients as initial parameters but also the degree of differentiation in space.

The analysis of experimental data (SPICAM on "Mars-Express" [2]) was carried out in the framework of the one-dimensional model.

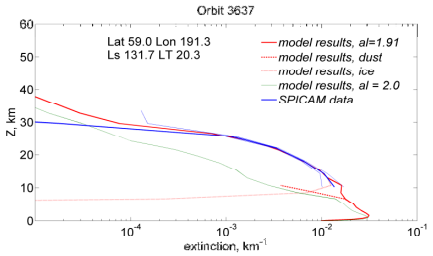

Figure 1: Vertical profiles of extinction.

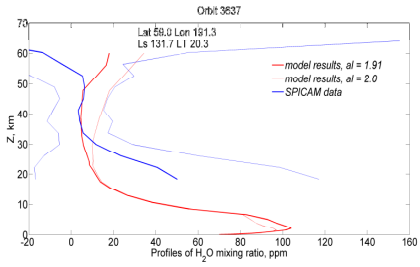

Figure 2: Profiles of H_2O mixing ratio (ppm).

In future the developed scheme will be used in the three-dimensional general circulation model of the Martian atmosphere.

Acknowledgements

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References

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[2] Fedorova A.A., Korablev O.I., Bertaux J.-L., et al.: Solar infrared occultation observations by SPICAM experiment on Mars-Express: Simultaneous measurements of the vertical distributions of H_2O, CO_2 and aerosol, Icarus, 2008, 200, 96-117.