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Subdust sublimation on comet 9P/Tempel 1.

K.J. Kossacki (1), S. Szutowicz (2)

(1) University of Warsaw, Inst. of Geophysics, (2) Space Research Center of PAS (kjkossac@fuw.edu.pl)

In the current work we analyze properties of the dust mantle, its thickness and thermal conductivity, necessary to reproduce observed rate of water production of comet 9P/Tempel 1. We considered simplified shape of the comet nucleus approximated by the symmetric prolate ellipsoid with smooth surface.

We have performed simulations, using models with dust mantle of the thickness either constant, but nonuniform (Model A), or evolving (Model B). In the Model A the erosion of the dust is equilibrated by thickening of the dust mantle due to ice sublimation beneath the dust, whereas in the Model B the dust mantle is episodically blown out when the vapour pressure of the subliming ice exceeds the critical value. The presented simulations show, that both models can reproduce general shape of the observed water production curve from the nucleus of comet Tempel 1. However, the temperatures detected with the Deep Impact spectrometer are reproduced much better by the Model A.

According to our model the thermal inertia of dust should be nonuniform. Reproducing observed high temperatures of the nucleus require extremely low thermal inertia of the dust cover, close to zero as already predicted by others. However, for the agreement between the simulated and measured water production the dust mantle regionally should have thermal inertia about 100. Such regions should be located south of the subsolar point.