LETTER

Contradictory saltation height measurements and unphysical assumptions

Almeida *et al.* (1) recently reported in PNAS novel scaling laws for the characteristics of the saltation layer in eolian sediment transport. Their model is similar to that proposed by Ungar and Haff (2) except for one key dynamical mechanism: the standard balance between erosion and deposition of grains (2, 3) is replaced in ref. 1 by a criterion that is not physically founded, the maximization of the sediment flux with respect to the number of grains released per unit surface and unit time. This model thus ignores the ability of the transported grains to expel other grains from the bed.

When the equations are correctly formulated—the equilibrium condition is then a replacement capacity equal to 1 (2, 3)—the results are very different from those reported in ref. 1. The wind velocity reduction in the saltation layer is such that grain trajectories are independent of u_*, so that the saltation height H is constant and not proportional to $u_* - u_{th}$ as in ref. 1. Experimentally, H has been derived from flux and particle density profiles (see for instance the papers cited in ref. 4) or from the aerodynamic roughness (3). These several independent measurements all show that the height over which the sand transport decreases is independent of the wind strength and scales roughly with $\sqrt{dl_\nu}$ (3). The characteristics of saltation on Mars are thus more likely to be predicted by former models (2, 3) based on the erosion/deposition balance. Finally, note that the size at which dunes form on Mars is related to the so-called saturation length (3, 5) and not to the saltation length.

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