



Scaling laws in sand launch process

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As the bond linking the micro research to the macro research in wind-sand flow, the scaling laws on sand mean launch velocity and mean launch angle can be used to calculate the mean velocity and the transport rate, and they also play an important role in understanding saltation. However, universal scaling laws are still absent. In analogy to the fluid flows, the wind-sand flow is divided into three periods based on the way of sand taking off from sand bed, and the hypothesis on the scaling laws in each period is proposed. Then according to the hypothesis we deduce the sand concentration piece-wise function for saltation layer and also the critical shields numbers dividing three periods. The comparisons between the predictions and the experimental observations show that under a lower shields number the vertical mean launch velocity and the mean launch angle scale with the wind shear velocity and the square root of shields number respectively. However, under a higher shields number the vertical mean launch velocity scale with the sand diameter and the mean launch angle is almost constant at 70° or so.