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## 风沙运动过程的颗粒流体动力学模拟(PDF)

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Title: Granular flow dynamics simulation of wind-blown sand movement process

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摘要: 采用颗粒流体动力学方法,在考虑沙粒与床面碰撞、沙粒-沙粒的空中碰撞及沙粒与气流的耦合作用后,对自然沙组成的风沙流发生、发展及达到动态稳定的这一个过程进行了数值模拟。数值模拟结果表明,该模型能够实现自然界风沙运动的沙粒蠕移、跃移的基本特征,如风沙流达到稳定的持续时间、输沙率、入射/溅射速度分布、入射/溅射角度分布等,且都与实验结果吻合。同时,在模拟中还发现,沙粒-沙粒在床面以上运动时的碰撞是不容忽视的,当摩擦风速为0.23 m/s,沙粒当量直径为0.228 mm时,其碰撞次数可占总碰撞次数21.5%。

Abstract: In this paper granular flow dynamics model is proposed to mathematically describe the evolution process of wind-blown sand movement. In this theoretical model, the complex phenomenon is composed of the basic mechanics process, such as particle-bed collision, particle-particle collision and the coupling interaction between saltating particles and wind flow, etc. After numerical calculations of a large system including 72 000 particles, the developing process of natural wind-blown sand movement was successfully realized, which proves that this model can simulate the essential properties of natural sand saltation, such as the duration time (wind-blown sand movement reaches equilibrium state), the profile of mass flux and distribution of ejected angle, are in good agreement with experimental results. The percentage of the particle-particle collisions increases from the beginning of the developing process of wind-blown sand movement until reaching dynamic equilibrium and accounts for about 21.5% of all the collision times.

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