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The cessation threshold of continuous sediment transport in Newtontian fluid[1] THOMAS PHTZ, Ocean College, Zhejiang University, ORENCIO DURAN, MARUM-Center for Marine Environmental Sciences, University of Bremen — One of the classical problems in sediment transport science is to predict the threshold Shields number below which a bed of loose sediment particles sheared by a homogeneous fluid flow ceases to move continuously. Depending on the particle-fluid density ratio (s), it has been believed for many decades that this threshold is a consequence of either fluid forces being just strong enough to dislodge particles resting on the bed (small s, e.g., water) or of particle-bed impacts being just strong enough to eject sufficient bed particles (large s, e.g., air). However, here we find from state-of-the-art numerical simulations that particle-bed impacts play an important role in sustaining sediment transport regardless of s. Guided by these simulations, we propose a simple, unified analytical model of the cessation of continuous sediment transport, which is quantitatively consistent with measurements in water (the famous "Shields diagram") and air on Earth and Mars. This model predicts that sediment transport on Pluto (transport of nitrogen ice particles in a very thin nitrogen atmosphere) can be sustained under surface winds comparable to those on Earth and Mars. This might explain wind streaks on Pluto's surface which have puzzled the lead researchers of the New Horizons mission.

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