Electricity plays role in geological erosion, airborne dust motion

By Nicole Casal Moore
News Service

Wind isn't acting alone in the geological process behind erosion, sand dunes and airborne dust particles called aerosols. The other culprit is electricity.

By taking both factors into account, U-M researchers have developed a new model that matches real-world measurements of "saltation" better than the decades-old classical theory.

Saltation is the process of wind blowing grains of sand across a landscape, sending them bouncing against the ground and each other. The bouncing motion of the saltating grains on the soil bed kicks dust aerosols into the air.

This new knowledge could lead to better climate models because it helps scientists understand how aerosols are released, U-M researchers say. Dust is one type of aerosol. Burning fossil fuels releases another type. They are known to affect Earth's climate by blocking and absorbing sunlight and seeding clouds.

Nilton Renno, associate professor in the Department of Atmospheric, Oceanic and Space Sciences, and doctoral student Jasper Kok have demonstrated that saltation creates a field of static electricity that can be strong enough to double the concentration of bouncing sand particles compared to previous assumptions.

"The effect of aerosols is one of the most uncertain processes in climate change modeling," Kok says. "We now know more of the physics of how dust aerosols get into the atmosphere, so we should be able to improve on the way that climate models account for their emission."

Years ago, while studying dust devils in Arizona, Renno first noticed that electricity might be missing from the equation. The devils had a strong electric field.

"I was surprised at how large the field was," Renno says. Others had suggested that electricity may be involved in saltation, but no one had determined the extent of that role and created a model to describe the process including electricity until now.

"What we discovered is that as these particles bounce and rub against each other, the surface of the ground gets a positive charge and the particles get a negative charge,"
Renno says, "The electric field can become strong enough to directly lift sand from the surface. It's a fundamental change in our understanding of the physics of saltation."

Kok and Renno's research on the basic physics of saltation and its implications to climate has been supported by the National Science Foundation's Physical and Dynamic Meteorology Program.

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