Takin' a ride.
"Human sliders" triggering sand sliding set off a booming dune.

Credit: Christopher Earls Brennen

Looking Inside a Dune for its Boom

By Richard A. Kerr
*Science*NOW Daily News
19 June 2007

Marco Polo heard them in the Gobi Desert, Charles Darwin in Chile, and physicists have been trying to explain them for 100 years. But booming sand dunes have remained mysterious. Now, a combined acoustic and seismological study of California dunes points to a natural internal structure that amplifies the sound of sliding sand at select frequencies.

Some dunes rumble loud and low when sand slides down their steepest faces. Previous work suggested that the cause had something to do with the nature of the sand grains, such as their size. Graduate student Nathalie Vriend and colleagues at the California Institute of Technology (Caltech) in Pasadena have found otherwise. In a paper in press in *Geophysical Research Letters,* they report how they used sound to look inside dunes. At Dumont Dunes, just south of Death Valley National Park in California, and at several dune fields in the American West, they wired up a microphone to record the booming and a network of geophones like those used in seismic oil prospecting. Then a few volunteers slide down the steep slopes on their derrières, trying to set off a sand slide and booming. To probe the dune's interior, the researchers struck a plate sitting on the sand with a large mallet and recorded the speed at which sound traveled through various parts of the dune.

The Caltech group found a close connection between booming and the dune's interior structure. In summer, when a large dune readily boomed, it had an outer layer about 1.5 meters thick in which sound traveled more slowly than it did in the air above or in the sand below. In winter, when the dune wouldn't boom, the low-velocity layer was gone. The group argues that the low-velocity layer would act as a "waveguide." A waveguide efficiently conveys sound of the moving grains as it reflects inward from the contacts with higher-velocity layers above and below the waveguide. At the same time, certain frequencies are amplified as they pile up on one another or resonate. The frequencies expected from a waveguide having the dimensions and sound velocities found in the dune match those the scientists observed. The group believes that such a natural amplifier is destroyed in the winter when the layering disappears, perhaps when more moisture penetrates the dune and raises the sound velocity there.

"It looks like we're homing in on this booming dune mechanism," says physicist Michael Bretz of the University of Michigan, Ann Arbor. "It's a very plausible mechanism." His colleague at Michigan, physicist Franco Nori, adds, however, that "there are many different variables in this complex problem. A resonating waveguide is important, but it's not the only variable." Human sliders will no doubt be returning soon to the dunes.

Related sites

- Caltech booming dunes page
- Multimedia page within above page: video of human sliders with booming and audio alone