

Science seeks answers to mysteries of the sand

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DUCK, N.C. — William A. Birkemeier was on his concrete pier, leaning into a howling gale. The sky was dark gray, the air was raw and the sea was crashing into the pilings below in breakers more than six feet high.

"Ah," he said, doffing his cap and sweeping it toward a seascape of uncompromising grimness, "this is great!"

Birkemeier is the director of an Army Corps of Engineers research facility here on the North Carolina coast. More than 100 coastal geologists and other scientists are at Duck now, working together on experiments they could not carry out alone.

This is the kind of weather they need to crack a mystery that is one of the keys to the erosion problems threatening most of the nation's beaches: exactly what happens when wind and waves meet the shoreline and start carrying sand around.

Researchers from Oregon State University in Corvallis, using a system of video cameras and computers, have watched mysterious features form at the edge of a sandbar. They theorize that the sandbar's shape there may be related to an erosion "hotspot" on the shore nearby.

Scientists at Washington State University in Pullman and Scripps Institution of Oceanography in La Jolla, Calif., have made measurements that raise new questions about a widely accepted theory about the formation of beach cusps, regular undulations that appear as if by magic on many beaches. The new findings challenge the theory that cusps on the sand are caused only by patterns in water movement.

Researchers working for the Navy are testing buoys designed to predict what surf conditions an amphibious force would meet on a beach.

Scientists from 11 universities, 6 government agencies, 3 private companies and 3 oceanographic institutions are conducting more than 30 experiments on topics such as the way waves carry sand in the surf zone, rip currents and sediment transport along the shore in storms.

The researchers began installing instruments in June, put most of them in the water by the end of August and are working to keep them producing data in steady streams until most of them are packed up at the end of October. Groups of scientists have done similar projects here before, but this is by far the largest.

The facility, formally the Army

Corps of Engineers Waterways Experiment Station Field Research Facility, has a staff of 12 scientists and technicians who maintain a year-round schedule of monitoring waves, currents, winds and the shape of the beach above and below the waterline.

They have plenty of practice setting instruments in the surf zone, which is a good thing: The task is difficult when the weather is mild and hair-raising when it is rough — when scientists are most eager for measurements.

They use surplus military equipment like amphibious landing craft and novel devices they built themselves like the "coastal research amphibious buggy," or crab, a sort of traveling closet powered with a Volkswagen engine and perched on three legs, each 30 feet long. Among other things, equipment on the crab can make highly precise measurements of the sea floor.

The scientists who gathered here this month brought millions of dollars worth of additional instruments, including radar arrays they set up in the dunes, sensors on pipes or frames the crab towed into position on the bottom of the sea, and gauges in canisters hung from the facility pier.

Additional instrument arrays extend all the way to the edge of the continental shelf, about 47 miles away. Scientists on two research vessels and the space shuttle also contributed photographs and other measurements.

The agglomeration of people and equipment adds up to much more than the sum of its parts.

"There is a synergy," said Dr. Robert T. Guza of Scripps, who is measuring currents with an array of sensors in the surf zone. "The logistics needed for something like this are enormous and could never be mobilized for a single investigator."

Many of the scientists have been working without a day off since their instruments went into the water. Each morning before the sun comes up the researchers gather to describe new findings, discuss problems with their instruments, and share advice, weather forecasts and other information. Then they head out into the wind.

It will be a year or more before results start to find their way through analysis and computer models and into scientific journals. By then, Mr. Birkemeier, his staff and the researchers will be hot on the Internet, planning their next encounter.