PHYSICAL SCIENCES

Dietrick E. Thomsen reports from New Orleans at the meeting of the American Physical Society

When the Gulf wind blows

It was a dark and stormy night. It was not a fit night out for man nor beagle. Indeed, there have been many nights on the Gulf coast of the United States when the beagles scurried for shelter before the storm. Unfortunately the people wouldn't always go as well.

The central Gulf coast, Louisiana, Mississippi and Alabama, has a long history of hits by hurricanes and tropical storms. Lionel Dureau of the University of New Orleans subjected the history of such hits since 1848 to a statistical analysis to see whether there are any patterns to be discerned. He finds that the storms have a fairly random pattern but with overtones that could suggest certain trends.

Dureau says he picked the starting date because records before 1848 are not reliable. He ended the survey at 1976. No single year had more than three storms; many years had none at all. An analysis of these data by one- or two-year intervals yields a random distribution with a 98 percent probability of being correct.

But, Dureau says, for a really good probability test you need at least five members in each interval. Some of these short intervals don't have that many storms. So he tried longer intervals. The whole span of time can be divided into four intervals of 32 years each. The oldest inhabitants of the community always say the weather has changed since they were young. The first 25 years of the first period of the hurricane survey counted 14 storms; the succeeding periods counted more: 26, 23, 22. Dureau says there is only a 2 percent chance, that is 50 to 1 odds, for that first period having only 14 storms. Maybe there has been a change, he says. If there is, it will surprise the oldest inhabitants. They always say the weather was worse in the good old days.

Another question that may be asked is whether there is clustering. If incidence of storms is high at a given time will it continue high for some time? If it is low, will it continue low? Dureau analyzed the data according to intervals of varying lengths counted from all possible starting points. The analysis yields a strong indication of random behavior, yet there seems to be some clustering. Dureau suggests that further analysis seeking to explain this behavior in terms of a triggering mechanism that doesn't always work might be profitable.

Animal magnetism, neurologic variety

The electrical properties of biologic specimens are usually determined by sticking microelectrodes into the bodies of the specimens. Microelectrodes are manufactured fantastically fine and deployed with extreme precision, but their entry into the body of a cell, for instance, represents nevertheless a disturbance and a breach of isolation of the interior from the outside world.

Electric phenomena often give rise to magnetic phenomena, which can often be measured at some distance from the source. Therefore, J. P. Wikswo Jr., J. O. Palmer and J. P. Barach of Vanderbilt University in Nashville, Tenn., are trying to work out a system for measuring the current that runs through the axon of a nerve at times when the axon is stimulated. They are trying to do this by measuring the magnetic field generated by that current.

Their first work involved axons from frogs. Because nerve action currents produce very small magnetic fields (about 1 nanotesla just outside the fiber and a picotesla a centimeter away) they started with ultracold superconducting sensing apparatus. Now they have developed a measuring system that works at room temperature. With this apparatus they have successfully measured the current in a lobster axon, "an ordinary 35 dollar lobster from [a fancy fish market]," Wikswo says. "It was delicious."

SPACE SCIENCES

Venus: Lightning and volcanoes

On earth, lightning is often associated with erupting volcanoes, which spew forth particles that rub together and generate static electricity. Spacecraft on and orbiting Venus have detected discharges characteristic of lightning at that planet, but are there also active volcanoes? And is there a connection?

Ongoing volcanism on Venus would be a stunning discovery. Besides the earth, only Jupiter's moon Io has revealed eruptions actually in progress, and for such a different reason — tidal dissipation heating caused by Jupiter rather than Io's own internal heat sources — that it is hard to draw meaningful comparisons with the terrestrial case. Venus in action would be a comparative planetologist's dream, but it hides its wonders beneath its dense, haze-ridden atmosphere.

Recent studies, however, have been suggesting reasons for hope. Radar measurements of the surface roughness show some regions to resemble volcanic terrain, with details sharp enough to imply that the activity could have been in the geologically recent past. Gravitational anomalies also seem consistent with relatively recent changes, and as some researchers have asked, why should a planet have been active for 98 percent of its history and then suddenly stop now, just when we start looking?

It still remains, however, to demonstrate that eruptions are actually in progress at present — and this is where the lightning fits in. Apparent signs of lightning have been detected on Venus as long ago as the Soviet Venera 9 and 10 missions in 1975, and since then, "whistler-mode" discharges have been recorded by the electric-field detector aboard the U.S. Pioneer Venus orbiter. Now, reports Frederick L. Scarf of TRW Inc. in Redondo Beach, Calif., analysis of the first 540 days of the orbiter's data indicates that 336 of the 340 whistlers in that period seem to come from the vicinities of what the radar researchers believe to be the two likeliest active volcanic regions on the planet.

One is called Beta, a northern-hemisphere rise that also seems to show the greatest roughness and the biggest gravity anomaly. The other is at the eastern end of a continent-sized highland named Aphrodite — whose central portion, a far less likely candidate for ongoing eruptions, has yielded no whistlers at all. The analysis so far covers only about two-thirds of Venus's circumference, but Scarf is working on the rest, which, if the correlation holds up, should show that western Aphrodite, too, is quiet.

Shuttle: A tank of a different color

One of the most familiar aspects of liftoffs from NASA's launchpads has been the pristine, almost glowing whiteness of the rockets themselves. The huge Saturn 5s that sent astronauts to the moon towered above the terrain like needles of snow; even the space shuttle has been a symphony in white, from the orbiter itself to its two strap-on booster rockets to its huge, external fuel tank, at 47 meters the tallest part of the whole system. The next time the shuttle appears, however, it will show a change. For the gigantic tank (jettisoned during the ascent after being emptied of the propellants for the shuttle's main engines) will be not white, but light brown.

The reason is weight. Leaving off the white latex paint that formerly covered the tank will enable the craft to carry about 600 additional pounds into earth orbit. Visible instead will be the spray-on foam insulation of the tank's thermal protection system, which engineers calculate will not be adversely affected by the lack of an overcoat. The step is part of a program to lighten each tank (the only major shuttle component not reused) by three tons from the first one's weight of 77,000 pounds. Chemical milling, lighter alloys and other techniques are being used, with the first fully lightened tank due for shuttle flight 6.