'88 Set Warm Record; '89 Looks Cooler

Global temperature measurements show 1988 as the warmest year in a century of recorded weather information, British climatologists reported last week. Last year joins a string of recent years that have topped the temperature charts and thereby transported the term "greenhouse effect" from scientific journals into the public lexicon. However, experts do not expect 1989 to follow suit, because a climate phenomenon in the Pacific is now causing ocean temperatures to drop and should make this year significantly colder than 1988.

Researchers at the United Kingdom Meteorological Office and the Climatic Research Unit of the University of East Anglia in Norwich, England, found that the global average temperature for 1988 exceeded by 0.34°C the average for the period 1950-1979. The year 1987, the second highest mark, was only slightly cooler at 0.33°C above the 30-year average, says climatologist Phil D. Jones from East Anglia. In total, the 1980s claim six of the warmest years in the last century (SN: 4/30/88, p.282).

The researchers based their analysis on a global average of land and sea surface temperatures measured at nearly 1,000 stations.

Reflecting the caution of most climate experts, Jones and his colleagues hesitate to blame the recent warm years on the rising atmospheric concentrations of many "greenhouse" gases such as carbon dioxide, methane and chlorofluorocarbons. "It's still a bit ambiguous. We can't associate this warming with the greenhouse effect," Jones says, while adding: "I think it's the most likely cause."

Researchers can speak more firmly about the effect of the climate phenomenon known as the El Niño-Southern Oscillation (ENSO). During an ENSO, a large patch of warm water develops in the central equatorial Pacific at about the same time the atmospheric pressure drops over the eastern part of the ocean relative to the west. Lasting about a year to 18 months, ENSOs rearrange traditional patterns of precipitation, bringing fierce rains to coastal Peru and drying out India and Australia. The individual events recur roughly three to seven years apart, and scientists have yet to determine what causes the phenomenon.

The year 1983 saw the strongest ENSO in a century. The next ENSO developed in early 1987 and carried through into early 1988. Jones says it is clear these events helped raise global temperatures during 1983, 1987 and part of 1988. But even with the ENSO effect removed, these years remain warmer than the 30-year mean, he says. It is this background warming that has scientists concerned.

Jones and most other climate experts expect global temperatures to drop markedly in 1989 due to a climate phenomenon that resembles the reverse of an ENSO. Scientists have yet to agree on what to call this interaction between the ocean and atmosphere. Some have named it the "cold phase" based on ocean temperature. Others call it the anti-El Niño. Still others have dubbed it La Niña, which is Spanish for "the girl," in an attempt to give it equal footing with El Niño ("the boy" or "Christ child," a reference to its winter timing). The confusion over names reflects the fact that scientists have only recently recognized the importance of this phenomenon.

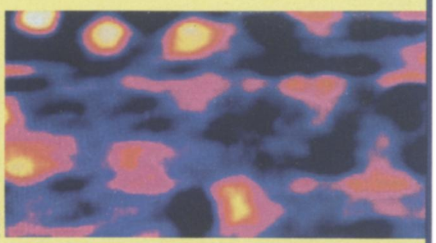
Chester Ropelewski and Michael Halpert of the Climate Analysis Center of the National Oceanic and Atmospheric Administration in Camp Springs, Md., have completed a statistical examination of precipitation records around the globe, and they find several recurring patterns associated with La Niña. The researchers focused on 19 areas of the globe that clearly experience some sort of effect during ENSOs and found that 15 of the regions also show characteristic precipitation change during La Niñas. These results will appear in an upcoming issue of the JOURNAL OF CLIMATE.

Ropelewski and Halpert found that during most La Niñas, Indian and Australian summer monsoons strengthen, as do the rainy seasons in northeastern South America and southeastern Africa.

Imaging ionic tides and soft surfaces

Cellular membranes abound with ionic flows. Minibursts of sodium, potassium and other ions rush in and out of the cell as tiny channels open and close. This frenzied activity plays a key role in such things as neural impulses and muscle-fiber contractions.

A new tool — the scanning ion-conductance microscope (SICM) — should help biologists witness this surface activity in greater detail, say its designers. "It can image soft nonconductors such as cell membranes without touching them, and it can image ion fluxes through pores in the membranes," says codeveloper Paul K. Hansma of the University of California, Santa Barbara.



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Ion currents in a synthetic membrane filter with 0.8-micron-diameter pores. Current is strongest in white, weakest in black, and intermediate in colors.

Like the scanning tunneling microscope, the SICM builds up an image of a sample surface by scanning a sharply tipped probe just above the surface's tiny hills and valleys. A feedback system raises and lowers the probe to maintain a constant electric current between the probe and the surface. Then a computer reconstructs an image from all of the probe's tiny displacements.

Electrons carry current in the scanning tunneling microscope, a device limited to imaging nonliving samples. Ions make up the current in the SICM, which "is designed specifically for biology and electrophysiology," the researchers say.

The SICM probe is a hollow glass microelectrode filled with a conductive salt solution. The researchers lower the probe toward the sample surface, which is covered in the same solution. By applying a voltage across the probe and another electrode in the sample solution, they generate a current of ions that travels through the probe. But as the probe gets very near the surface, space for ionic movement gets scarce and conductance decreases. In a scanning mode, the feedback system adjusts the probe height to maintain a constant current, creating a topographic map. For imaging local ion currents, the probe scans at a constant height and monitors the changing currents.

"Clever physiologists" might use it for making topographic maps of cell membranes and measuring the distribution and behavior of ion channels, says Hansma, who with colleagues describes the SICM in the Feb. 3 SCIENCE.

So far, the SICM researchers have successfully imaged the surfaces of acetate film and a synthetic, pore-ridden membrane filter. "It's a new way of looking at the microscopic world," says Kumar Wickramasinghe, a physicist at the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y. But he and Hansma agree that refinements in the existing device must come before its use for sophisticated membrane and ion-channel studies. — *I. Amato*