All quiet on the El Niño front

When meteorologists gazed into their crystal ball of Pacific Ocean surface temperatures earlier this year, they thought they saw the signs of an impending El Niño – a warming of the Pacific waters that every several years disrupts climate patterns worldwide (SN:3/22/86,p.184). But now the signs have died off and "the probabilities [of having an El Niño] this year are getting lower and lower every day," says Eugene M. Rasmusson of the Climate Analysis Center at the National Oceanic and Atmospheric Administration (NOAA) in Silver Spring, Md.

In February, the Climate Analysis Center established an El Niño watch after the Pacific waters off the coast of South America began to warm. Had an El Niño developed, meteorologists would have expected this warming of the eastern Pacific to continue through May or June. Instead, the warming, which was rather mild, stopped after the first weeks in March.

In the event of an El Niño, scientists also would have expected to see certain changes occurring in the western Pacific in April, such as a drop-off in easterly winds, a shifting of the heavy rainfall areas near Indonesia and a warming of the ocean near the date line. "There have been some little intermittent pushes in that direction," says Rasmusson. In addition, high rainfall, high mortality among young birds and the appearance of warm-water-loving Portuguese man-of-wars and sea snakes in the Galápagos Islands during March hinted at the onset of an El Niño. "But so far there's been nothing at all that's strong enough to indicate that this event was continuing," he says.

Because the 1982-83 El Niño developed in June – unusually late for an El Niño – scientists will probably wait a month to give their final prognosis. "So we can't write it off completely yet, but the time is getting short," says Rasmusson.

While the symptoms of an El Niño were quieting down, a group of researchers at NOAA's Atlantic Oceanographic and Meteorological Laboratory in Miami, Fla., has been developing a technique for using the sound level in a layer of the Pacific as an indicator for El Niños. Physicist David R. Palmer and his colleagues believe that during an El Niño a layer of water 50 to 280 meters deep becomes very quiet – that few low-frequency sound waves, such as those generated by ships, travel through it. The researchers presented their findings at the recent meeting in Cleveland of the Acoustical Society of America.

The speed at which a sound wave travels in the ocean depends on the temperature and pressure of the water, each of which changes with depth. Normally the temperature and pressure profiles in the equatorial Pacific are such that sound rays moving toward either the surface or the bottom are deflected — just as light rays are bent when they pass from air into a prism – and head back in the other direction before they reach their original destination. As a result, the sound waves can travel long distances without losing energy by crashing into the bottom.

During an El Niño, however, the additional warming of the upper layers of the ocean causes sound waves near the surface to be deflected downward at much steeper angles than usual, sending them into the bottom. Palmer's group used temperature and salinity measurements, collected by NOAA researchers over a three-year period that included the 1982-83 El Niño, to calculate in a computer model the El Niño's effect on low-frequency sound propagation. The researchers conclude that the intensity of sound in the upper Pacific layer should have decreased by as much as 1,000 times during the last El Niño.

They are now designing an experiment to check their findings. Palmer believes that ocean sound measurements will provide a new way to monitor an El Niño and to gauge its strength. The advantage of a system based on acoustics, he says, is that, unlike satellite measurements of sea-surface temperature, it would give scientists a sense of what's happening in the ocean interior. And, compared with moored instruments that measure temperature and other ocean properties only at isolated points, it would offer a less expensive and more complete picture of how an El Niño affects the ocean.

Because sound waves are extremely sensitive to changes in ocean conditions and because low-frequency sound can travel such great distances in the ocean, Palmer and a number of other scientists have been working for the last several years on using sound to probe the temperatures and currents of the ocean. "Studies of low-frequency sound in the ocean are analogous to remote sensing of the atmosphere with infrared and visible light and radar," says Palmer. Because the upper ocean layer is so quiet, scientists won't be able to use "acoustic tomography" to study its dynamics during an El Niño. But Palmer says they may still learn something about El Niños from sound traveling in lower layers.

Palmer's group is probably just as happy that an El Niño does not appear likely this year; it gives them more time to prepare for their experiment. As for whether an El Niño will develop next year, no one can say. Rasmusson notes, however, that a pattern of very warm water in the extreme western Pacific and slightly below-normal temperatures in the eastern Pacific – a pattern that typically precedes El Niños and that first made meteorologists wary last fall – is still in place.

"We're always hesitant to call these things either way," he says, "because the minute we do, nature crosses us up."

– S. Weisburd

Supernova patrol makes its first score

Supernovas are extremely transient astrophysical phenomena. Giant explosions of stars, they appear unpredictably in the sky and fade away in a few weeks at most. Astronomers probably miss many of them, and they tend to find the ones they do find late in their development. To remedy these deficiencies, a group of astrophysicists from the Lawrence Berkeley Laboratory (LBL) in Berkeley, Calif., has set up an automated sky patrol to search the sky in a regular pattern for incipient supernovas. On May 17 the patrol found its first supernova in the galaxy M99, a member of the Virgo cluster about 60 million light-years from us.

Frank Crawford, professor of physics at the University of California at Berkeley (UCB) and a member of the LBL team, found the supernova by comparing a picture made that morning with one of the same galaxy made May 9. Thus, he determined that the first light from the supernova must have reached the earth sometime between those two dates. The circumstance illustrates the principle of the patrol: It surveys about 1,000 galaxies, returning to each at intervals of about a week. When it is fully operational, the program should return to each galaxy every night, giving astronomers the best possible chance of getting supernovas at their very beginnings.

Supernovas are the final act in the lives of many stars. They are also the only plausible place for the synthesis of the heavier chemical elements. The explosions eject these elements, plus those made in previous stages of the star's life cycle, into space, where they are available for recycling into new generations of stars and planets. If the brightness and spectral characteristics of supernovas could be firmly determined, they could offer astrophysicists and cosmologists valuable markers for unambiguous determinations of the distances to the galaxies where they happen.

The system was several years in preparation (SN: 1/15/83, p. 44). It uses a 30-inch telescope at the University of California's Leuschner Observatory in Lafayette, located in the East Bay hills near Berkeley. Other members of the group are Richard Muller, Carl Pennypacker, Shane Burns, Peter Friedman, Jordin Kare, Saul Perlmutter, Craig Smith, R. Treffers, J. Graham and Roger Williams of LBL and UCB and V. Junkkainen of UC San Diego.

– D. E. Thomsen