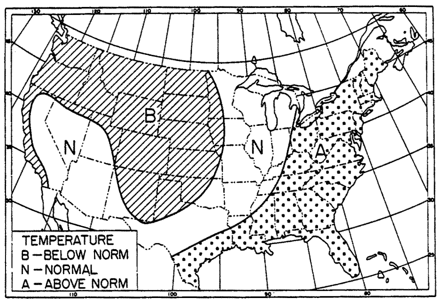
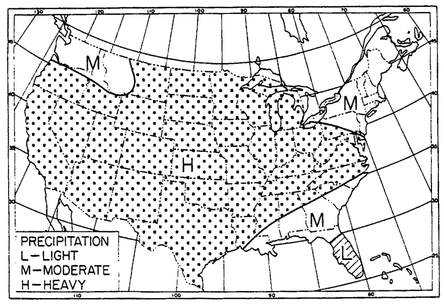
Forecasters answer a weather riddle





J. Namias/Climate Research Group

Warm in the East, cold in the West and wet all over. That's what forecasters are officially predicting for the United States this winter. The Climate Research Group at Scripps Institution of Oceanography predicts a mild, wet winter for the nation's eastern third and the Gulf states while much of the western part of the nation will be cold and wet, as the forecast maps reflect. The Climate Group's prediction is in general harmony with the official winter forecast issued by the Predictions Branch of the National Weather Service. Both predictions call for warmer than normal temperatures over the eastern states while the likelihood for lower temperatures than normal is greater for western states. Donald L. Gilman, chief of the Predictions Branch, says there is no reason to expect winter cooling, caused either by sunspot activity or the volcanic cloud from El Chichón's eruption in Mexico last April (SN: 5/15/82, p. 326). What may be significant, he says, is a narrow zone in the Pacific equatorial waters that is 5 to 7 degrees warmer than usual. A similar warming has occurred only eight times in the last 40 years. The warm water, he says, may affect the jet stream, influencing wind and storm patterns. Jerome Namias, a research meteorologist with the Climate Research Group, predicts that this winter, weather in the East will be dominated more by winds from the South than by the Arctic air masses typical in the 1981-82 winter. A bulge in the wind pattern over the central states may bring in polar air from the North. One result, he says, might be that the Midwest will be subject to storms and heavy precipitation where the warm and cold air masses meet.

Record of methane rise frozen in polar ice

At nearly every turn, researchers studying atmospheric methane confront half-answered questions: How does it affect climate? Which of the many sources produce how much of the gas? Where, exactly, does it go? What is clear, based on studies in recent years, is that concentrations of the gas in the global atmosphere are increasing. Now, results of two similar but independent studies show that methane levels were constant until several hundred years ago when they began to increase gradually to current levels. The increase may have coincided with changes in agricultural practices, such as rice paddy cultivation and cattle breeding (SN: 3/21/81, p. 184).

"This fits in with our hypothesis that the increase in methane in the atmosphere is something that reflects human activity," says Reinhold Rasmussen. "You just can't get away from making methane in the ordinary humdrum of human existence." Rasmussen and M. A. K. Khalil, both of Oregon Graduate Center in Beaverton, measured the methane in air bubbles trapped in ice 100 to 3,000 years old taken from Antarctic and Greenland ice cores. They found that until about 200 years ago concentrations of methane in the atmosphere were half what they are now. The research is described in the September CHEMOSPHERE. A model incorporating rates at which sources of atmospheric methane are growing predicts that methane eventually could double.

In other research, reported in the November GEOPHYSICAL RESEARCH LETTERS, Harmon Craig and C. C. Chou of Scripps Institution of Oceanography in La Jolla, Calif., found that in ice about 100 to 27,000 years old drilled in Greenland (SN: 6/19/82, p. 408), methane levels in gas bubbles began to increase about 400 years ago. They also find that methane levels in older ice are half of current values.

"We haven't proven yet that the methane concentrations in the ice reflect the methane concentration in the air," Craig says. He cites two possible explanations for the results. The first is that the methane level in the atmosphere did, in fact, begin to increase very rapidly about 400 years ago after at least 27,000 years at a constant level. The second is that there may be bacteria that live in the ice and consume the methane. Bacterial action is unlikely, Craig says, because a few meters below the surface, the ice does not contain the liquid water the organisms need to survive.

The answer has "important consequences" because if the methane is increasing that rapidly it could affect the earth's surface temperature, Craig says. Methane, like carbon dioxide, is a "greenhouse" gas, so called for its potential to contribute to global warming by altering the amount of radiation that the earth sends back to space. In the last 20 years, scientists have revised their view of methane as an unchanging, stable entity in the atmosphere; recent studies show that the current rate of increase is nearly two percent each year. The trace gas now is regarded as second only to carbon dioxide in its importance as a greenhouse gas.

The earth's climate already may reflect that levels of atmospheric methane have increased in the last several hundred years, but that will have to be determined by laboratories specializing in studies of the earth's thermal history, Rasmussen says. He stresses that the effects of the various trace gases on global temperature are cumulative and difficult to distinguish. If the effects of the gases add up, the net result may be that warming sufficient to cause climate change could occur sooner than expected.

The trace gases also react with each other. For instance, through a series of reactions methane can contribute ozone to the troposphere, the lowest major layer of the earth's atmosphere. At much higher altitudes, write Khalil and Rasmussen, methane reacts with chlorine atoms and may protect the stratospheric ozone layer from "destruction by man-made fluorocarbons." —*C. Simon*

A hint of odd quarks

These days nuclear physics seems to be turning up one fascinating anomaly after another. This time it involves a weird behavior of quarks reported in the November CERN COURIER.

The neutrons and protons that make up atomic nuclei are themselves supposed to be made of elementary structure units known as quarks. It should not matter to the quarks whether the neutrons and protons they build go to make up a deuterium nucleus or one of iron. To paraphrase Gertrude Stein, a neutron is a neutron is a neutron, and the same could be said for protons.

But it does seem to matter. Two experiments that use energetic muons to probe the structures of neutrons and protons in targets of deuterium and iron, the European Muon Collaboration and the NA4 group (physicists from CERN, Dubna, Saclay and the Universities of Bologna and Munich), are finding a difference in the "structure functions"—that is, the distributions of quarks in the two kinds of targets. "The quarks in the iron do not behave like those in deuterium," CERN COURIER says.

A small difference is expected from differences in the motions possible to neutrons and protons in the larger versus the smaller nucleus, but the observed difference goes in the opposite direction. Explanations are being sought for this behavior, "which could have significant implications for our understanding of particle interactions." □

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