Kasprowy Wierch, a summit in Poland, will soon get new snow-measuring instruments.

CLIMATE SCIENCE

Snow survey hopes for avalanche of data

More accurate snowfall measurements could improve climate models and estimates of water resources.

BY JANE QIU

Mountains are barometers of climate change, but some of the simplest questions about them are the hardest to answer. How much snow coats their peaks and slopes, for example? And how do these frosty shrouds alter from year to year? This week, an international programme kicks off to answer those questions.

In a two-year project called the Solid Precipitation Intercomparison Experiment (SPICE), spearheaded by the World Meteorological Organization (WMO), climate scientists will deploy a suite of state-of-the-art snow gauges at 15 sites in geographically and climatically diverse countries around the world, up

to 4,318 metres above sea level (see 'White noise'). The goal is to make accurate measurements of snow depth and snowfall — the most fragile form of precipitation, which can elude or clog simple collecting devices — and come up with recommendations for the best ways to do snow surveys in different parts of the world. The results could improve climate models and help to predict permafrost stability, ecosystem changes and the availability of water resources in the coming decades.

"Snowfall is an important part of the global hydrological cycle," says Roger Atkinson, acting head of the WMO's Instruments and Methods of Observation Programme in Geneva, Switzerland. "If we can't accurately measure the amount of snowfall, then we won't

be able to know how much water we have and how it will change in the future."

Snowfall also "partly determines whether a glacier grows or retreats," says Zhang Yinsheng, a climate scientist at the Chinese Academy of Sciences' Institute of Tibetan Plateau Research in Beijing, who is not involved in the SPICE project. "People have been debating the fate of Himalayan glaciers for a long time, but we don't have a proper grasp of even the basics."

Although researchers can accurately assess some climate parameters such as temperature, pressure, wind speed and humidity, measuring snowfall remains challenging. Snowflakes are light and drift with the wind, and weather conditions can dramatically affect what proportion of snowfall is actually captured by researchers' cylindrical metal gauges, says Rodica Nitu, a meteorological instrument expert at Environment Canada in Toronto who leads the project. And when the temperature is around freezing, the damp snow tends to stick to the rim of the container, soon forming a cap and preventing further collection.

"Undercatch is a serious problem," says Roy Rasmussen, a climate scientist at the US National Center for Atmospheric Research in Boulder, Colorado. This is particularly the case with automatic gauges, which can capture as little as 20% of the actual snowfall, he says.

Unreliable snow readings introduce one of the greatest unknowns to climate models, hampering the ability to predict future changes in water resources and mountain hazards, says Rasmussen. And snowfall, like other forms of precipitation, is expected to increase as the globe warms. Better snow data could help modellers to predict the increase in snowfall, and whether it will be sufficient to offset the increased melting of glaciers.

The last major international effort to measure snow was more than 20 years ago, and "there has been a lot of progress since then," says Rasmussen. One of the main aims of the project is to test the range of recently developed sensors, gauges and windshields. For example, field observations show that shields to reduce the horizontal wind speed above the gauge increase collection enormously. "It's the most important factor for accurate snow measurements," says Rasmussen.

New ways of heating the measuring gauges should also prevent snow capping without causing evaporation or air turbulence that blows the snow away. The field is also switching from manual to automated instruments, enabling continuous measurements over large, hard-to-access areas. Relating the two data sets will make records of snow measurements continuous over time, says Nitu.

Zhang says that the project is timely and important, but that it misses crucial regions such as the Himalayas, where SPICE doesn't have a testing site. Early next year, Zhang and his colleagues will set up a network of

A. RADOSAVLJEVIC/ALAMY

stations across the Tibetan plateau and surrounding mountain ranges, at altitudes up to 6,000 metres, which will gather accurate snow measurements across the region that could augment SPICE's results.

In the longer term, however, "there will never be enough ground measurements to cover an entire mountain", says Michael Lehning, a climate scientist at the Swiss Federal Institute for Snow and Avalanche Research in Davos-Dorf, who is involved in the project. Results from SPICE will be used to calibrate airborne and satellite-based sensors, which use techniques such as microwave, radar and laser ranging to survey much larger areas.

"The idea is to push remote sensing to be accurate enough for use in mountains," says Lehning. "It's still a long way off, but SPICE is a good starting point." ■

WHITE NOISE

The SPICE project aims to test the most advanced techniques for measuring snowfall at sites around the world.

ALTERNATIVE MEDICINE

Chelation-therapy heart trial draws fire

Critics not persuaded that metal-snaring treatment works.

BY EWEN CALLAWAY

With millions of Americans regularly using complementary medicines, researchers usually applaud efforts to test and debunk folk treatments such as echinacea, a herbal supplement often deployed against the common cold. But what if a trial shows that an alternative therapy might work?

That is the case for a study funded by the US National Center for Complementary and Alternative Medicine (NCCAM), part of the National Institutes of Health (NIH) in Bethesda, Maryland. The trial hints that a fringe therapy intended to sop up metal ions in the blood might reduce participants' risk of heart attack. Critics are attacking both the rigour of the study and the records of some of its investigators, complicating the NCCAM's efforts to answer charges from some researchers that it funds quackery, and raising questions about whether the centre's US\$128-million annual budget is being spent wisely.

The Trial to Assess Chelation Therapy (TACT) was a 10-year, \$31.6-million study involving 1,708 participants at 134 centres. It aimed to test whether weekly infusions of a salt of ethylenediaminetetraacetic acid (EDTA) can lower the risk of repeat heart attacks. EDTA is a chelating agent: the molecule is peppered with electron-rich nitrogen and oxygen atoms, which can grab and hold onto positive metal ions (see picture). The US Food and Drug

Administration has approved one salt, calcium disodium EDTA, to treat lead poisoning.

Proponents of chelation therapy for heart disease initially speculated that EDTA could also cleanse the blood of calcium ions, a component of the atherosclerotic plaques that block blood vessels. But evidence against that hypothesis led them to suggest alternative mechanisms, for example that the molecule captures other metals, preventing heart-damaging inflammation. In spite of the uncertainty, the treatment is already big business: a 2007 US government survey estimated that, every year, 110,000 Americans undergo chelation therapy,

The electron-rich oxygen (red) and nitrogen (dark blue) atoms in ethylenediaminetetraacetic acid can grab and hold onto positive metal ions (green).

which can cost thousands of dollars per course.

According to TACT, which the NCCAM co-funded along with the National Heart, Lung, and Blood Institute (NHLBI), the therapy shows signs of working. On 4 November at the annual meeting of the American Heart Association in Los Angeles, California, trial leaders reported that 26% of patients who received infusions of disodium EDTA went on to suffer a heart attack, stroke or other heart problem, compared with 30% of patients on a placebo — a statistically significant difference.

Many medical researchers were quick to question the results. Perplexingly, the benefit was observed only among participants with diabetes, and 30% of participants dropped out of the trial, undermining comparison between the treatment and placebo. Critics also note that nearly two dozen trial co-investigators have been disciplined by state medical boards for infractions ranging from insurance fraud to providing ineffective treatments. "They offer aromatherapy, crystal therapy and every imaginable wacky form of medicine. You can't do high-quality research at sites like that," says Steven Nissen, a cardiologist at the Cleveland Clinic in Ohio. "We wasted \$30 million and 10 years on an unreliable study."

He worries that the research will be used to support unapproved chelation therapies, which have been linked to heart attacks and death. "Public harm is going to come out of this. People are going to get bilked out of a lot of money. People are going to die."

Kimball Atwood, an anaesthesiologist at Tufts University School of Medicine in Boston, Massachusetts, and one of TACT's most vociferous critics, argues that the trial has been troubled from the beginning. In a paper titled 'Why the NIH Trial to Assess Chelation Therapy (TACT) should be abandoned' (K. C. Atwood *et al. Medscape J. Med.* **10**, 115; 2008), he claimed that trial proponents had mischaracterized earlier studies of chelation therapy ►