THIS WEEK

EDITORIALS

Support our buoys

An international effort is needed to restore an early-warning system for the vast warming of the Pacific Ocean that leads to extreme weather worldwide.

The numbers don't add up. When, in 2012, the US National Oceanic and Atmospheric Administration (NOAA) retired the *Ka'imimoana*, a former US Navy ship dedicated to maintaining an array of moored buoys that monitors the equatorial Pacific Ocean, administrators were able to chop roughly US$6 million from the annual NOAA budget. In 2013, the agency says, it spent up to $3 million chartering boats for the same purpose. Those charters have failed to keep pace with the rigorous maintenance requirements, however, and the Tropical Atmosphere Ocean (TAO) array has partially collapsed as a result (see *Nature* http://doi.org/q72; 2014). The upshot is that, to save a few million dollars, NOAA has left the world partially blind to a phenomenon that can cause tens of billions of dollars in damage.

The TAO array exists as a direct result of that phenomenon: an intense warming of surface waters in the eastern equatorial Pacific, known as El Niño. In 1982–83, scientists did not see it coming, and could only watch as its effects rippled through the global weather system to wreak havoc around the world. NOAA researchers responded with a moored array that could be used to monitor both the upper layer of the ocean and the atmosphere above. The agency partnered with the international community to test and deploy the instruments in the 1980s, and by 1994 nearly 70 moorings were in place. That helped scientists to give advance warning several months before the epic El Niño of 1997–98, which nonetheless contributed to extreme weather that killed thousands of people and caused massive amounts of damage.

Working in concert with computer models and satellite observations, the TAO array remains an integral component of a system to give early warning of events in the tropical Pacific. It has also helped researchers to advance the science surrounding El Niño and its sister effect La Niña, which is defined by a cooling in the same region. Progress in this field has laid the foundation for long-range forecasts, and the array provides crucial data for seasonal weather models released by the United States and other governments.

Those are reasons enough to maintain a viable monitoring system in the equatorial Pacific, but the array's value extends well beyond weather forecasting and into basic climate research. It also provides baseline data for researchers studying the effects of global warming on El Niño cycles. For instance, an analysis published this month suggests that the frequency of major El Niño events — such as those in 1982–83 and 1997–98 — are likely to double this century (W. Cai *et al. Nature Clim. Change* http://doi.org/q4c; 2014). And as discussed two weeks ago in these pages, the equatorial Pacific is also a focal point of research into the current global-warming hiatus (see *Nature* **505,** 261–262; 2014).

Budget pressures are understandable, and difficult funding decisions are made every day at agencies such as NOAA. But there can be no doubt that the decision to cut the costs of array maintenance was a mistake. The question now is what to do about it.

To discuss potential solutions, a group of researchers from around the world is meeting this week at the Scripps Institution of Oceanography in La Jolla, California. Although few seem to expect an immediate fix for the array, NOAA promised extra resources for it last week, and all involved must hope that the agency delivers. Further afield, and keeping fiscal constraints in mind, researchers must look at all the available technologies and identify what they need to maintain a viable monitoring system in the Pacific. The burden of implementation need not fall solely on NOAA, and could be shared among government agencies in other countries that benefit from these data, from South Korea to the United Kingdom.

"The benefits of this system are truly global."

Also on the agenda in La Jolla are the bureaucratic barriers hindering the international cooperation that would ensure scientists have the funds and ships they need to maintain the array. These obstacles must be overcome, and a look at the array's own past provides reason for hope. Six countries took part in its initial testing and deployment, and since 2000, Japan has maintained a dozen of the original moorings in the western Pacific, called the TRITON array. The benefits of this system are truly global. It makes sense for the international community to come together on a long-term solution. ■

Open invitation

Europe's proposed climate targets fire the starting gun on the long build-up to Paris 2015.

When European leaders agreed on three climate and energy targets in 2008, and established a set of policies by which to achieve them, the European Union (EU) was widely acknowledged as the world's first major economic power to tackle the climate-change problem in earnest.

Those landmark '20-20-20 targets' for 2020 aimed for a 20% reduction in greenhouse-gas emissions below 1990 levels while setting a mandatory 20% target for the share of electricity consumption coming from renewable energy sources and a 20% improvement in energy efficiency by that time.

With EU emissions now down by some 18% relative to levels in 1990, Europe is well on its way to exceeding the first and crucial goal. Against that background, the new mid-term emissions target — a 40% reduction on 1990 levels by 2030 — proposed by the European Commission last week has received a lukewarm response from environmental groups, scientists and green-minded politicians (see page 597).

The commission wants to scrap binding national renewable-energy targets and introduce a mere aspirational goal for the EU as a whole. This has led some critics to infer a Brussels-conspired counter-revolution in climate policies, which they say will deal a blow to Europe's emerging renewable industry and open the door to a renaissance of nuclear power on the continent. But the commission's proposal has more teeth than its critics would like to admit.

According to state-of-the-art energy-economy models, 40% emissions cuts by 2030 are achievable at reasonable cost and, provided sound investment is made in energy research, do keep Europe on track to cut emissions by at least 80% by mid-century.

Announced just as Europe is surfacing from the most severe economic downturn since the Great Depression, the cost efficiency of the plan is essential to its chances of success. To burden member countries with excessive environmental measures at this time could do more long-term harm than good. An economically weak, socially struggling region is unlikely to produce the wealth and creative power that will be needed to achieve the great transformation to a low-carbon civilization.

That transformation is a global task. With the EU accounting for little more than 10% of global greenhouse-gas emissions, the bulk of the effort will need to be accomplished elsewhere. But although the focus of global climate policies is increasingly shifting to the world's rising economies — and to China in particular — both the timing and the content of Europe's latest promise on global warming could be essential to building political momentum.

With a view to the United Nations climate talks next year in Paris, where nations hope to replace the underachieving 1997 Kyoto Protocol with a more stringent global climate agreement, the EU's bid is a clear and unambiguous signal. What Brussels has dished up well in advance of the Paris climate gala is a polite but firm invitation to the rest of the world, and one that governments from Beijing to Washington cannot lightly afford to ignore. By the end of the year, at the latest, the EU's main economic competitors will be expected to lay on the table solid offers for that crucial round of negotiations.

In terms of the magnitude of emissions cuts, the EU's unilateral proposal is an indication of the minimum level of commitment other developed nations can be expected to make if they take their climate-change responsibilities remotely seriously. But governments — including those of EU member states — must be reminded that gentle pathways to decarbonization such as the EU hopes to follow are by no means a guarantee of a benign future climate. In fact, even the more optimistic scenarios currently under debate would give the world at best a 50% chance of staying below 2 °C of warming, the often-cited threshold to dangerous climate change. The science strongly suggests that reducing this probability to a tolerably small value would require global emissions cuts at least twice as high as those proposed in Brussels last week.

"Europe's latest promise on global warming could be essential to building political momentum."

The question of how the substantial global cuts that might be required to safely stay below 2 °C of warming should be apportioned between rich and poor countries is one that science alone cannot answer. This issue requires input from ethics and the theory of justice as much as it does from science and empirical economics. The EU's latest climate aspirations, whether or not one considers them sufficient, are a timely reminder of the intricacies of the issues at stake. ■

Crystal clear

Celebrating the many achievements of crystallography.

In one of the more bizarre examples of science outreach, the website starnostar.com gives readers the chance to vote on who should win a popularity fight between the physicists Max von Laue and Paul Dirac (see go.nature.com/fw1omn). To the non-expert, there is not much to go on; the website biographies offer brief details on the physicists' birth places and their sign of the zodiac, but nothing on their achievements, popular or otherwise. (Dirac currently leads, with 69% of the vote, but don't despair, von Laue fans; the contest remains open, and a surge in support could yet tip the balance.)

Itching to pitch in to help choose between two of the greatest minds of the twentieth century, but unsure about their true credentials? Read on.

"In the right corner, Max." A friend of Albert Einstein and a student of Max Planck, von Laue (a Libra) is the rugged outdoors type. He discussed his Nobel-prizewinning idea that X-rays passing through a crystal would bounce around to form an identifiable signature while skiing. Skiing! He was brave as well — he stood up to the Nazis in his native Germany and helped Jewish colleagues to escape the country. He won a Nobel prize, and earns bonus points for the rip-roaring boys'-own tale of how the gold award was dissolved to hide it during the war, and then later recast.

"In the left corner, Paul." An awkward man and a sensitive soul, Dirac lived for his work and had little time for small talk, or for much else. But what work it was. His mathematical wizardry unlocked the secrets of quantum mechanics and quantum electrodynamics. He won a Nobel prize too, aged just 31! And for all you anti-establishment British types, he refused a knighthood. (He did not want to be known by his first name.)

Still undecided? Then take a look at a special collection of articles that begins on page 601, and a research paper on page 657. More than a century since von Laue's moment of inspiration on the slopes, and exactly a century since his Nobel prize, 2014 is the International Year of Crystallography. There are a lot of such celebratory years these days. But indulge us, and the organizers, who want to shout about the achievements and contributions of X-ray crystallography. Crystallographers deserve the chance — too often in the background when the spotlight falls on scientific accomplishment, like one of their refraction patterns, it is worth piecing together their separate successes to build a coherent image of the whole.

Such anniversaries and commemorations inevitably cast the eye and the mind backwards in time. But as this week's special collection makes clear, crystallography remains a cutting-edge field, and one that, if harnessed properly, could contribute as much in the next 100 years as it did in the previous 100. The development of the X-ray free-electron laser, for example, is a monumental technical achievement, and one that seems more suited to the world of 2114 than 1914, or even 2014.

Dirac's work continues as well. On page 657, physicists describe the first creation of something he predicted in 1931 — a magnet with a single pole: the Dirac monopole. A triumph of a growing research field called quantum simulation, which exploits real quantum systems to model others that are difficult to achieve, the research shows that not all magnets need have opposing 'north' and 'south' poles. Now that they know such a thing is possible (see the News & Views article on page 627 for more), physicists will continue to search for them with a spring in their step. As Dirac said: "one would be surprised if Nature had made no use of it."

Back to starnostar. To choose between Dirac and von Laue, of course, is to be forced to select either the north pole or the south pole of a magnet. As Dirac and von Laue, and later physicists, show us, we don't need to do that. Each can stand on his own. And much else rests on both. ■

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