POLICY

Developing need

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Proc. Natl Acad. Sci. USA
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Even with the funding offered in Copenhagen by rich nations, financial assistance to help developing countries adapt to climate change is still below assessed needs. More worryingly, it looks unlikely to improve in the coming years. What has remained unclear, however, is when the world's least developed countries will need this money most.

Anthony Patt of the International Institute for Applied Systems Analysis in Laxenburg, Austria, and colleagues examined the effects of climate-related extreme events and socioeconomic development on the mortality rate in 23 of the least developed countries over the next 50 years. Focusing first on Mozambique, they show that a steady rise in disaster frequency will rapidly increase the death toll in the next 20 years. After this time, projections suggest that the rate at which human lives are lost will fall, but only if socioeconomic factors improve. Without development, the death rate will continue to increase. Extending the approach to an additional 22 developing countries revealed a similar pattern, one in which the death rate increases rapidly up to 2030 and then falls if development occurs.

The study highlights the urgent need to scale up financial assistance for adaptation in the developing world.

Anna Armstrong

PALEOCLIMATE

Insights from earth

ISTOCKPHOTO / MARIA TOUTOUDAKI

Proc. Natl Acad. Sci. USA
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Atmospheric carbon dioxide levels during some of the hottest periods of the Earth's past may have been much lower than once thought. An analysis of soils shows that during eras of extreme warming 251–65 million years ago and 55 million years ago, carbon dioxide concentrations were similar to those anticipated for 2100 under a worst-case emissions scenario.

Daniel Breecker of the University of Texas, Austin, and colleagues looked at modern soils in the United States to determine the conditions that allow formation of the mineral calcite, which is produced in part from carbon dioxide and can be used to estimate atmospheric CO_2 concentrations. They found that calcite forms in soils only during the hottest and driest times of year, rather than year-round. Using this information, the team recalculated atmospheric CO_2 concentrations over the past 400 million years. While previous studies point to atmospheric CO_2 concentrations of 3,000–4,000 parts per million during ancient greenhouse events, Breecker's team revises this down to around 1,000 parts per million.

Their findings are in line with estimates from plant fossils, which have previously been regarded as controversial. The study suggests that a hothouse world may be closer to present-day reality than once believed.

Alicia Newton

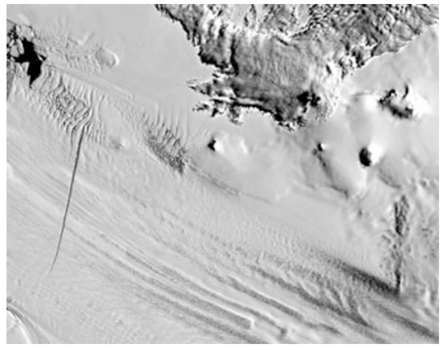
CRYOSPHERE

The bottom line

Proc. R. Soc. A. doi:10.1098/rspa.2009.0434 (2010)

The stability of the West Antarctic Ice Sheet (WAIS) is the largest source of uncertainty in estimating future sea level rise. Grounded on rock below sea level, the 3,000-metre-thick ice sheet could disintegrate rapidly if it becomes unstable at its base.

A new theoretical study by Richard Katz at the University of Oxford and Grae Worster at the University of Cambridge, UK, provides



NASA

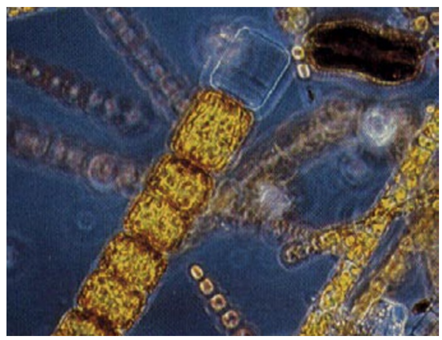
evidence of the conditions under which the ice sheet becomes unstable at its grounding line, where it floats free of its base. Katz and Worster applied a novel theoretical and mathematical model to explore what will happen to the ice sheet as the climate changes. Most notably, their model suggests that grounding-line recession — a precursor to ice-sheet loss — may already be underway in Pine Island Glacier, the largest stream of fast-moving ice on the WAIS.

Previous studies have been inconclusive on the issue of grounding-line stability. Katz and Worster say that their model of ice-sheet flow and grounding-line movement is simple, but has an improved physical and mathematical basis compared with previous models. The authors caution, however, that the issue needs further scientific scrutiny.

Olive Heffernan

OCEAN SCIENCE

More acid, less iron



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Science doi:10.1126/science.1183517 (2010)

Rising carbon dioxide in the oceans may hinder, not help, marine phytoplankton blooms — because increasingly acidic waters could stifle their supply of iron, a crucial nutrient.

Dalin Shi and researchers at Princeton University, New Jersey, recorded a decrease in the uptake of iron by four species of plankton as their laboratory-controlled culture medium was acidified, changing from pH 8.6 to 7.7. At the same time, the concentration of bioavailable dissolved iron — in other words, iron not chemically bound by organic matter — dropped proportionately, suggesting that the phytoplankton's enforced diet was due to pH-induced changes in iron chemistry that made the nutrient less available to them, and not because of a physiological reaction to more acidic conditions. In samples of Atlantic surface waters, the team saw the same effect: on average, iron uptake by a marine diatom in these field experiments dropped 10–20% as ocean acidity increased by 0.6 pH units.

By 2100, ocean acidity is projected to increase by 0.3–0.4 pH units under a 'business as usual' emissions pathway. The researchers did not find that acidified waters reduced phytoplankton's intrinsic need for iron, suggesting that iron shortages could well diminish phytoplankton in many ocean areas as acidity increases.

Richard Van Noorden

CLIMATE PREDICTION

Don't count on it

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Geophys. Res. Lett. **36,** L23711 (2009)

Governments and the private sector are seeking to base decision-making in such areas as agriculture, health and water management on seasonal climate forecasts, which predict temperature and precipitation from one to nine months in advance. The problem, according to a new analysis, is that existing climate models show very little accuracy more than one month out. Even during the first month, predictions are markedly less accurate for the second half than the first. Current models simply cannot account for the chaotic nature of climate, researchers say.

David Lavers of Princeton University in New Jersey and colleagues tested eight seasonal climate forecast models — essentially extended weather forecasts — for their skill at predicting temperature worldwide and precipitation over land masses. 'Skill' is the degree to which predictions are more accurate than simply taking the average of all past weather measurements for a comparable period — for example past February temperatures in northern France. Overall, temperature was better-predicted than precipitation, but the longer-range the forecasts, the narrower the areas in which they were skilful. At longer lead times, skill was negligible for land areas.

Decision-makers require significantly improved models to develop meaningful policies, say the authors, adding that this goal may prove elusive.

Harvey Leifert

EXTREME EVENTS

Strengthened storms

NASA

Science **327,** 454–458 (2009)

The number of strong storms in the western Atlantic could double by the end of the century, despite a drop in the overall number of storms, finds new research. Previous studies have hinted at an increase in hurricane intensity, but scientists have now used a modelling approach capable of capturing storms of category-3 or higher intensity, enabling them to simulate twenty-first-century storms realistically.

Morris Bender of the US National Oceanic and Atmospheric Administration and colleagues applied a two-step 'downscaling' technique to increase the resolution of climate models. Using the ensemble-mean of 18 global climate models and 4 regional models, they assessed the climatic response to a 'business as usual' emissions pathway. They then employed a hurricane model to simulate storm development in response to the projected warming. In the simulations, the number of category-4 and category-5 storms in the Atlantic Ocean rose 81 per cent by 2100, while the number of storms with winds greater than 65 metres per second increased by 250 per cent. The largest jump in intense storm activity occurred in the western Atlantic Ocean.

The researchers caution that the increasing numbers of the strongest storms could drastically raise the cost of storm damage.

Alicia Newton