“The past allows us to test the future”

INTERVIEW BY DANIEL SARAGA PHOTOS: THIERRY PAREL

Thomas Stocker and his team at the University of Bern have found a veritable climate archive in the Antarctic ice. This internationally reputed climatologist is co-leader of the Intergovernmental Panel on Climate Change’s (IPCC) Working Group I, which is responsible for the scientific underpinnings of climate change.

To predict future climate, we need to understand that of the past. At research bases in the Antarctic and Greenland, scientists drill kilometers down into the ice, retrieving frozen ice cores that contain tiny bubbles of air, trapped when the ice was formed tens of thousands of years ago.

These bubbles are an extraordinary record of the planet’s atmosphere. They provide precise measures of greenhouse gas concentrations, notably carbon dioxide and methane, and allow scientists to estimate local temperatures. Research conducted by University of Bern physicist Thomas Stocker has resulted in a reconstitution of climate that stretches over nearly 800,000 years — a decisive contribution to the understanding of global warming.

[REFLEX] **Your studies retrace the past. How can they inform us about current warming and about its future evolution?**

[THOMAS STOCKER] These atmospheric archives allow us first of all to better understand climate, such as the interactions between the concentrations of greenhouse gases and temperature. We can even learn what might have happened hundreds of thousands of years ago in specific regions of the globe, for example in quantifying dust carried by the wind from South America to the Antarctic.

Thomas Stocker: "The biggest mistake would be to tell the media what they should or should not write."

Our measurements also serve as a reference point for computer-simulated climate models. These numerical models have to be able to reproduce past events that are observed indirectly through the ice. In climatology it's difficult, if not impossible, to conduct experiments. The past is thus a critical tool for testing our models.

[REFLEX] **These models play a central role in the IPCC's reports when they predict, for example, a certain temperature increase.**

Are you sure the models are accurate enough?

[THOMAS STOCKER] That depends on the question you're asking. Our models are very good for global processes, such as global mean temperature. Depending on var-

Isotopes as thermometers

To estimate past temperatures in polar regions, scientists measure the concentration of heavy water, which contains deuterium in the ice (deuterium is an isotope of hydrogen that is "heavy" because it contains an extra neutron). At low temperatures, heavy water in the oceans evaporates more slowly than normal water, and condenses more rapidly. Thus, its concentration in the air relative to that of normal water is reduced. This can be seen in the snowfall that formed the Antarctic ice thousands of years ago.

Thomas Stocker was author and coordinator of the 3rd and 4th Assessment Reports from the Intergovernmental Panel on Climate Change (IPCC). This internationally recognized climatologist is now co-leading IPCC's Working Group I, dedicated to investigating the physical science basis for climate change.

A native of Zurich, Stocker obtained his PhD in natural sciences from ETH Zurich in 1987 before working at University College London, McGill University in Montreal, Columbia University in New York City and the University of Hawaii in Honolulu. In 1993, he was appointed professor of environmental physics and climate at the University of Bern.

ious CO_2 emissions scenarios, it will likely increase by 1.1 to 6.4°C between now and 2100. The IPCC takes into account results of more than 22 numerical models developed by various research groups. When these models say the same thing, we are confident of their predictions. For example, more than 20 out of 22 models predict a decrease in precipitation in the Mediterranean region around 2050, ranging from -10% to -40%. But simulating precipitation is trickier than simulating temperature, and some areas still cannot be modeled with certainty.

There are certainly limits. We can't say whether there will be ice in the Arctic Ocean in September 2030. Extreme events like hurricanes are very difficult to predict. But our models are improving, and I hope that in 10 years we'll be able to give an indication as to whether there will be an increase in hurricane frequency.

[REFLEX] **It's one thing to simulate the trajectory of a missile on a computer, and quite another to model climate. This extremely complex system involves so many parameters: temperature, cloud cover, ocean salinity, heat exchange.**

[THOMAS STOCKER] That's true, but our simulations are based on very rigorous physical principles. They reproduce all the observations on current and past climate change events, such as variations in temperature and precipitation, frequency of heat waves, absorption of CO_2 by the oceans, and increases in ocean acidity. After years of research and verification, we have acquired real confidence in our results.

[REFLEX] **Would a decrease in solar activity offset warming?**

[THOMAS STOCKER] It's possible in the short term, but the warming predicted to take place in the next century will be far superior to variations in temperature caused by the sun. Climate, it must be repeated, varies naturally. Temperatures can increase by 0.3°C in an El Niño year, or decrease by a half degree for several months following a major volcanic eruption. And temperatures have been stable since the year 2000. But global warming caused by an increase in atmospheric CO_2 will come about slowly and inexorably.

"The biggest mistake would be to tell journalists what they should or should not write."

[REFLEX] **Your predictions lead to important decisions involving billions of dollars. Does that huge responsibility keep you up at night?**

[THOMAS STOCKER] No. I'm sometimes stressed, but mostly because people don't want to listen. For a scientist, it's crucial to come up with accurate responses.

[REFLEX] **Your role in the IPCC brings you into the world of the decision-makers. Isn't it dangerous to mix science and politics?**

[THOMAS STOCKER] Of course. It's important to maintain a well-defined distance between the two worlds, and part of my job is to protect scientists from too much political influence. We must carefully explain what science can do, but also its limitations. It can never relieve politicians of their responsibility, which is to make decisions. We can only provide the best information possible, without hiding the uncertainties that always accompany it.

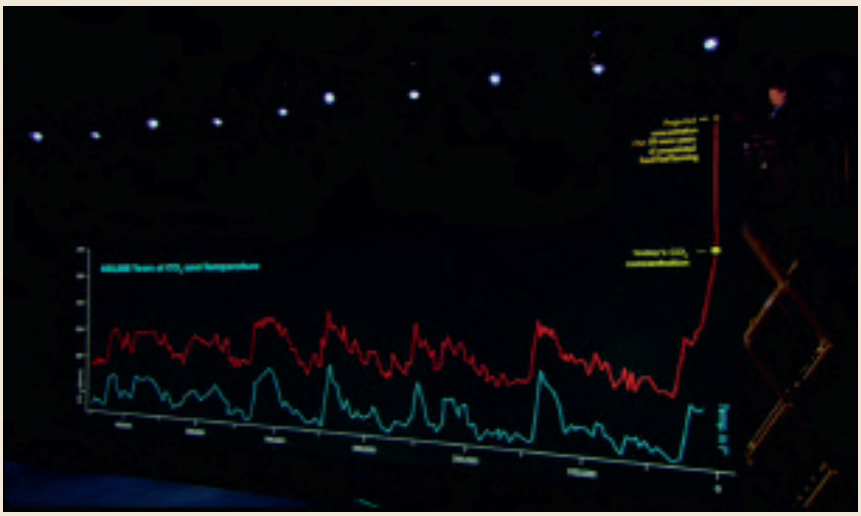
[REFLEX] **You also express opinions on political topics.**

[THOMAS STOCKER] Well, when a journalist asks me my opinion, I give it. For example, I'm convinced that Switzerland should take the lead in green technologies and set very ambitious goals for CO_2 reduction.

[REFLEX] **The EU is committed to reducing its CO_2 emissions by 20% by the year 2020, and by 50% by the year 2050. Do you think this is realistic?**

[THOMAS STOCKER] It's an ambitious goal, but I'm convinced it's possible. We should never underestimate the success of the Kyoto agreement, even going beyond whether or not its goals were

Does temperature necessarily follow CO_2?



In his film "An Inconvenient Truth," Al Gore uses a graph that was specially prepared by Thomas Stocker's team. Obtained by analyses of ice cores extracted in the Antarctic, it shows the evolution of CO_2 concentration (in red) and temperature (in blue) over a period of 800,000 years. But this key moment in the film also has its own bit of ambiguity.

Al Gore explains here that "the relationship between CO_2 and temperature is very complicated, but [...] when there is more carbon dioxide in the atmosphere, the temperature climbs." The sentence is correct – it is just an explanation of the greenhouse effect. But taken in this context, Al Gore seems to be using the graph to illustrate that the evolution of temperature necessarily follows CO_2 concentration – which is incorrect.

"The ends of glacial periods are initiated by external events," explains Martin Beniston, director of the climate change research group at the University of Geneva. "In particular, the variation in the Earth's orbit changes the quantity of solar radiation arriving at the surface. This initial hearing reduces the solubility of CO_2 in the oceans, and it escapes and accumulates in the atmosphere." In the beginning of these warming periods, then, it's the CO_2 that follows temperature, and not the inverse. Then a feedback loop becomes established: an increase in the greenhouse effect warms the planet, which increases the concentration of CO_2, and so on. "This feedback is essential for rapidly exiting periods of glaciation," says Beniston. "Variations in insolation on the order of a few percent are too weak to accomplish this."

This ambiguity in Al Gore's presentation is fodder for climate-change skeptics. They indicate that on the graph presented in the film, the CO_2 curve seems to follow temperature. But this doesn't alter the fact of the greenhouse effect, which remains uncontested.

"The major novelty of the last 200 years is the injection of carbon dioxide into the atmosphere," explains Stocker. "It doesn't come from the oceans, as it did at the ends of the prehistoric glacial periods, but from our burning of fossil fuels. We can show its origins by an isotropic analysis of atmospheric carbon atoms. We are certain that this intensification in the greenhouse effect is currently warming the planet."

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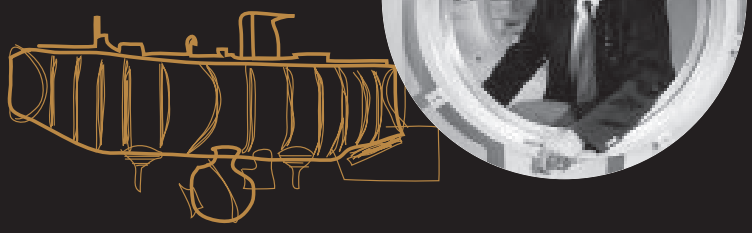

Jacques Piccard (1922 –2008)

Son of August (physicist and balloonist), father of Bertrand (psychiatrist and balloonist), Jacques Piccard made his mark in oceanography. In 1960, traveling aboard the Swiss-built bathyscaphe Trieste, he and U.S. Marine officer Don Walsh broke the deep-sea diving record (10,916 m) in the Pacific Ocean. To increase public awareness of the fragility of undersea life, Piccard built a submarine prototype for public use, allowing hundreds of people to discover the depths of Lake Geneva. He also created the Foundation for the Protection of Lakes and Seas, based in the lakeside village of Cully, near Lausanne.

met. For the first time, countries from the entire world started to talk together and develop mechanisms for confronting the problem. It's a critical first step.

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[REFLEX] **For the moment, we don't seem to be going in the right direction. Don't you think that governments and populations, beyond their platitudes, are afraid to reduce consumption and see their standard of living decrease?**

[THOMAS STOCKER] We must above all change the way we consume energy, and reduce consumption in certain areas. I don't think this will reduce our comfort level. A car that consumes one liter for every 100 km is still a car. We must be more intelligent with the energy at our disposition. Considerable energy savings can be made in buildings. We must create enticements and set specific objectives for industry. Don't forget that without massive government investment, nuclear energy wouldn't exist. We can do the same thing for renewable energy.

[REFLEX] **The media love it when a scientist disagrees with the consensus and criticizes the global warming paradigm. Does that bother you?**

[THOMAS STOCKER] Contradiction is at the origin of all scientific progress, but that doesn't mean that every contrary opinion necessarily has a grain of truth. I don't like it when these criticisms come from people who have not worked in the field of climatology. But I understand clearly why the media gives them so much attention: it's a hot news item and that's how they function. I accept that. The biggest mistake would be to tell journalists what they should or should not write. What I can do is to take my own pen and write responses to articles that seem to me to be completely wrong. I did that in response to several articles published in [the right-wing Swiss magazine] Weltwoche denigrating the work of the IPCC. The independence of the press must be respected at all costs – just like the independence of science.

[REFLEX] **You have gone only twice to field sites near the poles. Do you regret not having done this more often?**

[THOMAS STOCKER] No, I have too much work to do here. It's much more efficient to send specialists to the field. But when you're there, you work like everyone else. I went to the NEEM research station in Greenland last year. For two weeks, I participated in building a warehouse for storing ice cores. I also did a little drilling and ice work. It's interesting for once to devote myself to real physical work – and also to see the real working conditions experienced by my partners. ■