profile

Captain Climate

Achim Stössel brings an ocean of experience to Texas A&M

Rahilla C.A. Shatto

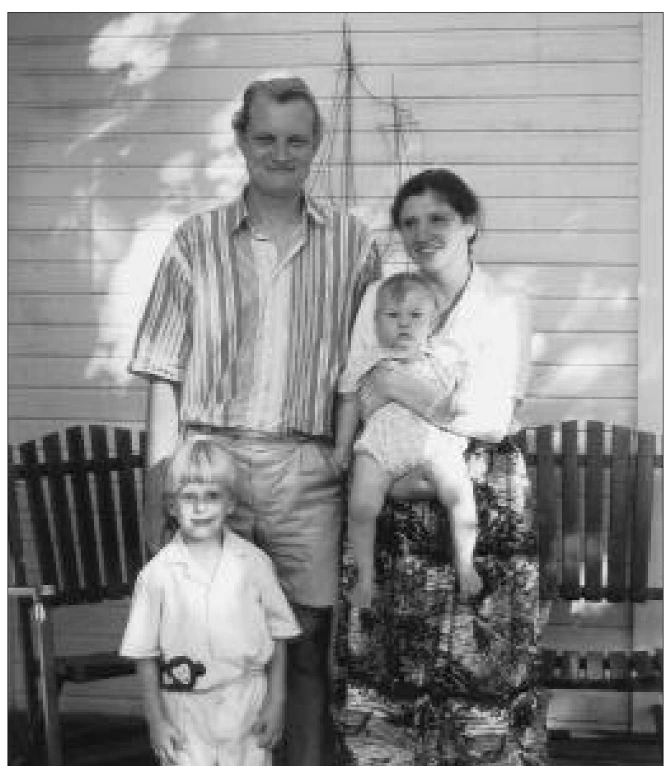
Not many people enter the world of academic research to find stability and a respite from stress. But imagine that you are Achim Stössel, a new member of the faculty in physical oceanography at Texas A&M University. At age nineteen you began your career at sea as an ordinary seaman manning a passenger vessel which serviced the route between Helsinki, Finland and Leningrad, USSR. Over the objections of your parents you spent the next eleven years at sea for months at a time, earned advanced degrees in nautical engineering, and ultimately obtained a commercial captain's license. The prospect of establishing a career on a university campus might sound comfortable indeed compared to carrying full responsibility for the lives of a crew and cargo worth millions of dollars through the world's oceans, the Persian Gulf, the Gulf of Mexico, and elsewhere.

Although it is easy to imagine Stössel steadfastly minding the helm of even the largest ship, he never commanded his own vessel. He left the commercial shipping industry instead—not because it was too tempestuous for Stössel's amiable and courteous nature, but rather he felt he had exhausted the challenges seamanship could offer. He had followed commercial shipping since age eleven and by the time he reached the pinnacle of the profession it had become less engaging. Stössel felt himself sliding into complacency.

At sea and in school

Fortunately, Stössel's background amply prepared him for a smooth transition to an oceanography career. He was born in Rome, Italy, the child of a German diplomat, and while growing up he also lived in Amsterdam, The Netherlands and Helsinki, Finland. It was the two-day voyage from Amsterdam to Helsinki that had inspired young Achim to study commercial

Marion Stössel



Donald P. Shatto

Top: ***Achim Stössel aboard the cargo ship*** **Vagabund** ***during his days as a sailor.***

Bottom: Stössel with his wife, Marion, and two children, Ingo (left) and Tinka (right), at their Bryan home.

navigation. Throughout his adolescence in Helsinki, he monitored ferry schedules and routes in the Baltic Sea using his own charts.

When he graduated from the European equivalent of high school and started working the Helsinki-Leningrad route, his parents were not enthusiastic. They encouraged him to continue his education, so Stössel half-heartedly attended the University of Kiel in Germany and completed a curriculum in physical oceanography. Throughout college he continued to work as a seaman during breaks. After graduation he decided to commit himself to shipping and began the four years of practical experience at sea and three years of formal education necessary to obtain a captain's certificate. His parents reaction? Stössel recalls that "They finally gave up arguing."

But Stössel quickly realized that two years "before the mast" is not as fun as three-month stints between university sessions. Foreseeing that he could not spend his life at sea, Stössel took up a dual course of study in physical oceanography at the University of Hamburg and nautical engineering at an engineering college. Thus he continued to pursue his dream of being a ship captain and simultaneously planned for a more rewarding and stable future.

From 1980 to 1986 he spent part of each year at sea and part in school and in 1983 he married Marion Guerrero, who also holds a degree in physical oceanography. Stössel left shipping in 1986 after obtaining his captain's license, and followed it four years later with a Ph.D. in oceanography at the Max-Planck Institute (MPI) in Hamburg.

Forsaking the sailor's life for good, Stössel continued at the Max-Planck Institute for Meteorology as a Research Scientist. There he immersed himself in sophisticated computer modeling to examine the formation and movement of sea ice and its role in global climate.

Stössel brings a healthy light-heartedness to science, fostered by years of practical experience with the ocean. He finds computer simulations of environmental change much less worrisome than the harm that can be wreaked from the bridge of a bulk carrier. As he puts it, a fatal error on a ship can cause catastrophic damage to life, property, and the environment. Grinning, Stössel contrasts that to a numerical model, in which "you get a 'Fatal error' message from the computer when the [computer] code explodes for some reason. You just find the bug and resubmit it."

Westward, Ho!

By 1994 the Stössel family was ready for another challenge, and that fall Stössel joined the physical oceanography faculty at Texas A&M University. He had grown tired of interacting almost exclusively with computers, and looking around he felt that some of his colleagues developed problems communicating in ordinary language with people outside their field. Stössel did not want this to happen to him.

Marion had put her career on hold three years earlier with the birth of their first child, Ingo. Like Achim, she was raised abroad, primarily in Bogotá, Colombia but also in Pittsburgh, Pennsylvania. After twelve years together in Hamburg the two were ready to go international again.

At Texas A&M Stössel continues to refine our understanding of global climate using computer models, and teaches modeling techniques to students in specialized graduate courses such as Computational Fluid Dynamics and Ocean Modeling. He finds that teaching offers the communication challenge he sought, but is surprised that he and his students will often judge the same lecture quite differently. With practice he hopes to identify and consistently reproduce the elements of good teaching in all his classes. Stössel also works for the newly-formed, interdisciplinary Texas Center for Climate Studies, which now offers a seminar series designed to confront scientists and students across disciplines with climate issues.

Although he and Marion miss the lengthy vacations that most German employers offer, they enjoy their new situation in Texas. They recently had a second child, Tinka. Ingo, now four years old, especially prefers the wide open spaces in Bryan/College Station to Hamburg's crowded streets which lack space for playing!

The Earth's poles—where the action is

In keeping with his previous research on sea-ice formation and dynamics, Stössel's current work primarily concerns modeling the role of the Earth's poles in global climate.

Achim Stössel Profile

Born:

October 24, 1955
Rome, Italy

Experience:

1994-present
Assistant Professor
Oceanography, Texas A&M University
1990-1994
Research Scientist
Max-Planck Institute for Meteorology
1987-1990
Doctoral Candidate
Max-Planck Institute for Meteorology
1986
Scientist
Finnish Institute for Marine Research
1982-1983, 1985-1986
Nautical officer
Various commercial vessels
1978-1980
Seaman
Commercial vessels

Education:

Ph.D. Geosciences
Universität Hamburg, 1990
M.S. Physical Oceanography
Universität Hamburg, 1985
M.S. Nautical Engineering
Fachhochschule Hamburg, 1982
B.S. Physical Oceanography
Universität Kiel, 1977

Research Interests:

- Sea ice modeling
- Global impact of sea ice
- Atmosphere-ice-ocean interactions

Family:

Father, Günter, served the German diplomatic corps throughout Europe.
Mother, Waltraud, was a substitute teacher and homemaker.
Sister, Saskia, lives in Boston and is pursuing a Ph.D. in languages at Boston University.
Wife, Marion, holds a degree in physical oceanography.
Son, Ingo, is four years old and will start kindergarten in Bryan next fall.
Daughter, Tinka, is 10 months old and is the first member of the Stössel family to be born in the United States.

Languages spoken:

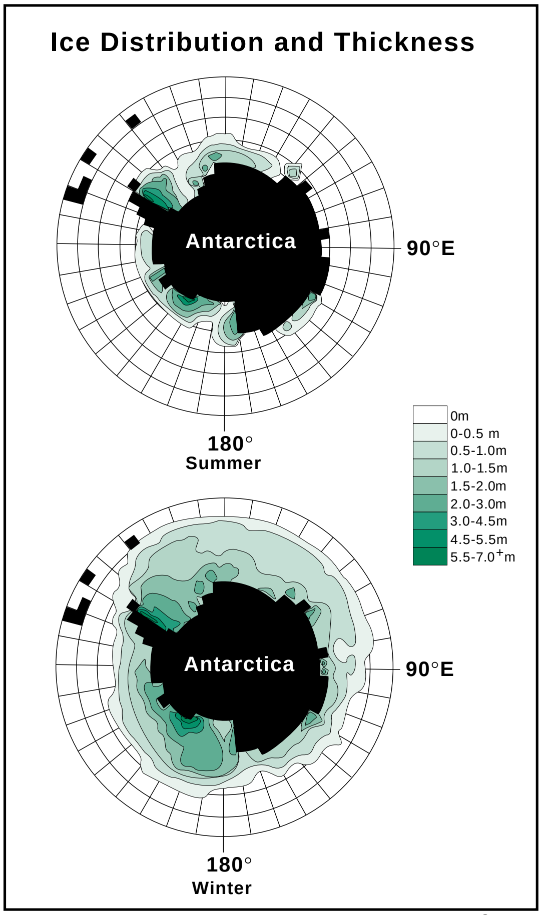
- German
- Dutch
- Finnish
- French
- English

Hobbies:

Classical and Flamenco guitar

Best book read lately:

Rikos ja Rangaistus (*Crime and Punishment*) by Fyodor Dostoyevsky, translated into Finnish



Graphics generated by a computer model of sea ice formation show how sea-ice coverage and thickness vary from season to season.

Although many of us may think of the poles as static regions, largely isolated from mankind's activity, the polar ice caps can be viewed as highly interactive components of our climate and sensitive indicators of global change.

Sea ice is an important player in determining climate for two reasons. First, the shining white icecaps reflect most of the sun's short-wave radiation back into space after it enters the atmosphere. If this reflectivity decreases, for example due to human-induced increases in greenhouse gases, more radiation will remain trapped at the Earth's surface. In places where sea ice has melted the air temperature, normally -30° to -40°C, would increase to match the surface temperature of the ocean, a comparatively steamy -2°C. This increase would be large enough to significantly influence the way air circulates in our atmosphere.

Second, when seawater cools and ice forms at the poles, masses of dense, cool water with high salinity are created. When seawater freezes it pushes excess salt out of the resulting ice and into the surrounding water. The salty, dense water may eventually sink to the ocean floor, displacing saltier, albeit warmer water to the surface to take its place. As more ice forms and more dense water sinks, the "bottom water" is forced to flow slowly toward the equator. Long and complicated mixing processes eventually push the water to the surface at lower latitudes. On the surface, the water flows poleward again, simultaneously pulled by the ever-sinking dense water in the regions where bottom water forms and pushed and prodded by other global forces.

Stössel cautions that the role of sea ice on global climate is still not well assessed. In one extreme scenario, any reduction in surface cooling and decline of new ice formation in the critical regions where "bottom water" is formed would mean that no dense water could form there. A lens of fresh water could form on the surface in those regions, such as the northern North Atlantic, enhanced by increased freshwater runoff from glaciers melting in the continually warming atmosphere. No dense water would sink and no warm water would be pulled in to replace it. The North Atlantic Current, a northern branch of the Gulf Stream, might slowly deflect eastward toward the Iberian Peninsula rather than blaze into the northern North Atlantic as it does today. Without the tremendous influx of warm water provided by the Gulf Stream, water and air temperatures in the northern North Atlantic would decrease dramatically and cause cold, inclement weather throughout Europe.

Get higher–forcing from the atmosphere's interior

Stössel points out that despite the fact that characteristics of sea ice are well-documented, it remains difficult to include all the processes associated with them in climate models. He says that people simulating regional or small-scale environmental change "tend to have all kinds of sophisticated sea-ice related features included [in their models], specifically regarding snow on top of the ice…realistic ridging characteristics of ice and things like that." But "when you talk about *global* climate models you want to restrict the physical processes to the most important ones in order to retain a reasonably computable program, and to maintain an overview of the various complex interactions in your model. The biggest challenge is to find the compromise among the models of each climate component, keeping in mind that they will compete with one another for the computer's resources."

The aspects of sea ice which are least understood have to do with its interaction with both the ocean and the atmosphere. Stössel notes that this involves atmospheric and oceanic boundary-layer physics, which must be carefully treated in a good simulation. The traditional method for studying global climate consists of linking an existing model of ocean circulation to one of its atmospheric counterpart. Conditions at the interface between the ocean and the atmosphere, which consist of specified boundary conditions in an uncoupled simulation, form the input for each other in the coupled model. Stössel is quick to point out that this type of model is regarded as the most reliable tool for climate prediction and probably will remain so well into the future. The boundary between the ocean and atmosphere is still manipulated, however, in order to prevent a coupled model from drifting into an unrealistic climate state.

Stössel has applied for funding to surmount this problem. He wants to create a model in which conditions in the interior atmosphere, far from the sea surface, drive a global sea-ice–ocean model. This should result in a simulation of both the atmospheric and oceanic boundary layers, and thus a true representation of the atmosphere–sea-ice–ocean interface. Stössel hopes this kind of configuration will finally avoid predetermination of or correction toward known conditions.

The need for speed

To date, the computer models that scientists use can reflect only the outlines of the complexity of Earth's climate. Even a fairly small model including a limited number of climate variables requires days of computer time on the fastest workstations.

Fortunately, current satellite surveys do not show significant reduction in polar ice coverage due to global warming—yet. It may not be too late to learn as much as possible about the role of sea ice and try to predict how much change the Earth's poles can tolerate before our ice starts to melt.

In the upcoming years, Achim Stössel will dedicate his research to the development of more meaningful climate models using increasingly powerful computers and networks, while he trains new scientists in that endeavor. Stössel would like to make sure that the role of the Earth's polar regions is reflected in climate models accurately enough for the models to lend more credibility to climate change prediction. ❂