all citizens have the right to vote on issues in the United States, they need to be critical thinkers and well educated.

So, how can we as science researchers help in this movement? The best thing we can do is share our expertise. As it turns out, teachers across the nation are always looking for experts in the sciences to speak in the classroom and help their students with science-exploration topics - especially they look for atmospheric scientists! Because climate change is talked about frequently in the media, the atmosphere is becoming a popular classroom topic. Atmospheric researchers are more important than ever, so it is a great time to be involved!

If you are ready to lend your expertise to the movement, or if you are looking for an outreach component to satisfy requirements of a research grant, there is a way to connect yourself to local educators. Go to www.nationallabday.org and click on "I'm a scientist." You can register yourself, and the website will provide you a list of educators in your area looking for volunteer experts.

If we want the public to be better informed about issues in atmospheric sciences, it begins in our schools. Researchers have the best information and a responsibility to ensure the public is aware of these issues. The National Lab Day website is one way for you to get involved!

Interview with Aristita Busuioc

Hans von Storch

Dr. Aristita Busuioc

Dr. Aristita Busuioc was born in 1950 in Romania. She studied mathematics at the University of Craiova (1969-1974) and she has been working at the National Institute of Meteorology and Hydrology (now National Meteorological Administration), Bucharest, since 1974. In 1997 she received her Ph.D. in Mathematics. In 1988 she became the leader of the "Dynamical Climatology Group" and in 2006, the head of the Climatology Division, until December 2009. Her scientific interests are related to climate variability and climate change, especially statistical downscaling models. She has been involved in various EU projects (as participant or team leader). She has published about 70 articles, 17 of them in international peer-reviewed ISI journals. She was awarded with the Stefan Hepites prize of the Romanian Academy. She also participated in the Fourth IPCC Report as Lead Author, she has been editor in chief of the Romanian Journal of Meteorology, a member of the Editorial Consulting Committee of the "The Open Atmospheric Science," and a Senior Associate to the ICTP in Trieste (2004-2009).

How did the change from an authoritarian political regime to a democratic one affect science in Romania?

The most important change was related to the fact that the Romanian scientists were at last free to collaborate with any Western scientific institution. In this way we could become involved in many European projects and enjoy research stays at prestigious European research institutes. On the other hand, we could participate in various scientific meetings to present our results and to exchange experiences with other scientists from all over the world.

There are still not many women among the "higher" ranks, such as professors, department heads and the like. Is meteorology and climate science still "male territory"?

To obtain the highest scientific degrees (such as professor or senior scientist) there is no difference but the management positions such as director are still "male territory."

About 20 years ago, you were suddenly confronted with the possibility of travelling, particularly to the west. This must have been a rather different world. How did you experience this, and which effect did it have on your research activity?

My first long trip was a research stay at the Max Planck Institute for Meteorology in Hamburg. This was a very big challenge. First, from a technical point of view, I had to work with big computers, but I was lucky to have very nice colleagues who helped me very much. From a scientific point of view, this visit practically changed my career. I learned about global climate models and especially about climate change projection on local scale (statistical downscaling) and then I used this expertise during all my research activity. These fields were new in that time in Romania. All the other international collaborations were practically related to this field.

What would you consider to be the two most significant achievements in your career?

I consider that the most significant achievement in my career is related to the development of the climate research field in Romania (development of complex statistical method for analysis of regional climate variability, validation of the global/regional climate models and climate change projection using statistical downscaling models). The second important achievement is my participation in the Fourth IPCC Report as Lead Author of the Working Group 1 contribution.

When you look back in time, what have been the most significant, exciting or surprising developments in atmospheric science?

I consider the assessment of the uncertainty of local/regional climate change estimates using the ensemble of multi-model approach started in the EU ENSEMBLES project one of them. But maybe the most exciting one, from my point of view, is one of the main objectives included in the High Level Declaration of the World Climate Conference-3 (Geneva 2009) which is to develop the inter-annual and multi-decadal climate predictions.

What constitutes "good" science?

It is very difficult to answer this question. In my opinion, "good" science means performing science based only on “science rules” answering (with scientific tools) to the needs of society as well as possible. But of course this depends on the scientific field. Unfortunatly, in the case of atmospheric science it cannot meet all the needs of society with scientific arguments, and these needs are very high. I do not like the speculations.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

In atmospheric science in general, but especially in climate research, the instinct is very important. For example, to perform an efficient statistical analysis of climatological data, the choice of data set and method is firstly based on instinct but then the scientific culture also helps you with this.

initial goal of using a minimum of 10% renewable energy. Some of the power will come from a CLF&P coal-fired plant that chemically scrubs the coal to reduce emissions of certain pollutants. The project leaders hope to be certified by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. "We want the most energy efficient design possible so we can minimize the carbon footprint," said Laursen.

Construction is planned to begin after the design review next spring. According to the proposed timeline, the NWSC will be completed by summer 2011 and will be online early in 2012. According to Craig Douglas, a University of Wyoming professor with a background in computer science and parallel algorithm development, the supercomputing center will be a peer with top-notch facilities like the National Center for Supercomputing Allocations (NCSA) at the University of Illinois. "This is a great resource for people in Colorado and Wyoming, and the world," he said.

Winds of Change in Wyoming

Wyoming is one of the least economically diversified states in the nation. However, this is changing, and the NWSC has a large role to play. The state of Wyoming and the University of Wyoming are investing heavily in the supercomputing center project. UW is providing $20 million to the center's construction, and the university plans to contribute $1 million annually toward computing and data storage costs. Over the next 20 years, the expected budget for the center is $535 million.

Being part of the NWSC fits in well with the state's push for more advanced energy research in Wyoming. "Even before we have shovels in the ground, the university has already benefited from the proposed center," said Laursen. UW has a new School of Energy Resources, and 20% of the center's computing resources will be shared by university and NCAR researchers. This has already attracted faculty to Wyoming. The center itself will employ a staff of roughly 20 people, about half of whom will move from NCAR in Boulder. And having a high-tech supercomputing center in Cheyenne could attract more technology-based business to the area.

Douglas was brought to the UW School of Energy Resources in 2008 because of his expertise in supercomputing. He is the Director for the Institute of Scientific Computation and a distinguished professor in mathematics. Douglas is anticipating using the NWSC for research on carbon sequestration techniques. "I'm really excited that the University of Wyoming is involved in this," he said. For Douglas, determining what research questions to pursue with the computing allocations is all "part of the fun and excitement." If the business, education and technology leaders who have pushed to bring the NWSC to Cheyenne are correct, watching Wyoming's economy grow and diversify will be exciting as well.

From Cheyenne to the World

The increased electrical and storage capacity of the new supercomputing center will benefit atmospheric scientists. From climate change to severe weather or carbon sequestration, the research that will be done at the center will have important implications, much like the work that has been done through the NCAR Mesa Lab over the past 42 years. Unger points out that much of the public is still unsure about if or how climate change will affect them. "[The NWSC] will take us a step closer to delving into local impacts and will give decision makers the tools to take action," she said. Laursen agrees, adding, "It will be a key piece to help researchers work on these problems."

Reference

Manabe, S., and R.T. Wetherald (1967), Thermal equilibrium of the atmosphere with a given distribution of relative humidity, *J. Atmos. Sci.*, *24*(3), 241-259.

* Incidentally, 1967 was a big year for the University of Wyoming as well. The Cowboys football team went 10-1, with their only loss coming against Louisiana State University in the Sugar Bowl**.**

Interview with Raino Heino

Hans von Storch

Raino Heino, Finnish Meteorologist and Climatologist, was born in 1943, with a M.Sc. in 1968 and a Ph.D. in 1994 from the University of Helsinki. Since 1996 responsible Research Manager for Climate at the Finnish Meteorological Institute (FMI), and an adjunct professor at the University of Helsinki since 1999. For more than 25 years representative of FMI at the World Meteorological Organization (WMO) (in particular in the Commission for Climatology); a national delegate for the Intergovernmental Panel on Climate Change (IPCC) since 1994; vice-president of the European Meteorological Society 2002-2008, and Chair of the Meteorological Division of the Geophysical Society of Finland since 1999. Among his more private achievements is his stamp collection of meteorology, which has received several gold medals in international stamp exhibitions. The collection was also published by the WMO (Nr. 1023).

Raino Heino in the military weather service (1964).

In which areas of meteorology have you worked?

Mostly in climatology at the Finnish Meteorological Institute (FMI). In the beginning of my professional life I also worked in the information-communication technology-area, for instance by using the first computer of my country in the mid-1960s. In addition, I was a teacher of meteorology at Helsinki University (Dept. of Meteorology) for 30 years.

What about your international activities?

Since the 1970s I worked with various climate-related tasks of the WMO; at present time I am leading the climate data management activities of the Commission for Climatology. In addition, I am serving on the Commission for Basic Systems (CBS) Expert Team on Evolution of Global Observing System and GCOS Atmospheric Observations Panel for Climate.

I have also taken part in different European activities during these years, for example in the European Meteorological Society from its foundation. In Europe, the climate-related cooperation is promoted by the European Climate Support Network (ECSN), which coordinates the work of the National Meteorological Services and (continued in the next page)

Meteorology also as a hobby. Several gold medals for the thematic exhibit "From Weather Gods to Modern Meteorology" of meteorology-related stamps and postal history items, to trace the development of weather-related activities, as illustrated in the philatelic pictorial material published by the postal administration of numerous countries.

organizes conferences and workshops among European climatologists. I have been involved in that work from the beginning of the ECSN in the early 1990s, and worked since then as a member of its advisory committee. European Union-funded projects have also had a key role in European climatology.

What's your role in the IPCC as well as the BACC (BALTEX Assessment of the Baltic Sea Region)?

I was the Finnish national IPCC delegate and focal point for 15 years during the 2nd, 3rd and 4th Assessment Reports and thus I was part of the IPCC when it was awarded with the Nobel Prize in 2007.

BACC, also known as the "Baltic IPCC", was created to assemble, integrate and assess available knowledge of past, current, and expected future climate change and its impacts on ecosystems in the Baltic Sea basin. The BACC book was published in 2008. I was the coordinating lead author of the chapter on Past and Current Climate Change. Thanks to you Hans for working as the overall coordinator of the project. Also thanks for leading the new BACC II assessment that hopefully will result in a new book to be published in 2012, thus supporting the 5th IPCC report.

Is it an advantage to live and work in a relatively small meteorological community?

Well, it's nice to know practically all the Finnish meteorologists by first teaching them at the only university dedicated to meteorology in Finland, and afterwards by working with them at the FMI. But this is not limiting, since the involvement in various international projects results in having many contacts outside your own country, too.

What would you consider the two most significant achievements in your career?

The fact of initiating the computer-based work in the 1960s, not only in climatology, but also in many other fields of meteorology of the FMI, may be a major achievement. The FMI will soon celebrate the 50-year anniversary of the use of computers, and the 40-year anniversary of its own computers. I seem to be the only "pioneer" still working at the FMI.

Various climate-related activities ranging from data processing to all kind of climate applications and research represent maybe not major achievements, but the sum of this large number of smaller steps certainly had an impact.

The IPCC-related work is of course the "crown" of my career as a climatologist.

When you look back in time, what had been the most significant, exciting or surprising developments in atmospheric science?

The development of computers and new observing techniques have been the most significant, especially to our science. Both of them have improved weather forecasting as well as the research process as a whole. Quite surprising, on the other hand, was the sudden change of scientists' attitudes from the threat of the next ice age in the 1970s to the present over-warming by the greenhouse effect.

Is there a politicization of atmospheric science?

Yes, but only concerning the climate change issues. It is understandable, because the economic values involved are tremendous. The work of the IPCC, however, is the major cornerstone in assessing regularly what's going on in climate science. It makes it also easier for individual scientists to respond to increasing inquiries from all sides.

What constitutes "good" science?

Good education, hard work and honest output of the results.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

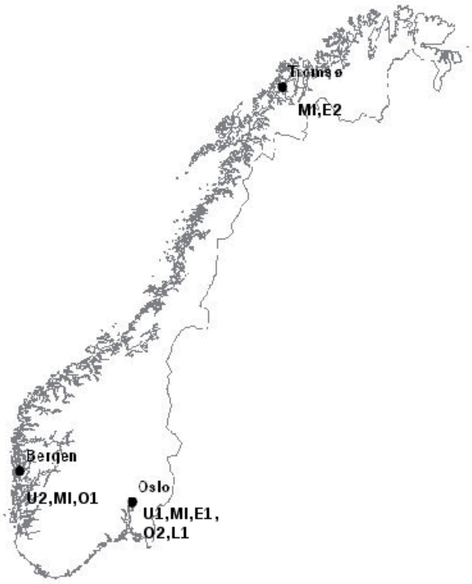
The subjective element is also present in science, but probably it is not very dominant, especially concerning the normal scientific communication. The internet has, however, opened an influential door for subjectivity. Culture may not matter very much in international science. Concerning the role of instinct I would like to refer to H.Wanner's interview [in Atmospheric Sciences Section of AGU Newsletter 3 (3), 4-5]: "Instinct is an important ingredient of a good scientist, but has to be combined with enthusiasm, creativity and stamina."

Reference

Heino, R. (Ed.) (2008), *WMO-No.1023. From Weather Gods to Modern Meteorology: A Philatelic Journey*, 112pp, World Meteorological Organization, ISBN: 978-92-63-11023-7.

"From Weather Gods to Modern Meteorology: A Philatelic Journey." (WMO) (cover).

for the last millennium based on marine and terrestrial climate proxies. This observation-based analysis explores interannual and multidecadal fluctuations in the region for the last millennium. Based on this analysis, and with support from climate models, the potential and skills for climate predictions on time scales up to a decade are examined. Dynamical and statistical downscaling methods are used to provide regional climate scenarios for the period 2030 to 2100 (U1, U2, MI).



Map of Norway with several universities and research centers.

In-depth knowledge of key physical processes is required for understanding climate fluctuations and the sensitivity of the climate system to external forcing. Therefore, processes with particular importance for the climate in Norway and the Arctic are studied. An Earth System Model (ESM) addressing also biogeochemical feedback processes is in preparation (U1, U2, MI, O1).

Information of past climate change on a longer time scale derived from instrumental and historical climate data is considered relevant for assessing the skill of projection predictions of climate change (U2, E2).

Polar meteorology: Ice conditions in the Barents Sea and the Greenland Sea have been mapped since 1966 on a weekly basis (MI, E2). At present, daily maps are prepared (MI).

The long time development of the climate in the Arctic including temperature, precipitation, snow and ice conditions is studied as well as physical processes involving ocean, sea ice and terrestrial ice (U2, MI, E2). Deep water formation and sea ice in Fram Strait and the size and mass balance of Svalbard's glaciers are being investigated. Ice cores in the thick inland ice of Dronning Maud Land - providing information reaching 900 000 years back in time – have been drilled (E2). Ny-Ålesund, Svalbard, comprises stations from ten nations from around the world, and its activities have been expanded rapidly in the last few years. During the polar year, Polar Lows were a topic for an international project (U1, U2, MI).

The issues of agricultural meteorology are studied at L1, and the processes relevant to local climates at U2, MI, and L1. The thawing of frozen soil (Permafrost) is studied at several places in Norway (U1, MI). The research in air chemistry includes field measurements, instrument development, chemical analyses, model development, air pollution forecasts, dose/response analyses, international co-ordination and training support (U1, E1, MI).

Interview with Christoph Kottmeier

Hans von Storch

The German meteorologist Christoph Kottmeier heads the Institute of Meteorology and Climate Research (Tropospheric branch) at the Karlsruhe Institute of Technology (KIT), a recent merger of the University of Karlsruhe and the Research Center Karlsruhe. He was born in 1952 and obtained his diploma in meteorology at the University of Hannover, Germany in 1977 and his Ph.D. in 1982, with a thesis on low level jets in the nocturnal boundary layer. From 1983 to 1989 he became involved in Antarctic Research. He made two long trips with the German icebreaker POLARSTERN to the Antarctic and performed various boundary layer measurements. He used radiosondes, sodar, turbulence towers, tethered balloons, and instrumented kites both from the vessel and at the German polar station Neumayer. In 1989 he moved to the Alfred Wegener Institute of Polar and Marine Research. In the following years he conducted three Arctic measurement programmes on sea ice-atmosphere interaction with his group, mainly based on measurements with two extensively equipped aircraft. In the Antarctic, he started a long series of buoy deployments to study the dynamics of sea ice and polynya formation. In 1997 he became a professor of meteorology at Karlsruhe University and engaged in experimental and applied modelling work on atmospheric convection, flow over complex terrain, meteorological hazards and regional climate.

In recent years has become the spokesman of several large research programmes, such as the Helmholtz Programme "Atmosphere and Climate" and the KIT-Center "Climate and Environment."

What was your reason for studying meteorology?

I was considering studying electrical engineering or meteorology. In the end I opted for meteorology, mainly because I had been a glider pilot since my 14th birthday. I was always impressed that the convective gliding conditions could be forecasted quite reliably just from the midnight sounding before. So I wanted to improve my own skills in forecasting convection to become a better crosscountry glider pilot in competitions. That did not work out too well and I never got a top place in a major competition. But this experience with aircraft helped me define the way I approach problems in general and also in science.

Why do different types of measurements play an important role in your work?

I really believe that a good understanding of atmospheric processes can only be achieved by merging observations with modeling. Since not many meteorologists know which instruments to use in specific problems, I put more effort in measurements, but made sure that the needed modelling work was done.

Basically all measurements, even those from 3D scanning radars and lidars or satellite remote sensing are snapshots gathering very limited and undersampled information of what is going on. Numerical models, which somehow represent the physics correctly, may result in a completely inadequate description of the real world, if initial, lateral boundary conditions, parametrizations and the background state are not considered properly.

Last but not least, participating in field programmes in different regions of the world gives a lot of motivation, both from contacts with colleagues in science and with local people.

In which international activities have you been involved?

During my Polar research period I had several tasks: I was the national representative in SCAR/IASC working groups, responsible for the substantial German contributions to the WCRP Arctic and Antarctic Buoy Programmes (IABP, IPAB), and chairman of the executive committee for WCRP-IPAB for several years.

(continued in the next page)

C. Kottmeier's own way of coping with strong winds.

In recent years I became member of the ISSC or of the Governing Boards of major atmospheric and climate programmes such as AMMA in West Africa, COPS in Germany/France, and the planned large Mediterranean Programme HyMeX.

What do you consider your most important scientific achievement?

My contributions to understanding the small-scale dynamics and thermodynamics of Polar sea ice are worth mentioning. The work was based on buoy measurements, coupled modelling, and satellite observations. The significance of tidal and inertial motion as well as winds for polynya formation and associated atmospheric turbulent fluxes, salt injection and the mass balance is still referred to in the literature. The focus of my recent work is quantifying the effects of convection over complex orography. I have had results on the initiation of convection in relation to surface conditions, the structure of the PBL and the entrainment zone, the transition from shallow to deep convection, but also the model representation of convection in weather forecast and regional climate. Even if most of the results have to be creditted to the scientists at my institute, I claim to have set the right aims and prepared the ground to go.

What is your role in the local and national meteorological community?

There are surprisingly many chairmanships in boards, new research initiatives, and review processes offered to a university professor like me. That may be partly due to the fact that competitors are either too young or too old, or just too smart to get selected. The fact that I have spent time at different meteorological communities in Germany is the reason why my colleagues consider me as being close enough to understand what they do and far enough from them to develop an independent view.

In the Helmholtz Society and locally in the Karlsruhe Institute of Technology it is a permanent challenge to keep atmospheric and physical climate sciences properly acknowledged.

Is there a politicization of atmospheric science?

In present times, when climate change is a hot topic, and even weather science is an accepted research issue, atmospheric research is receiving attention by more people than ever. Politicians and important stakeholders need to believe or not what scientists tell them about climate change. When they accept climate change as a problem, they need to react according to their role and responsibilities. Together with the media attention this puts certain stress on the leading scientists. There seems to be more competition in the research community itself but also between organizations which, from my point of view, should serve science instead of just counting papers and citation numbers.

What constitutes good science?

There should be well defined, really open questions, originality at least in applied methods, clarity in conceptual approaches, and transparency in descriptions.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

I think that subjective elements play a larger role in atmospheric and climate science than we would like to admit. We develop a lot of physical reasoning in intermediate steps of rational thinking. But we basically begin with just believing certain facts, which sometimes may be questionable. This becomes obvious when we meet people who have arrived at results that contradict our own. Full objectivity would enable us to resolve contradictory points of view, which often does not happen. Cultural differences do matter, and this becomes evident when talking to people from research communities of other disciplines or in other countries.

The classical theory in science remains obviously valid: there is no way of proving a scientific fact, there is only a common belief in it, and we have to change our mind when someone proves that it is wrong even if it is only in one case.

Opportunities

Note: You may be asked for your AGU member # to open the following links. Visit the AS Section website for links to other job opportunities not listed here.

Some of these job postings and others can be found at:

http://www.agu.org/cgi-bin/membership_services/joblistings.cgi

__Atmospheric Sciences__

* Faculty Position in Climate Sciences, Department of Earth and Planetary Sciences, Johns Hopkins University. Contact: Kristen Gaines (kgaines@jhu.edu).

* Manager, Climate System Research Center, Dept of Geosciences, University of Massachusetts, Amherst. Contact: Raymond S. Bradley (rbradley@geo.umass.edu).

* Post-doctoral scientist position in socioeconomics of weather, NCAR, Boulder, Colorado. Contacts: Dr. Rebecca Morss (morss@ucar.edu) and Dr. Jeffrey Lazo (lazo@ucar.edu).

* Postdoctoral research position in land surface-atmosphere exchange of greenhouse gases, Atmospheric Science Department, Lawrence Berkeley National Laboratory, Berkeley, California. Contact: Marc Fischer (mlfischer@lbl.gov).

* NCAS-Weather Research Fellow in pollution transport (Ref.: A001), Lancaster Environment Centre, Lancaster University, Lancaster, UK. Contact: Oliver Wild (o.wild@lancaster.ac.uk).

Dr. René Laprise. Photography courtesy of René Laprise.

Interview with René Laprise

Hans von Storch

René Laprise is a French Canadian trained meteorologist and forecaster. He studied physics at Sherbrook, meteorology at McGill (master in 1977) and the University of Toronto (PhD in 1988). Since 1988, he is a professor in the department of "Sciences de la Terre et de l'Atmosphère" at the University Québec à Montréal (UQAM). He has led the Canadian Network for Regional Climate Modelling (CRCM) till recently and is presently director of UQAM's ESCER "Centre pour l'Étude et la Simulation du Climat à l'Échelle Régionale".

René Laprise was instrumental in setting up Ouranos in Québec: the Consortium on Regional Climatology and Adaptation to Climate Change. This Ouranos is a consortium that brings together 250 scientists and professionals from different disciplines. It focuses on two main themes: Climate Sciences and Impacts & Adaptation.

He was recognized as "Personality of the Year" 2007 by La Presse/Radio-Canada, in the category of "Humanities, Natural Sciences and Technology," as being the father of Regional Climate Modelling (RCM) in Canada, among other achievements.

You have been a pioneer in developing and using regional climate models. What do you think is the significance of these tools?

Sometimes, objections are raised, arguing that the use of lateral boundaries is be un-physical, or that such models will be outdated with enough increase of computer power.

One should keep in mind that a regional-nested model is a tool, not a purpose in itself. The goal of regional models is to reduce computing demand compared to a global model with the same high resolution. All models are based on a set of approximations: numerical discretisation, resolution truncation, parameterisation of the sub-grid effects. Regional models have an additional approximation related to the imposition of artificial lateral boundaries. My team has been able to show with a set of systematic idealised experiments based on the perfect-prognosis "Big-Brother Experiment," that regional models can perform adequately when some basic rules are followed with respect to resolution jump, domain size and nesting technique.

Nowadays, regional climate models allow making high-resolution climate simulations that resolve mesoscale circulations at a computationally affordable cost. Computing power will continue to increase in time; this will make feasible to integrate global models at much higher resolution soon. This does not mean that RCM will become outdated; on the contrary, they will allow addressing other challenges at even higher resolution. For example ultra high resolution (e.g. 1 km or 100 m mesh) will permit to tackle fascinating issues relating to very fine-scale topographic or physiographic features. Such models could be used advantageously for example to explore potential sites for wind-power generation.

In Montreal, you are with the Ouranos consortium. Could you say something about the concept, its significance and performance?

The major weather events that have struck Québec in recent years, in particular the Saguenay flood in July 1996 and the ice storm in January 1998, have focused the attention on the vulnerability of society to such disasters. The Ouranos Consortium on regional climatology and adaptation to climate change was established in 2001, as a joint initiative by the Québec provincial government, the Hydro-Québec electric utility and Environment Canada, with four member universities. Ouranos acts as a reference center to decision makers for all concerns relating to climate fluctuations, climate changes and their impacts on a wide range of issues, such as public safety, infrastructures, energy supply, water resources, health, forestry agriculture, tourism, transportation, and the natural environment.

Ouranos is a unique institution in Canada; it constitutes a stable infrastructure to secure the expertise, and it provides a rich milieu where climate scientists and practitioners in climate impacts and adaptation can interact. Graduate students can greatly benefit from such multidisciplinary working environment.

You are a French-Canadian, i.e., a person with a non-English cultural background – to what extent is this an advantage or disadvantage for your scientific endeavor?

The status of English as lingua franca for international (and Canadian!) science certainly creates an additional challenge to non-English speakers, here in Québec and elsewhere. I think this is especially acute early in one's career when "learning the ropes of the trade." In my group, our several foreign graduate students who are neither from French nor from English background face a double challenge: they attend classes and write exams in French, and when they are ready to communicate their research findings, they are sent to international conferences and asked to write scientific papers in English. But they all succeed remarkably well! Possibly the fact that their professors themselves face the language challenge serves them as "role model."

What would you consider the two most significant achievements in your career?

The first is the dynamical formulation of a "universal" model based on the fully elastic atmospheric equations solved by semi-implicit and semi-Lagrangian marching scheme (Tanguay, M., A. Robert and R. Laprise, 1990: A semi-implicit semi-Lagrangian fully compressible regional forecast model. Mon. Wea. Rev. 118: 1970-1980.), with terrain-following mass vertical coordinates (Laprise, R., 1992: The Euler equation of motion with hydrostatic pressure as independent coordinate. Mon. Wea. Rev. 120: 197-207.). This work demonstrated that the same model could be used efficiently from cloud-resolving scale (without the need to invoke the anelastic approximation) to global scales (without the need for the hydrostatic approximation). Similar approaches are now used in several models around the world, including GEM in Canada, WRF in the USA, HIRLAM in Scandinavia, ALADIN and AROME in France.

The second is clearly my 18-year endeavor to develop from scratch a regional climate modelling team in Canada (Laprise, R., 2008: Regional climate modelling. J. Comp. Phys. 227: 3641–3666.). With graduate students and junior research associates, we built an original (and efficient) Regional Climate Model, developed a suite of diagnostics analysis tools and graphics software, and initiated a set of climate simulations and climate-change projections over North America. Through this effort some 60 young scientists have been trained, and this highly qualified personnel constitutes in my opinion the most important legacy of this endeavour. This RCM team has been instrumental in initiating the Ouranos Consortium.

When you look back in time, what where the most significant, exciting or surprising developments in atmospheric science?

Sophisticated data assimilation techniques and widespread satellite remote sensing data have greatly improved the accuracy of the initial state of the atmosphere for weather forecasts. Faster computers have had tremendous impact, making possible the treatment of the vast amount of observational data, the integration of high-resolution complex numerical weather prediction models, and the automation of weather forecasting.

Is there a politicization of atmospheric science?

In my view, science gains by being policy relevant, but it should refrain from the temptation of becoming policy prescriptive. When asked by media to give my personal opinion on a topic such as global warming, and emission reduction targets or strategies, I always restrict myself from explaining the consequences on the climate of actions or inactions in terms of emissions, and some of the expected impacts on the natural environment. I feel that scientists lose the edge conferred by their profession when making statements outside their own specialisation area, and when they do they join the pack of ordinary opinionated citizens.

What constitutes "good" science?

I think that scientists should constantly question the current science paradigms. I have been rather surprised early in my career to find that, contrary to my initial naïve view of science aimed at pushing back the limits of knowledge, the majority of scientists tend to be very conservative and not much interested in encouraging the emergence of new scientific ideas.

For myself, I prefer to work on scientific topics that lend themselves to combining theory and application. Theory alone is what I would call "a solution that seeks a problem to solve;" not my cup of tea. Applications alone lead to engineering approaches; may be very important in practice, but not of much interest for me.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

I do not believe much in natural, spontaneous instinct. On the other hand I think that one's character and personality exert great impact on the scientific practice. I think that what is often referred to as instinct is in fact developed from previous experiences, personal progression, and hence one's scientific culture. For example, I do not think I would ever have conceived working on the formulation of a universal model if I had not been acquainted before with a hydrostatic global model while working at the Canadian Climate Centre, and later with an anelastic mountain wave model for my doctoral research.

The 2nd Lund Regional-scale Climate Modelling Workshop

Burkhardt Rockel, Lars Bärring and Marcus Reckermann

From 4-8 May 2009, about 200 climate scientists from around the world met in Lund, Sweden, for exchanging and discussing the latest developments in regional climate modelling. This Second Lund Regional-scale Climate Modelling Workshop was a follow-up to the first regional-scale climate modelling workshop held in Lund, Sweden in 2004. Now, five years later, it was time to take stock of the scientific progress in the wide range of topics that regional climate modelling spans. These range from the theoretical understanding and parametriza tion of meso-scale and regional processes in the atmosphere / ocean / land surface / biosphere system to the numerical methods and links between regional climate modelling and global climate/earth system models, as well as numerical weather prediction models, the evaluation of models using various observational datasets, the model intercomparison and ensemble-based methods, the production and utility of regional climate scenarios, and the application of regional climate modelling output for impact studies. In this Second Lund Regional-scale Climate Modelling Workshop those present summarised develop ments and progress achieved in the last five years, discussed open issues and focused on expected future challenges related to regional climate modelling. Thus, the overall theme for this workshop was 21st Century Challenges in Regional-scale Climate Modelling.

The response to the workshop was overwhelming. We received over 170 paper contributions from scientists from all continents, and a total of about 220 participants from 43 countries registered for the workshop. This was more than twice as many as in the first workshop in 2004, reflecting the growing interest in regional climate modelling, largely driven by the growing demand for high resolution climate projections.

The workshop was structured in seven topic areas, which were represented both in the oral and the poster sessions. Since a prominent application of regional climate models is the provision of high resolution climate scenarios by downscaling global climate model scenarios, it was not surprising that the session on dynamical downscaling was the most frequented. In particular, the use of spectral nudging techniques (a method imposing time-variable large-scale atmospheric states on regional atmospheric models in order to improve downscaling), received much attention. Spectral nudging techniques are now used in regional "reconstructions," i.e., downscaling of re-analyses of the last few decades, dealing with, for instance, the changing statistics of the East Asian summer monsoon, or of polar lows. Results from the next generation of regional climate models, which are applicable

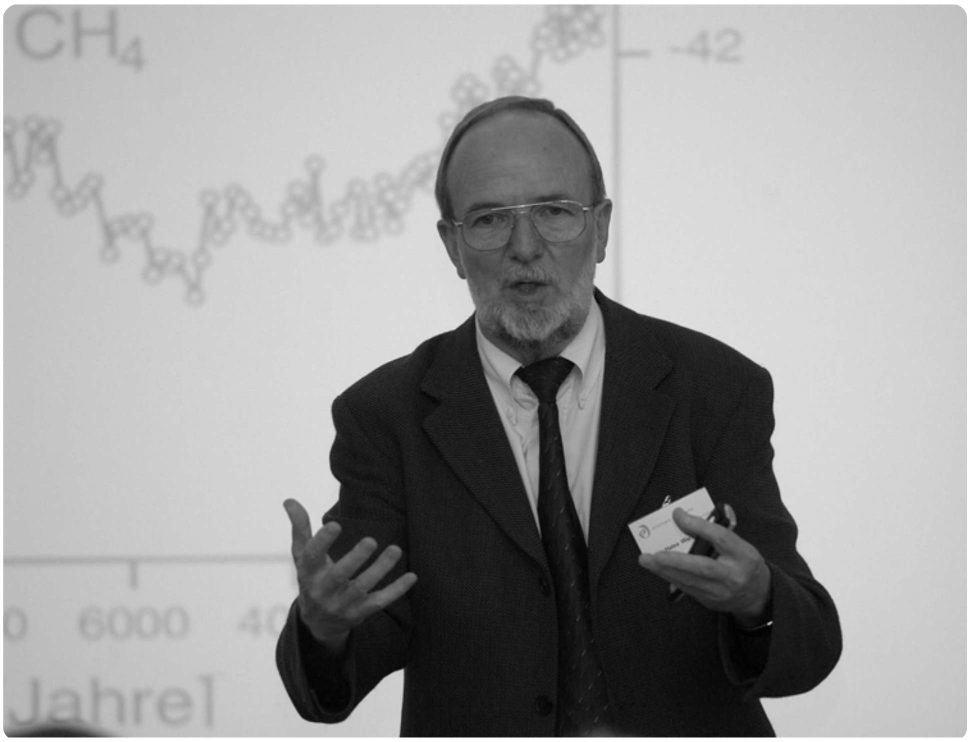
Interview with Heinz Wanner

Hans von Storch

Heinz Wanner is a leading atmospheric scientist from Switzerland where he currently holds a professorship at the University of Bern. He serves as president of the Oeschger Centre of Climate Change Research at the University of Bern. From 2001 to 2008 he was the acting director of the Swiss National Climate Research Programme NCCR. Heinz Wanner is an honorary member of the Swiss Academy of Science. In 2006 he got the Vautrin Lud prize, which is called the unofficial Nobel prize in geography, and his achievements will be recognized by an Honorary Doctoral Degree in October 2009 from the Humboldt University in Berlin, Germany.

Heinz Wanner completed a teachers training college and taught in a primary school for four years. Afterwards he studied geography, climatology, geology and mathematics in Bern and in Grenoble (France). In his first "scientific life" Heinz Wanner worked on mesoscale dynamics, synoptic and mountain meteorology, and atmospheric chemistry. Then he got a postdoctoral research position at the Atmospheric Science Department of Colorado State University in Fort Collins, he worked as a deputy operations director of the GARP ALPEX programme and he also was a co-director of the Swiss research programme on meteorology and air pollution (POLLUMET).

After being nominated full professor at the University of Bern in 1988, his late colleague Hans Oeschger pushed him to jump into a second "scientific life." Since then, Heinz Wanner has worked on paleoclimate reconstructions and diagnostics at different time scales between the last few hundred years and the Holocene.



Dr. Heinz Wanner. The paleoclimatologist in action (Engelberg symposium, 2004).

Heinz, your earlier work was on mesoscale processes, mountain meteorology and air pollution dispersion. Then you switched to paleoclimate dynamics. Isn't it a disadvantage to make such an about-turn during your career?

Wanner: It might be a disadvantage to do so today, because you have to be focused and publish in high-ranked journals, and this can be an around the clock effort. For me, I had a chance to get experience in basic meteorology, and to learn important techniques, such as weather analysis and weather forecasting or the principles of numerical modeling. This has greatly benefited me in paleoclimatic research.

You were an active teacher at university for almost 40 years. Did you ever feel this as a burden having all your other obligations?

Yes, it was a burden to prepare lectures until late in the evening. But the students made up for this in terms of their enthusiasm and stimulating scientific discussions. I would never have given up my work with students and young collaborators.

In the early 1980s you acted as an assistant operations director of the field experiment of mountain subprogramme ALPEX of the Global Atmospheric Research Programme (GARP). How was the scientific atmosphere during this field phase?

Overwhelming! To work in the ALPEX operations centre in Geneva with motivated top scientists and colleagues from all around the world, such as the brilliant director Joachim Kuettner, was one of the crucial kicks of my career. By the way: Joachim will celebrate his 100th birthday this year!

You served as an infantry colonel in the Swiss army. Did this interfere with your scientific career?

Yes, definitely, but I think I kept my scientific mind. During my army service I was very often abroad in the Swiss mountains, and this gave me the chance to get a certain distance from the scientific environment, to meet very fascinating colleagues and friends (farmers, managers, politicians) and – quite important for a university person – to learn management skills.

You are the founding president of the Oeschger Centre for Climate Change Research at the University of Bern. What are the topics this centre works on?

Bern has a long tradition in paleoclimate research. It was our intention to form an interdisciplinary research centre. Therefore, 20 research groups within the Oeschger Centre participate in four work packages: global climate dynamics, regional climate dynamics (main emphasis: Europe, Alps), risks and biological impacts of climate change, impacts of climate change on economy and society.

What would you consider the two most significant achievements in your career?

Difficult question! Did I do too many things? As a scientist I tried to combine the best methods for reconstruction of past climate with tough dynamic and synoptic principles. As an (old) professor I have tried to form a rather small but creative team of young enthusiastic scientists. I would see these as two key achievements of my career.

When you look back in time, what where the most significant, exciting or surprising developments in atmospheric science?

Possibly the development of the computer and information technology. Thereby big steps forward were made in numerical modeling, data analysis and remote sensing. But the density and the speed at how information is processed today, is increasingly hard to digest.

Is there a politicization of the atmospheric science?

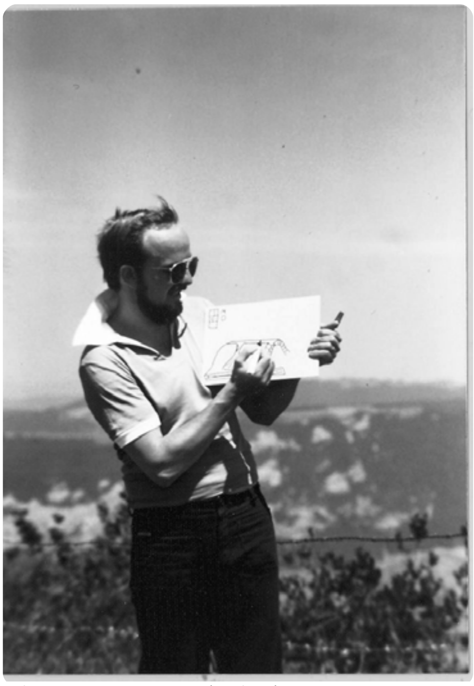
Undoubtedly, yes! Political parties want to increase their success with tendentious climate change issues, and scientists are besieged by journalists. This makes it difficult to remain fully independent or, in words of Roger Pielke Jr., to remain an "honest broker."

What constitutes "good" science?

Certainly not the production of several sensational short articles per year. It requires an intensive debate between individual scientists during a longer time period. It includes success and failure. "Good science" also includes excellent reviews.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

Maybe personal history matters more than culture. Without a doubt, instinct is an important ingredient of a good scientist, but is has to be combined with enthusiasm, creativity and stamina.



Heinz Wanner as postdoc in the 1970s.

Teachers Learn about Wind Power During the ATEEC Fellows Institute

Morgan B. Yarker

The Advanced Technology Environmental and Energy Center (ATEEC) at the University of Northern Iowa promotes and supports national education about energy and technology. For the past 15 years, the ATEEC fellows institute has provided science content for high school and community college teachers nationwide.

Maureen Clayton, director of the ATEEC institute and Associate Professor of Biology at the University of Northern Iowa, explains that there is a lot of new content from research being done in the science community that doesn't get communicated to educators. "There are lots of great teachers out there that are eager to include this research into their classrooms, but they don't have the knowledge or resources to do it," She said. "This institute helps with that."

ATEEC recruits 18 high school and community college teachers every year to take part in the institute. ATEEC tries to recruit a mix of prior participants as well as new participants, but all have experienced teaching strategies.

The fellow's teaching experience is important because they are not expected to only learn content; they are also responsible for working in groups to develop new and innovative lessons that can be brought back to the classroom. These lessons are also available for free on the ATEEC website for any educator or interested party. The fellows generally describe the curriculum development project as being extremely time consuming, but at the same time one of the best outcomes of the institute because they develop several finished products that can be immediately used in the classroom.

Every year, the topic discussed at the ATEEC institute is different and reflects newer scientific research. Clayton said she tries to pick topics related to Iowa, since that is where the institute is held. This year, ATEEC's topic is wind power. In the past two years, wind power has grown substantially, producing approximately 15% of all electricity in the state, making it the second ranked state in the nation that produces wind power.

The participants took part in lectures from experts at the University of Northern Iowa campus as well as in field trips to locations that provided them with hands-on experience. The participants visited Iowa Lakes Community College's Wind Energy & Turbine Technology program, which is a two-year program that trains wind turbine technicians. They also visited Clipper Wind in Cedar Rapids Iowa, a factory that assembles, delivers, and monitors turbines.

Clayton explained that the field trip experience is one of the most important components for teachers to learn about a topic. "At first, I thought the learning came from access to researchers and facilities on campus. But when I saw how fascinated they looked while on their field trips, it really hit me how much they were getting from it."

Participants echo Clayton's comments about field trips. Roy Sofield, ATEEC participant and instructor at Chattanooga State Technical Community College, said that he chooses to attend ATEEC every year because he knows the field trips will provide excellent hands-on learning as well as interesting and exciting content. "The topic of wind this year is a timely and popular attraction. Having a history with ATEEC, I knew the field trips would be so awesome… I knew we would do incredible things. Every year, it has met my expectations."

Sofield also added, "I find it both interesting and kind of funny that more and more my lectures are starting with the phrase, 'when I was in Iowa, I learned…'"

Bob Ford, instructor at Frederick Community College in Maryland, had the unique opportunity to climb the wind turbine with technician instructors at Iowa Lakes Community College. Having first hand experience in what the technicians do every day provides the teachers with unique material to bring back to the classroom. When asked what he learned this week, Ford replied, "Seeing the technology in the turbine was amazing, and the view from the top was great!"

For more information about ATEEC and the fellows institute, visit: www.ateec.org.

Participants in the AETEEC Fellows Institute.

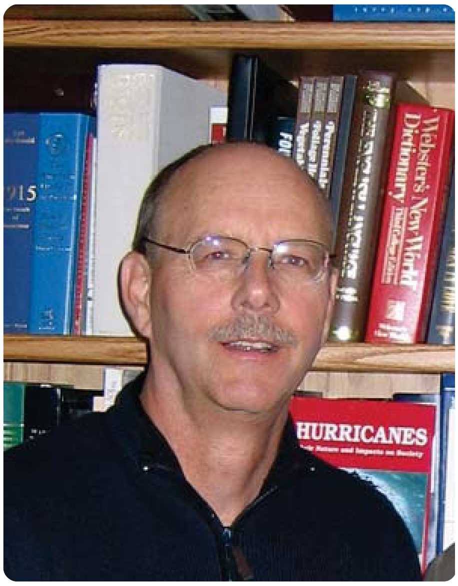
in reducing eutrophication in the Baltic Sea. The session on "Hydrological modeling, water management and extreme hydrological events" featured presentations on the variability of extreme events like storm surges, droughts and extreme precipitation, and recent attempts to forecast those events. A new project to exploit high-resolution modeling of surface currents for environmental management of the Baltic Sea (optimization of ship routing, identification of environmental risk areas, etc.) was introduced in several presentations. A dedicated session on "Regional adaptation to climate change" presented examples of regional adaptation projects in northern Europe. A special highlight was a multimedia presentation designed to be presented in a multimedia theatre dome, with the aim of demonstrating scientific findings on global and regional climate change in a comprehensive way to non-experts.

The conference was jointly organized by the Institute of Oceanology in Sopot, the University of Szczecin, the Research Centre of Agriculture and Forest Environment, Poznań, the West Pomeranian University of Technology, Szczecin (all Poland), and the International BALTEX Secretariat at GKSS Research Centre Geesthacht, Germany. A special journal issue featuring selected full papers presented at the 6th Study Conference on BALTEX will be published by Oceanologia. Further information on BALTEX and the 6th Study Conference, including a proceedings volume containing the extended abstracts of accepted presentations, is available at the BALTEX web site: www.baltex-research.eu.

Interview with Roger A. Pielke Sr.

Hans von Storch

Roger A. Pielke Sr. is currently a Senior Research Scientist at the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado and a Professor Emeritus of the Department of Atmospheric Science, Colorado State University. Pielke has studied weather and climate on local, regional and global scales using both models and observations throughout an over 40 year career. He has authored, co-authored and co-edited several books including "Mesoscale Meteorological Modeling" (1984; 2002), "The Hurricane" (1990), 'Human Impacts on Weather and Climate" (1995; 2006), "Hurricanes: Their Nature and Impacts" (1997) and "Storms" (1999). Roger Pielke Sr. was elected a Fellow of the AMS in 1982 and a Fellow of the American Geophysical Union in 2004. He has served as Chief Editor of the Monthly Weather Review and Co-Chief Editor of the Journal of the Atmospheric Sciences. He is currently serving on the AGU Focus Group on Natural Hazards (August 2009-present) and the AMS Committee on Planned and Inadvertent Weather Modification (October 2009-present). Dr. Pielke has also published over 350 papers in peer-reviewed journals, 50 chapters in books, and made over 700 presentations during his career to date. A listing of papers can be viewed at the project website: http://cires.colorado.edu/science/groups/pielke/pubs/. He is among one of three faculty and one of four members listed by ISI HighlyCited in Geosciences at Colorado State University and the University of Colorado at Boulder, respectively.



Roger A. Pielke Sr.

Prof Pielke, you are an atmospheric scientist - what were the main scientific issues you have tackled in your long professional career?

Our research team has investigated a wide range of climate processes. This includes studies in meteorology, hydrology, ecology and oceanography. Among our findings has been the clear demonstration of the close coupling between land surface processes and weather. I have also worked extensively to improve our understanding of the transport and dispersion of air pollution, as well as ways to reduce the risk from this environmental hazard.

How do you weigh the role and the potentials of models?

Models are powerful tools with which to understand how the climate system works on multi-decadal time scale as long as there are observations to compare reality with the model simulations. However, when they are used for predictions of environmental and societal impacts decades from now in which there is no data to validate them, such as the IPCC predictions decades into the future, they present a level of forecast skill to policymakers that does not exist. These predictions are, in reality model sensitivity studies and as such this major limitation in their use as predictions needs to be emphasized. Unless accompanied by an adequate recognition of this large uncertainty they imply a confidence in the skill of the results that does is not present.

You have become known for dissenting views in the present debate about the perspective of anthropogenic climate change. For example, you stress the role of land uses chances as another key driver in influencing our climate. Could you outline your position?

My perspective is summarized in a recent publication with 18 other Fellows of the American Geophysical Union in an EOS article titled "Climate change: The need to consider human forcings besides greenhouse gases" [*Pielke Sr. et al.*, 2009]. We wrote "the 2007 Intergovernmental Panel on Climate Change (IPCC) assessment did not sufficiently acknowledge the importance of these other human climate forcings in altering regional and global climate and their effects on predictability at the regional scale" and because "global climate models do not accurately simulate (or even include) several of these other first order human climate forcings, policymakers must be made aware of the inability of the current generation of models to accurately forecast regional climate risks to resources on multidecadal time scales."

If you were right, how would the range of options for response measures for limiting man-made climate change within certain bounds differ from what is commonly considered?

We need to recognize that the IPCC starts from an inappropriately narrow perspective that the human input greenhouse gases is the dominate environmental concern in the coming decades and then the IPCC presents policymakers with a resulting broad range of expected regional and local impacts. This is, however, at best a flawed significantly, incomplete approach.

The IPCC process should be inverted. In our 2009 EOS article that I referred to above, we recommend that the next assessment phase of the IPCC (and other such

(continues on the next page)

assessments) broaden its perspective to include all of the human climate forcings. It should also adopt a complementary and precautionary resource based assessment of the vulnerability of critical resources (those affecting water, food, energy, and human and ecosystem health) to environmental variability and change of all types. This should include, but not be limited to, the effects due to all of the natural and human caused climate variations and changes.

After these threats are identified for each resource, then the relative risk from natural- and human-caused climate change (estimated from the GCM projections, but also the historical, paleo-record, and worst case sequences of events) can be compared with other environmental and social risks in order to adopt the optimal mitigation/adaptation strategy.

The issues we should focus on can be summarized in this set of questions:

1. Why is this resource important? How is it used? To what stakeholders is it valuable?

2. What are the key environmental and social variables that influence this resource?

3. What is the sensitivity of this resource to changes in each of these key variables? (this includes, but is not limited to, the sensitivity of the resource to climate variations and change on short (e.g. days); medium (e.g. seasons) and long (e.g. multi-decadal) time scales.

4. What changes (thresholds) in these key variables would have to occur to result in a negative (or positive) response to this resource?

5. What are the best estimates of the probabilities for these changes to occur? What tools are available to quantify the effect of these changes. Can these estimates be skillfully predicted?

6. What actions (adaptation/mitigation) can be undertaken in order to minimize or eliminate the negative consequences of these changes (or to optimize a positive response)?

7. What are specific recommendations for policymakers and other stakeholders?

I have been commissioned as Chief Editor of a set of five books which will apply this bottom-up, resource based perspective.

You have retired a few years ago from your active duty as a professor at Colorado State University. Did retirement present for you a loss of opportunities, for instance with respect to teaching, or an opening of new possibilities?

I continue to work with graduate students at the University of Colorado, and at other institutions including Purdue University and the University of Alabama at Huntsville. I continue to be active in research and mentoring of younger scientists.

What would you consider the most two significant achievements in your career?

First, the opportunity to mentor graduate students and postdoctoral research staff, a number of who have become leaders in atmospheric and climate science has been an achievement I am proud of. Second, the perspective that climate is an integrated nonlinear physical, chemical and biological system, which requires the understanding of all components of the atmosphere, ocean, land and cryosphere, is starting to become more widely accepted. I have sought to promote this view over the last 20 year. This broader view of climate as a complex, nonlinear geophysical system is more scientifically robust than has been presented in the IPCC reports.

When you look back in time, what where the most significant, exciting or surprising developments in atmospheric science?

The ability to monitor the climate system from space has provided a much better understanding of climate as a system. We also are developing an improved recognition of the difficult challenges we face in seeking to skillfully predict climate decades from now. In terms of negative developments, the bias in the funding of climate science research which tends to exclude perspectives that differ from the IPCC viewpoint is a major concern. Also, the introduction in the last 10-15 years of the publication in peer reviewed research papers of climate forecasts and impacts decades into the futures. Their publication subverts the scientific process since these predictions are not testable until after that time period has elapsed.

Is there a politicization of atmospheric science?

Very definitely. There is a clear intent, for example, in the climate assessment report process to exclude scientists who disagree with the IPCC perspective from research papers and from funding. This was exemplified in the CRU e-mails, but it is a much wider problem as I have documented on my weblog, testimony to the U.S. Congress and in Public Comments.

What constitutes "good" science?

"Good" science is completed when hypotheses are presented and tested with real world data to see if they can be refuted. Unfortunately, the IPCC uses multi-decadal global climate model predictions as a basis for policy action yet these model predictions cannot be tested since we need to wait decades to obtain the real world data. Even in hindcasts of the last few decades, these models have shown no regional predictive skill.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

Science needs to advance by following the scientific method. This needs to be independent of culture or any other external influence.

For further reading about the opinions and views of Dr. Pielke Sr.'s refer to his blog: http://pielkeclimatesci.wordpress.com/

References

Pielke, R., Sr., et al. (2009), Climate Change: The Need to Consider Human Forcings Besides Greenhouse Gases, Eos Trans. AGU, 90(45), doi:10.1029/2009EO450008.

The opinions presented in the interview do not necessarily represent those of the interviewer or the AGU.

Interview with Nanne Weber

Hans von Storch

Nanne Weber (1959) graduated with honours in mathematics in 1985 at the University of Amsterdam. She obtained her Ph.D. with a thesis on ocean waves in 1989 at the University of Utrecht and worked at the MPI-M in Hamburg (BRD) in 1990-1991, witnessing from close by the German Unification. In addition, she learned a lot about climate research. After that she worked at KNMI, specializing in paleoclimate modeling. Her research interests range from the last millennium to Milankovitch timescales. She worked in different KNMI divisions and was division head in 2001-2004, but decided to move back to research. She became part-time professor at the Faculty of Geosciences at Utrecht University in 2007, giving her inaugural address on February 29, 2008.

Nanne Weber participates in the Paleoclimate Modeling Intercomparison Project (PMIP), convenes a successful 'PMIP' session at the EGU General Assembly and is editor of Climate of the Past.

Nanne Weber.

Nanne, after being trained as a mathematician first and having studied the ocean waves after that, you are presently mostly working on paleoclimate. One would not call this a linear development but more a career with significant breaks and changes. How did that come about?

When I went to university I chose mathematics. I had no idea that something like climate studies existed. After graduation I looked around for a Ph.D. position in a field with more concrete subjects of study than mathematical objects and I found ocean waves. This was fun for some time, but when I became acquainted with the field of climate research (as a post-doc at the MPI-M in Hamburg), it appealed much more to me. I am not sure whether you should strive for a linear career. When you are young you are flexible and you can make these shifts. Climate research used to be a small field in the Netherlands and many people who are active in it have backgrounds in physics, mathematics, etc. Such a 'hard science' background is useful, but of course you need to catch up on topics like climatology, etc.

For most of your career you have worked at the Royal Netherlands Meteorological Institute (KNMI), which is a governmental institute combining climate and weather research with an operational Weather Service. Later, you became a part-time professor at the neighbouring Utrecht University (UU) – how do these two lines of work fit together?

KNMI likes to have some professors among its research staff, as this provides for natural links with the university. The UU, on the other hand, likes to have easy access to the modelling expertise at KNMI and its meteorological/oceanographic data. So, there are benefits on both sides. For me personally, there is a smooth transition between my two work places. At the university, I do some teaching and supervising of students. However, my students (Master and Ph.D.) often get a place to work at KNMI too, as they work with models that are developed at KNMI. So these activities are carried over to my KNMI office. In my own research, there are some topics which are typically 'KNMI'. This mostly has to do with contributions to reports commissioned by the government or public outreach projects. Contrary to general belief, there is quite some commercial consultancy work done by university staff so this type of work is not completely alien to my colleagues at UU. Apart from this, my research is a patchwork of interconnected projects not confined to one workplace.

There are still not many women among the 'higher' ranks, such as professors, department heads and the like. Are meteorology and climate science still 'male territory'?

Obviously yes. It is difficult to pinpoint down the reasons for this or to find the solutions. I had never been in favour of positive discrimination or quota until I had the following experience. I sat on a selection committee for a managing position and could not prevent a well–qualified female candidate being put aside and a less-qualified male being appointed. The psychology behind this process is very subtle (in this case it was a wish to maintain a monolithic team). I found that you can only fight such an attitude when there are more people involved who recognize the process. We put in complaints and pointed out to the 'higher levels' that they were going to miss their targets if they let go of talented women like this. When a similar position became vacant shortly after that, she was appointed. Since this experience I am all in favour of quota. This simple pressure works faster than re-socialising a whole generation of men. Once the women are there, the male establishment has to adapt anyway.

At the university I see that a dedicated effort toward promoting diversity has already increased the number of women in higher ranks. The self-evident support of this policy by the dean, department heads, etc., has created an atmosphere where diversity is the standard. This works especially well, because other cultural and ethnic groups are included.

What would you consider the two most significant achievements in your career?

Being offered a part-time professorship at the Faculty of Geosciences of the Utrecht University is definitively one. For me, this was a recognition of my efforts over the last decade to bring scientists working with paleodata together with modellers, to integrate empirical and model-based science and to put model-data mismatches on the research agenda.

The second achievement is a small set of my best papers. Their value for me personally has to do with the results that they describe, their level of recognition, and the fun of working with the people involved in that particular paper. One example is one of my papers on the glacial thermohaline circulation (THC) in the Atlantic ocean. For this paper we analysed mechanisms of the THC response to glacial conditions and found that there is no convergence among models, nor between models and data. So we understand little of past THC changes.

When you look back in time, what have been the most significant, exciting or surprising developments in atmospheric science?

The slow merging of on the one hand geography and geology, with their emphasis on data collection and phenomenological approach, and on the other hand, the climate modeling community that is primarily process-based and whose members identify with physics rather than geosciences. At least in the Netherlands these used to be worlds apart. But bridges are starting to be built and especially young people do not confine themselves to one discipline. This is an exciting development which will bring new research topics and challenges. Do we understand past Greenhouse climates? How (continues on the next page)

can we presume to be able to predict the future THC, if we do not understand its past behaviour? What is the role of solar and volcanic activity in explaining climate variations during the recent past?

Is there a politicization of atmospheric science?

It is more a politicization of some members of the scientific community than of the community as a whole. The public debate on global changes brings some individuals to extreme positions (either alarmist or skeptic), which are more based on politics than on science. This rarely leads to 'good' science.

What constitutes 'good' science?

Good science is science that inspires. Necessary conditions are scientific work that is transparent and solid, raises new questions, leaves room for doubt and alternative explanations, gives credit to and relates to earlier work. In addition, there should be an element of surprise, a spark which catches and keeps your attention.

What is the subjective element in scientific practice? What is the role of instinct?

Instinct helps in choosing the right topics and in sorting out the more and less relevant results. So there is definitively a subjective element. Everyone knows examples of papers in which they have discovered errors (in methodology, data, computations – you name it). But then in the end we have to admit that this paper contains 'good' science and the author is right on the concepts that are proposed. This is the best illustration I know of the power of instinct that some scientists have. Those of us who are less gifted in this respect obviously have to be very scrupulous and avoid any sort of error.

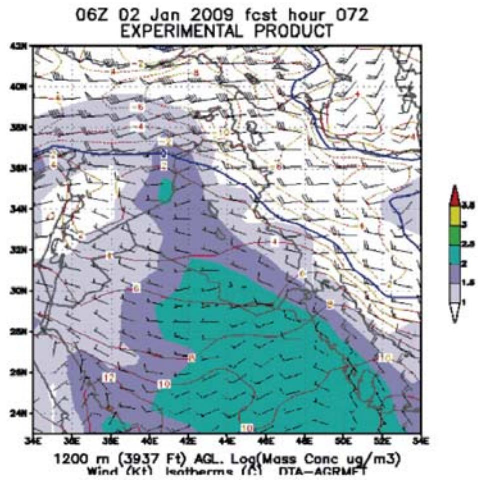
Nanne Weber in 1986.

The opinions presented in the interview do not necessarily represent those of the interviewer or the AGU.

Meteorology in the Military Part II: AFW Research and Development Program

Lt. Col. Neil Sanger, Lt. Col. Lee Byerle, and Yolande Serra

What research and development (R&D) is taking place within Air Force Weather (AFW)? To answer this question, we will take a look at some of the work being done by AFW's primary innovative development organization within the Air Force Weather Agency (AFWA), the 16th Weather Squadron (16th WS). The 16th WS is a center of excellence for development, implementation, and visualization of terrestrial, atmospheric and space weather models, displaying observational data, and identifying environmental impacts on future weapons systems. Its mission is to exploit cutting-edge technologies, science, and innovations to provide responsive, accurate, and relevant weather intelligence for military operations and other national agencies.



A 72 hour forecast of 1.2 km AGL dust concentration from DTA-MM5 valid 2 January 2009 06Z.

While the 16th WS is often associated with traditional, mesoscale weather modeling, They also develop and support a broad range of highly specialized models, which address specific environmental issues critical to military operations such as clouds, dust, ensembles, and even space weather. Additionally, they are creating a revolutionary web visualization tool hosted on one URL that provides dynamic interaction and Google Earth geo-locatable capabilities for all AFW data. Finally, they are the technical staff that supports AFWA's exploitation of meteorological satellite imagery and raw data.

The following is a synopsis of just some of the projects the 16th WS is undertaking in the areas of cloud forecasting, land-surface characterization, dust forecasting, and mesoscale and ensemble modeling:

Cloud Forecasting: AFWA uses the cloud depiction and forecast system, version 2 (CDFS-II), which produces cloud analyses for individual satellites and merges them together, along with conventional observations, into a Worldwide Merged Cloud Analysis. In addition, CDFS-II is responsible for three different techniques used in the cloud forecast models. These models are both user and forecast-time specific. Traditional numerical weather models, even when using complex microphysics, often fall short of the degree of accuracy in cloud forecasting required for the full spectrum of DoD operations. To that end, the 16th WS has developed a suite of cloud models that improve greatly upon numerical guidance. All of the cloud models leverage a real-time analysis from a mosaic of satellite imagery from multiple platforms.

The Diagnostic Cloud Forecast (DCF), for example, is a statistical model that correlates model predictors with actual clouds in the merged CDFS-II analysis, producing more accurate 12-hour to 3-day cloud forecasts than numerical models alone. DCF consists of two processes: the coefficient building process and the forecast process. The coefficient building process executes every three hours, creating linear relationships between cloudy pixels and the available forecast model predictors for a sliding 10-day period. The forecast process then uses the 10-day statistics and a multiple discriminate analysis (MDA) method to diagnose clouds from the forecast model predictor fields (Fig. 1). The forecast process is applied as a post-processor to WRF and is configured based on theater-specific configurations. DCF produces more accurate cloud forecasts beyond 9-12 hours and provides additional cloud information, including cloud base, cloud heights, and cloud type. The method quickly adapts to large-scale weather patterns due to the moving 10-day statistical period. DCF is a purely statistical model so its performance is directly related to that of the forecast model. Errors in the cloud analysis from the numerical model will propagate into the cloud forecast. Finally, DCF can produce a global or regional cloud forecast depending on the domain of the forecast model.

Land-surface characterization using the Land information System (LIS): over the past 5 years, the 16th WS has been closely collaborating with NASA's Goddard Space

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Looking for Editor-in-Chief

Our section is looking for a new Editor-in-Chief for this newsletter beginning January 2011. Duties include: collecting and distributing announcements of activities related to Atmospheric Sciences, Section news, interviews, scientific news, reports from meetings, and job announcements. You will manage a team of Contributor Editors and will decide about the contents of each issue.

If you desire to contribute to the AGU as an active part of our community in a engaging and interesting role, this is a good opportunity. You will participate in the Atmospheric Sciences Section and work with top researchers and leaders in the community. Also, you will develop communication skills and enjoy visibility among an AGU Section with more than 10,000 affiliates. We encourage your application. Open to everyone, this is an excellent opportunity for an advanced Ph.D. candidate or postdoctoral researcher. Part-time professionals might also consider applying.

To apply, send a statement of your background and interest in doing the job, along with a CV to Prof. Alan Robock (robock@envsci.rutgers.edu).

Interview with Alan Robock

Hans von Storch

A young Alan Robock, in Kauai in 1990.

Dr. Alan Robock is a Professor II (Distinguished Professor) of climatology in the Department of Environmental Sciences at Rutgers University. He graduated from the University of Wisconsin, Madison, in 1970 with a B.A. in Meteorology, and from the Massachusetts Institute of Technology with an S.M. in 1974 and Ph.D. in 1977, both in Meteorology. Before graduate school, he served as a Peace Corps Volunteer in the Philippines. He was a professor at the University of Maryland, 1977-1997, and the State Climatologist of Maryland, 1991-1997, before coming to Rutgers. At Rutgers he directs the Rutgers Undergraduate Meteorology Program. Professor Robock has published more than 290 articles on his research in the area of climate change, including more than 165 peer-reviewed papers. His areas of expertise include geoengineering, climatic effects of nuclear war, effects of volcanic eruptions on climate, regional atmosphere-hydrology modeling, and soil moisture variations. He serves as Editor of Reviews of Geophysics, the most highly cited journal in the Earth Sciences. His honors include being a Fellow of the American Meteorological Society and a Fellow of the American Association for the Advancement of Science (AAAS). Professor Robock is a Lead Author of the upcoming Fifth Assessment Report of the Intergovernmental Panel on Climate Change, which was awarded the Nobel Peace Prize in 2007. He currently serves as Past-President of the Atmospheric Sciences Section of AGU and Chair of the Atmospheric and Hydrospheric Sciences Section of AAAS.

You have important positions in both AGU and AAAS. What is the role of such organizations in times of climate change and the sometimes difficult interaction of policymaking, politics and science?

I am currently the Past President of the AGU Atmospheric Sciences Section and the Chair of the AAAS Atmospheric and Hydrospheric Sciences Section. The primary role of these societies is to produce excellent peer-reviewed journals to publish the results of our science. In addition, the other major role of AGU is to provide the Fall Meeting and other smaller meetings to enable scientists to meet, share their recent results, and organize new scientific projects. In addition, it is the role of both societies to inform the public and policymakers about the science we have produced in a form that they can understand. One mechanism is seminars in Washington, DC, for Congressional staffers and others working on policy issues. The AAAS Annual Meeting also serves this purpose, by presenting new science in a way that non-experts can understand.

It is not the role of the societies to advocate specific policies in response to scientific findings. But we need to make sure that our science is not misrepresented in policy discussions. And we need to defend scientists who are attacked for just doing their job. For example, it is important to issue a condemnation of Virginia Attorney General Kenneth Cuccinelli's ongoing attack on academic freedom at the University of Virginia, and in particular on the work of Michael Mann. It is also the role of our societies to advocate for funding for our scientific research and for improved science education throughout the school system from kindergarten through universities.

Some people see political adversaries at work, who want to undermine the authority of science, and advocate different world views, for instance creationists or climate change deniers. How should science deal with such challenges?

We have to deny the deniers. However, we are not trained as politicians or in public relations. And we do not have the massive budget available to those whose interest is in confusing the public about global warming, so they can continue to sell products that use the atmosphere as a sewer and produce global warming. The one thing we can all do as individuals is continue to produce good science. I think we also have an obligation to explain our science to community groups, schools, friends, and in the media. I offer courses and lectures at my university for non-scientists. I never say "no" when asked to give a talk at a school, at a senior-living center, at a Rotary Club, or on television. For example, I appeared on CNN twice in November, 2009, during the Copenhagen conference. Although the network found it necessary to provide people to debate the science with me, it was easy to counter them and I felt good

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about the opportunity to educate a much larger audience than I usually address. Through our societies, IPCC, and individually, we just have to continue to tell people about what we know. For our individual careers we have to publish in peer-reviewed literature. But for the good of the planet, we also have to inform the general public.

How do you see the role of the IPCC, for the public, for science and for policymakers?

It is the role of IPCC to assess the latest science and give an objective, non-political view of what we know and what we do not know, so that the public and policymakers can make informed decisions in response to climate change. The IPCC has a rigorous writing and reviewing process, which insures that all information is evaluated and considered without prejudice. Working Group I, The Scientific Basis, for which I am a Lead Author for the Fifth Assessment Report and which is now being written, has produced very detailed reports, with no errors that have been discovered. Minor errors in the last Working Group II report have been exploited by global warming deniers, but the entire report provides an excellent summary of the global consensus on climate change, and there are no other legitimate views that should be taken seriously. As for the impact on science, IPCC does not generate or drive science – it only assesses science, but questions it brings up do inspire curiosity-driven research. For example, the global climate modeling community is now conducting the Coupled Model Intercomparison Project 5 (CMIP5), the results of which will form the basis for much of the analysis in the Fifth IPCC Assessment, which will be completed in 2013.

Is there a politicization of atmospheric science?

When our science has policy implications, those affected, such as oil and coal companies, act politically. However, I have not found the process of science among scientists in my discipline to be politicized. Ideas advance on their merits, not based on who writes them or due to any outside influence. The editorial process works, by using peer-review, and serves to improve scientific content and communication of new ideas. As we all know, things sometimes slipthrough that later prove to be wrong, but the scientific process, by continuing to evaluate and question accepted ideas with new ideas and data, corrects such issues.

What constitutes "good" science?

Because new scientific knowledge that will be created is by definition unknown, and because the use to which scientific knowledge will be put cannot be known in advance, it is difficult to define a priori what is good. In my value system, scientists should work hard on topics about which they are curious, and publish their work so that all can be able to access the new knowledge. But if you find that your work can be used for what you consider to be evil purposes, then it is your obligation not to do the work. If you find dangers to society as a result of your work, it is your obligation to warn society of them. If you find positive contributions you can make from your work, it is good to work on those aspects.

What do you think about the relationship between science and media?

With a few exceptions, the media does a poor job of educating the public about science. I think that is because they do not see that as their job. Their job is to sell newspapers (or whatever the current medium is), and they do this by sensationalizing their stories. They exaggerate new results, rather than treating them as incremental hypotheses. They try to find conflict rather than agreement. And they are taught in journalism school that you need to show both sides of each issue. This is a fair way to treat political views, for example, but not to treat our field of endeavor, where by and large there is a consensus and agreement on basic understanding. In addition, science journalists are disappearing from major media outlets, and not being replaced. For some reason, editors think they need specialists to report on sports, but that general reporters can report on science. The result is quite uninformed news articles, often with errors, and a diminishing understanding of science by the public. Therefore, we need to seek independent means of getting scientific information to the public, and not depend on the media.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

Subjectivity cannot be removed from science. To start with, we make subjective judgments about what research to undertake. We make subjective decisions about stopping certain lines of research. And we make subjective choices about how much time to spend on our work, and on how to divide our work time on research, teaching, administration, and public outreach. Both scientific culture and different national cultures affect how we behave, and how scientific research programs are organized and funded. My feeling is that large organized projects such as those that develop satellite and other observing programs or general circulation modeling centers, with models, computers, and technical support, are crucial to science, but they also need to be combined with curiosity-based work by individual investigators and small groups. Instinct is important to recognize new concepts when analyzing data and model outputs. I am always inspired when I think of Ed Lorenz recognizing chaos when he got diverging results after repeating a calculation started with slightly different initial conditions.

What would you consider the most two significant achievements in your career?

The most significant achievement is my work on nuclear winter. In the 1980s, by running climate model simulations, doing studies of the impacts of forest fire smoke on surface temperature, and by writing about policy implications, I am proud to have been part of the team that warned the world of the danger of the use of nuclear weapons. Nuclear winter theory led to a vigorous discussion of the direct effects of the use of nuclear weapons and a realization that the nuclear arms race was crazy and dangerous, and that the use of nuclear weapons would be suicide. This led directly to the end of the nuclear arms race, several years before the end of the Soviet Union. Mikhail Gorbachev, then leader of the Soviet Union, described in an interview in 1994 how he felt when he got control of the Soviet nuclear arsenal, "Perhaps there was an emotional side to it…. But it was rectified by my knowledge of the might that had been accumulated. One-thousandth of this might was enough to destroy all living things on earth. And I knew the report on 'nuclear winter.'" And in 2000 he said, "Models made by Russian and American scientists showed that a nuclear war would result in a nuclear winter that would be extremely destructive to all life on Earth; the knowledge of that was a great stimulus to us, to people of honor and morality, to act in that situation." [Robock and Toon, 2000]

I am now working with Brian Toon and other colleagues to warn the world that the current reduced American and Russian arsenals can still produce nuclear winter, and that even a nuclear war between India and Pakistan could produce climate change unprecedented in recorded human history. We are frustrated that people are not paying as much attention to our results as people did previously, but I was honored in September, 2010, by an invitation from Fidel Castro to come to Cuba and give a talk about nuclear winter. He listened for an hour to my talk and then wrote extensively about the need to rid the world of nuclear weapons. For the story (continues on the next page)

of my trip, please visit: http://climate.envsci.rutgers.edu/Cuba/

The other most significant accomplishment is my contribution to the understanding of the effects of volcanic eruptions on climate, including the winter warming phenomenon. These results are summarized in my most highly cited paper, Robock [2000], and since then I have continued to work with my students on this topic by producing an update ice-core-based time series of volcanic forcing for the past 1500 years and to better understand the effects of high latitude eruptions.

When you look back in time, what were the most significant, exciting or surprising developments in atmospheric science?

In 1974,when I was a graduate student at MIT and my Masters' advisor, Norman Phillips, left, I talked with other faculty members looking for an advisor and Ph.D. dissertation topic. Ed Lorenz told me, "Climate would be a good field to get into these days." It was brilliant advice and I was lucky enough to follow it. I found in my Ph.D. dissertation that increasing CO_2 would affect future climate and published the first transient climate model simulation of the effects of CO_2 on climate [Robock, 1978]. What is surprising and exciting to me is how this topic has slowly, and now more rapidly grown to become a dominant issue for the planet. It is the subject of international negotiations, political campaigns, criminal theft of private emails, and multi-million dollar lobbying and disinformation campaigns by multi-national corporations.

Another topic is the increasing skill of weather forecasts. When I was younger and told people I was a meteorologist, they said, "You guys are always wrong." Now they say, "Will it rain tomorrow?" Although we clearly understand that there is fundamental limit to predictability, accurate weather forecasts have become more and more an assumed part of people's lives for several days into the future.

Would you recommend that students go into an interdisciplinary degree program?

No. To work in an interdisciplinary or multidisciplinary or transdisciplinary field, first you need to have a discipline. Certainly progress in science depends on various members of a team contributing their own expertise, but each person needs to be an expert in a field. I would tell students to go deep into a narrow area, learn how to be a scientist, learn various techniques, such as data analysis, instrumental design, and modeling, learn how to write papers and proposals, and most importantly learn how to ask scientific questions. If a person becomes spread too thin at the beginning, they will not learn as well how to be a scientist. Only after becoming a scientist in a discipline can they contribute to an interdisciplinary team.

Signed photo of Fidel Castro Ruz and Alan Robock, September 14, 2010, taken in Havana after the nuclear winter lecture by Alan Robock.

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The opinions presented in the interview do not necessarily represent those of the interviewer or the AGU.

Douglas R. Worsnop: Kaufman Award winner

Anna B. Harper

Congratulations to Dr. Douglas Worsnop for receiving the Yoram J. Kaufman Award for Unselfish Cooperation in Research. As evidenced by his credentials, Worshop's research career and collaborations cover a range of disciplines and span many miles. He is the Vice President of Aerodyne Research, Inc. (ARI), the Director of their Center for Aerosol and Cloud Chemistry, and a Finland Distinguished Professor in Physics at the University of Helsinki. Worsnop is co-author of more than 200 publications, as of January 2010. He was named an AGU Fellow in 2007.

Worsnop earned a Ph.D. in chemistry from Harvard University in 1982, and then spent three years in Freiburg, Germany, as a Humboldt Fellow in physics. International collaborations have benefited his personal life, as well, because he met his wife while in Germany. In 1985, they moved back to the U.S. and Worsnop started working at Aerodyne Research, Inc., a private company that provides R&D services and advanced instrumentation in areas such as atmospheric and environmental science, energy and propulsion technologies. One landmark milestone in his career was developing the Aerodyne Aerosol Mass Spectrometer (AMS), which enables ambient field measurements of the chemical composition of sub-micron sized particles. His work with the AMS has created the opportunity for numerous collaborations.

As one nomination letter stated, "The AMS community is an amazing collection of people who work in Doug's spirit: together they improve the instrument, develop the science, share ideas, work openly and support each other."

Worsnop also enjoys advising and mentoring graduate students and post-doctoral scientists, something not usually available for people in the private sector, but his passion for these things has prompted him to pursue opportunities beyond Aerodyne's walls.

Another nomination reads: "Doug Worsnop stands for everything that the late Yoram Kaufman symbolized: altruism, enthusiasm, curiosity-driven science and the willingness to share it, and an unstoppable will to spend time with young and established scientists in order to help them do real and exciting science."

Worsnop made time in his busy schedule to tell us a little more about himself, as he (continues on the next page)

(http://www.ncdc.noaa.gov/snow-and-ice/nesis.php), and according to the RESIS the Jan. 10-11 storm was a category 2 (“significant”).

Severe winter storms garner a lot of attention. From a meteorological point of view, they can be complex and challenging to forecast. From the point of view of city planners, they can be well-anticipated but still overwhelming. And people of any profession can appreciate the beauty of a fresh snowfall, or the annoyance of lingering cold and deep snow. In a national sense, this winter has not been highly unusual, but severe winter weather has still had notable impacts on several U.S. cities.

Interview with Gabriele Hegerl

Hans von Storch

Dr. Gabriele Hegerl, Professor at the University of Edinburgh.

Dr. Gabriele Hegerl is a mathematician by training. She obtained a Ph.D. in applied mathematics, on a topic of numerical fluid dynamics at Ludwig-Maximilians University, Munich in 1992. She worked on detection and attribution of climate change at the Max-Planck Institute for Meteorology in Hamburg to 1997, and then spent two years at the Department of Atmospheric Sciences at the University of Washington, Seattle, US, under a Feodor Lynen Fellowship by the Alexander von Humboldt Association. After research positions at Texas A&M University and Duke University she moved as a reader to the School of GeoSciences, University of Edinburgh in 2007 and was promoted to Chair of Climate System Science in 2009. Gabriele has contributed to the last three Intergovernmental Panel on Climate Change Assessment report, to the last one as Coordinating lead author and member of the summary for policymakers writing team, and is a lead author in the upcoming 5th report. She also serves and served on many research committees (US Climate Research Council, CLIVAR expert teams) and advisory board. She is married and has two sons.

You have "moved" in different ways. Once from mathematics to atmospheric sciences, from Bavaria over to Hamburg, and then from U.S.A. to Scotland. Would you like to comment on these moves? Was is random walking or did you have an agenda?

I have indeed moved a lot although I definitely do not enjoy the process of moving! I applied to the Max-Planck Institute in Hamburg because the research topic of climate change interested me. I studied mathematics in Munich and pursued a Ph.D. there in numerical fluid dynamics. In my free time I had done a lot of hiking and skiing in the mountains, and I was surprised that the glaciers were often quite a bit further up the mountain compared to their position on the relatively old maps my friends and I had rented for our outings. That made me curious about climate change, which was just beginning to be discussed by the general public. And climate models also seemed wonderfully complex applications of numerical fluid dynamics. My time at Max Planck Institute was wonderful, and I never regretted my decision to go there, although it meant to accept a temporary position far from Munich rather than a permanent position in Munich. I applied fingerprint methods to recent observed temperature trends under the really inspiring guidance of Klaus Hasselmann and Hans von Storch, and what I learned there, for example, on the origin of low-frequency climate variability, and about statistical techniques in climate research, still influences me today. I also collaborated with climate modellers, for example, Uli Cubasch, on analyzing recent model simulations. This collaborative work environment in Hamburg was quite different from the environment during my Ph.D. and I found that to be much more fun. The next move then was to Seattle, on a Feodor-Lynen fellowship from the Alexander von Humboldt Association. My goal was to learn more about climate dynamics and the atmosphere. Also my husband to be was an American, so a move to the U.S. seemed like a good plan. The moves after that were all attempts to find suitable positions for two people at the same time, which was quite difficult – both at Texas A&M and at Duke I was on a soft-money funded research position, which on one hand gave me a lot of freedom to pursue my own research agenda, and to reduce my working time while my children were very small. On the other hand, I could never be quite sure what would happen when the next grant ran out. The move to Edinburgh offered a permanent position for both my husband and me. The fact that Edinburgh is back in Europe and closer to my family made the decision easier.

So the agenda behind moving was first one, then two careers in science. It was always hard to uproot and move on, particularly later, once we had children. It is of course a big adventure every time, and every move broadens one’s perspective – things are done differently than at home in other countries and other work environments, and that questions one’s prior assumptions and judgements, which I found quite a broadening experience.

How is the situation of females now in atmospheric sciences? Has the situation improved in the last ten years?

I think there is more consciousness now, compared to the beginning of my career, that there are a number of inequalities which are quite pervasive and not easy to overcome. There are now quite a few top female scientists in influential and highly respected positions. There is also a more widespread realization that diversity, not only in gender but also other aspects such as nationality and background, is an advantage. However, the representation of women in top positions is still limited; for example, many departments have only a small fraction of female professors.

Women have a number of difficulties to overcome. Much more often than men, women take breaks or sharply reduce hours when having small children. I have done that as well, and it was very rewarding but also a bit scary to realize that I was competing for funding and positions with people with very straight careers without interruptions and complications, people who could easily work long hours and pursue anything they wished to pursue. At the same time I felt I had to prove to myself that I am not a ‘Rabenmutter’ and that my wish to continue my research career did not short-shrift my children. I had very good at-home childcare. I still pick up from school one day a week almost every week, and I used to stay home first several, then one day per week to spend time with my kids, their friends, and attend playgroups and music classes. A science career is in many ways more flexible than corporate jobs, and allows working whenever it’s feasible, during naptimes, and at night after the children are in bed. I also found my family to be a wonderful balance for the pressures of an academic career.

I realize that there are also men who are closely involved in rearing their children, and know cases where a father is the primary parent, but the majority are still women. A higher percentage of women in positions of leadership may help to raise consciousness of the need to balance family and work, and convince people that unorthodox work hours do not mean lack of commitment.

Integrating family and children is, of course, not the only problem women face. I believe (and I have seen occasionally studies that seem to support this) that on average, women express themselves differently, and prefer collaborative to competitive situations more than men. This is sometimes interpreted as weakness. I have sometimes felt ignored with suggestions only to hear a male's identical suggestion enthusiastically welcomed. That experience seems not to be unique to me. There also sometimes seems to be a prejudice of what makes excellent science – the lone author paper challenging prior beliefs is still valued particularly high in some circles. I find collaborative papers, maybe with an interdisciplinary authorship, that address an interesting problem as completely as possible, at least as useful type of science, and one that I enjoy more.

Throughout my career, I have encountered wonderfully supportive colleagues, men and women, who encouraged and supported me. As more women make it further up the top (and that seems to be slowly happening), I hope that their skills will be better and wider appreciated. But there is still a way to go. Until then, it is important to encourage and support a diverse set of colleagues and enjoy the breadth that comes with it.

You worked for a while for a large international company - why did you move back to science?

My Ph.D. thesis was supported by the research department of Siemens AG in Germany. The Siemens research campus in Munich is a research environment, although under a corporate sponsorship, and with more applied priorities. Some of my colleagues there were scientists at heart as much as my university colleagues, but that was less the case for the leadership. When I interviewed for "regular permanent and pensionable" positions after my Ph.D. I found that the corporate world away from research just didn't attract me to the same extent that science did. After moving to the Max-Planck Institute I appreciated how much difference it makes to have an outstanding scientist rather than an administrator to lead the research groups – I found that environment fantastic.

What would be your advice for a young female student, who has to decide about going in to science?

My main advice to her would be to follow her interest and do what she would like to do most, irrespective if it seems rational, logical, or straightforward. My winding career path via mathematics and Max-Planck Institute, into the U.S. and back to Europe is an example of this working. My second advice is to find a supportive mentor whom she can trust and

At home: Gabriele and her son.

whom she can ask for advice on career questions. I found it incredibly important to be able to vent and worry aloud, and I had some wonderful, female and male, mentors. And then there is the not-quite-serious advice that it would help to find a mate with a moveable career....

What would you consider the most two significant achievements in your career?

I am quite proud of my work estimating the human contribution to late 20th century warming, and attributing it to greenhouse gas increases. I wrote one of the first papers showing that late 20th century warming trends were highly unusual in pattern and magnitude compared to long-term trends that can occur due to internal climate variability. The follow-up paper used several fingerprints to distinguish between climate change caused by different external drivers, for example, greenhouse gas forcing, aerosol forcing and solar forcing. Our paper introduced a new method to attribute climate change to causes which is, after excellent later modifications by Myles Allen and Simon Tett, still the main method used for this purpose.

I worked on a number of other topics, including changes in climate extremes, causes of climate change in the last millennium, estimating climate sensitivity. The latter was a fascinating and challenging topic and I would still like to improve on it. I am also proud of my contribution to the IPCC 4th Assessment report. I was coordinating lead author and member of the summary for policymakers writing team. Working on the IPCC report was an amazing experience, scientifically very rigorous, Susan Solomons leadership was outstanding, and I learned lots from the excellent group of colleagues that worked on that report.

When you look back in time, what where the most significant, exciting or surprising developments in atmospheric science?

I am not sure I can speak for atmospheric science as a whole. In terms of climate science, I find the increasing confrontation of models with data from longer timescales fascinating. Investigating to what extent models can reproduce changes in climate at times when the climatic mean state was quite different, and the forcings were different is a very useful test of climate models. The uncertainties are large of course. Related to that, I also find earth system modelling an amazing step forward. If we better understand the role of vegetation and carbon cycle changes in the past, this will give much better confidence into predictions. Another interesting development was the recognition in the late 90's that climate change is affecting modes of variability, and recently, that it is affecting precipitation and extremes.

Is there a politicization of atmospheric science?

No doubt climate science is politically relevant. The question of how to address climate change is a very difficult one, and one that needs input not only from climate scientists, but also economists, energy specialists, humanities, and much more. Therefore, climate scientists don't have all the answers. We have answers about the observed and projected changes in climate assuming certain emission scenarios, and some information about how much of a problem climate change might turn out to be, on what timescales it is reversible, and how much change to expect.

For me, this means that I am happy to provide scientific input, for example, through the IPCC, but I also believe it benefits the discourse if scientists avoid making direct policy recommendations, since we will not have all the information necessary for a good decision. On the other hand, it is important to try to ensure that the public and politicians are informed in a rational and effective way about what our scientific findings mean for them, and for the generations to follow. As a publicly funded scientist I believe it is my duty to provide information to society, via committees like the IPCC, and also via the media.

So, to address the question: of course the results of climate science are politically relevant. Although that makes it difficult to keep politics out of it, I believe that society and science benefit from some level of separation of science and politics. That is true for climate science to the same extent as for other sciences.

What constitutes "good" science?

Good science to me is asking an interesting question that can be addressed, and answering it objectively and rigorously. Identifying the interesting and important questions is a key part of good science and may well be the most important step. Good science means that the scientist is open-minded about what the answer may be, and sceptical about his or her theories. It should be welcomed when data raise questions about a theory or method, because that means we are about to learn something new and surprising, which after all makes science so much fun. A good scientist also should have not just a narrow problem in mind, but the broader context of a problem, and find and emphasize the most important aspect of a problem.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

Instinct is very important – I followed my instinct in the somewhat twisted way my career went, and many people call it "gut feeling" that a result is right, or that something is either wrong or missing 'instinct'. I am not sure it is instinct – I think our mind processes a lot of information in a semi-conscious manner and so we cant always point the finger at what looks wrong, but this 'instinct' that something isn't right often means that this contradicts other information we have. Society and culture may influence to some extent what questions we ask and how we ask them. But I also know that there are absolute truths – things that can be logically shown to be true, hypotheses that are supported by data, hypotheses that are not, or statistically unlikely to be, reconcilable with the data. Also, the scientific community as a whole, who continues to challenge each other and compete with each other, minimizes in my view the role of culture and the subjective element.

The opinions expressed in this interview do not necessarily represents those of the reviewer or the AGU.

An Indo-Norwegian Research Collaboration on Climate Change

Mesquita, M.d.S.[1,2], Veldore, V.[3], Bhadwal, S.[3], Jansen, E[1,2], Bhardwaj, S.[3],, and Machineni, N.[3]

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[3] The Energy and Resources Institute, India

In today's climate discussions, challenges persist to follow sustainable development due to different factors such as: large scale regional variations in availability of observed datasets for validation at desired scales, limited understanding and capabilities across regions in the quantification of observed climate change, present day climate variability and future expectations of the change. The latter could in turn have a high impact on the development pathways aimed for a sustainable future. We are presently in an era where the quantification of climate change impacts is essential and intrinsically linked with all life forms on Earth including ecosystems and livelihoods.

A special event in The Delhi Sustainable Development Summit to discuss the status of the Indo-Norwegian project. Delegates from Norway and India were present. Photo source: TERI, India.

The challenges of climate change

The challenges in today's global climate system can be mainly attributed to tipping points of different impacts due to climate change induced by human interventions. The progress in this direction would be to assess the nature of the tipping point, whether it is going to increase the occurrence of extremes or to change the intensity and the pattern of occurrence. The WMO (2010) report shows a snapshot of different spatial regions, where the increase in extreme events has been very prominent in the last decade. The assessment of these extremes, using state-of-art Earth System models, can provide feedbacks of all the processes in the Earth System to pave the way forward.

An Indo-Norwegian Project

In this context, an initiative has started between the frontier scientists at the Bjerknes Centre for Climate Research (BCCR) in Norway and The Energy Resources Institute (TERI) in India. The aim is to increase the understanding of the Earth System processes that would further facilitate impact assessments with finer resolution information to approach towards defining adaptation strategies. India, a developing country, is extremely vulnerable to changes in climate owing to the fact that a large part of the population still relies on climate sensitive sources for a living. As part of this project, a special event was held during the Delhi Sustainable Development Summit 2010 to discuss the initiatives and the requirement of improved climate projections both at the global and local scales, for better impact assessments within the Indo-Norwegian project.

Professor Eystein Janse, Director of BCCR and Professor Arabinda Mishra, Director of the Earth Science and Climate Change Division at TERI shared their views on the importance of this project for future collaborations between Norway and India, and the value addition and capacity building required in a developing country like India for better impact and vulnerability studies.

This Indo-Norwegian project makes use of the Norwegian Earth System Model (NorESM) for the global simulations. The project is also aimed at downscaling the NorESM data using the Weather Research and Forecasting model, a state-of-the-art dynamical downscaling model developed at the National Center for Atmospheric Research in the United States. The model simulations will make use of the new AR5 scenarios of the Intergovernmental Panel on Climate Change. These scenarios are called Representative Concentration Pathways (RCP), which represent the radiation imbalance on top and discover a valuable mentor in you. Thus, mentors need to recognize the importance of their personal interactions with the students and the impact of their behavior on the students. Students' experience in their mentor's hands shape their scholarship and reinforce their commitments to their cause.

Remember a mentor is many things rolled into one: Advisor, Teacher, Role Model, and a Friend. A good mentorship emphasizes compassion, self-discovery and empathy, and has power to significantly impact lives long after students finish their internship.

And above all realize this: a student is like a pumpkin seed, which becomes a fruit only under the right conditions! Each person has a unique gift of shaping the future.

Interview with Bette Otto-Bliesner

Hans von Storch

Dr. Bette Otto-Bliesner, Senior Scientist at NCAR.

Dr. Otto-Bliesner is an atmospheric scientist by training with her degrees from the University of Wisconsin-Madison. Her career has spanned synoptic meteorology, climate diagnostics, and climate change modeling, and has included teaching, research and community service. Her early research focused on the development of a climate model of intermediate complexity, which she used to understand the modern climate system and past climate change. Before returning to NCAR in the 90's, she was on the faculty in the Geology Department at the University of Texas at Arlington. She is currently a Senior Scientist in the Climate Change Research Section of the Climate and Global Dynamics Division at NCAR, where she is focused on development and testing, within the framework of the Community Earth System Model, of our understanding of past climate change to enhance the credibility of future projections. Dr. Otto-Bliesner has chaired the International Geosphere-Biosphere Programme, Past Global

Early period of Dr. Otto-Bliesner's career (1976) with left to right: Dave Williamson, Bette Otto-Bliesner, Akira Kasahara, Warren Washington, and Bob Chervin, outside NCAR, Boulder, Colorado.

Changes Project for the last 3 years and was selected to serve as Lead Author of the Intergovernmental Panel on Climate Change 4th and 5th assessment reports. She has been active in educational activities and is the Sigma Xi Distinguished Lecturer for the American Meteorological Society for 2010-2011.

Could you briefly sketch the different fields of atmospheric sciences, with which you have dealt over the years?

I started my career in the atmospheric sciences as an undergraduate at the University of Wisconsin in Madison working as a student assistant in the map room, posting the daily maps that were printed on a facsimile machine. This wall of maps was a focal point for discussions of the weather and so in my early years my main interest was in synoptic meteorology, mid-latitude weather, and thunderstorms. My Masters' thesis was with Donald Johnson, moving me towards climate diagnostics, and, of course, using his favorite isentropic coordinate system.

My path to climate modeling began when I worked with Warren Washington and the NCAR atmospheric general circulation model in the 1970s. The speed of the computers at that time only allowed us to run this grid-point model for perpetual months, January and July. This encouraged me to develop a spectral general circulation model (GCM) of intermediate complexity that could be used for seasonal cycle simulations. I returned to the University of Wisconsin Madison to work with David Houghton for my Ph.D. This model also provided me with my first foray into paleoclimate. John Kutzbach and I used it to test the role of Milankovitch seasonal variations in incoming solar radiation on the intensity of the Holocene Asian and North African summer monsoons.

My passion to understand past climates in terms of their forcing and feedbacks has led me to spend much of my career since then using GCMs, as they developed into more and more sophisticated climate models, for this purpose. While in the Geology department at the University of Texas-Arlington, I concentrated on deeper times in the past, modeling the roles of tropical mountains for the formation of the Appalachian coal beds, vegetation on polar warmth in the Cretaceous, and continental position on the hydrological cycle. Since returning to NCAR in the 90's, my research has concentrated on paleoclimate modeling of glacial and interglacial periods of the last 130,000 years and recently also the last millennium.

You paused your employment for a few years for having time for your children. In retrospect, was that the right decision? How difficult was it to "come back"?

Actually I never paused my employment but I did work varying amounts of part-time. This did make it difficult at times for the evaluation of my productivity as compared to those who stayed full-time since the standard is often publications per year since PhD. My part-time status was somewhat necessitated by the challenges of childcare but my non-traditional career path was much more necessitated by the challenges of two-career family. My move to Texas for my husband's career meant I left research for a while and did some consulting and teaching. I also learned a lot more about geology. In the end, this detour gave me a much broader perspective of past climates.

How is the situation of females now in atmospheric sciences? Has the situation improved in the last ten years?

The numbers are increasing. We are starting to have women in top positions – i.e. Susan Avery as President and Director of the Woods Hole Oceanographic Institution, Jane Lubchenco as Administrator of the National Oceanic and Atmospheric Administration, and Marcia McNutt as Director of the United States Geological Survey, but women in these top positions are still few in numbers. As more women are asked to serve on committees and panels (a good thing), there is the challenge to balance this service with research and/or teaching. And it is still requires flexibility and compromises to find the best situations for both partners in two-career families. Although the situation is much improved for women in the sciences, studies have shown that there are still subtle inequalities which remain.

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What would be your advice for a young female student, who has to decide about going into science?

Passion is key as in any field. So if you have a passion for atmospheric science, it would be great to have more women choosing it as their career path. Many jobs in the sciences allow flexibility, which is great for balancing work with family. I would highly recommend that the preparation for a science career also includes a good emphasis on communication skills – writing, conference presentations, and the media. Also studies have shown that there are different communication styles between males and females so understanding these differences can make your interactions more effective.

What would you consider the most two significant achievements in your career?

I am proud that I have been involved in using numerical models from their early stages to now to understand the climate processes and mechanisms that explain what we see in the paleo-proxy record from the very deep time of the Carboniferous 300 million years ago through glacial-interglacial periods to the recent last millennium. Since my early days as a participant of COHMAP, I have found that an interdisciplinary approach with close interactions with researchers in the proxy data community has allowed me to achieve the most complete understanding. My recent collaborative work to understand the impact of climate forcings on the Last Interglacial sea level rise and on the evolution of climate during the last deglaciation are two significant achievements for which I am quite proud.

And second, the opportunities to promote the relevance of paleoclimate for understanding climate change, past-present-future, to the wider community is also an achievement that I consider significant. I was asked to chair the AGU Paleoceanography and Paleoclimatology Focus Group when it was first formed in 2002, and have taken leadership roles in IGBP PAGES and the Paleoclimate Modeling Intercomparison Project. I am especially pleased with my roles as Lead Author in the 4th and 5th IPCC assessments.

When you look back in time, what were the most significant, exciting or surprising developments in atmospheric science?

Very exciting in climate research has been the development from atmosphere-only models, to coupled atmosphere-ocean models, to climate models, and now to Earth System Models. At the same time, computers have become more and more powerful. We can now run very long simulations and can explore feedbacks that heretofore have had to be prescribed as forcings. Our first simulations of past climates required us to specify sea surface temperatures, either assuming conditions not that different from today or using reconstructions such as CLIMAP. With the coupling of the oceans, we could then allow the ocean temperature, salinity, and circulation to respond to the forcings, and explore whole new questions such as the stability of the thermohaline circulation. Climate models have allowed us to simulate rather than prescribe changes in sea ice and vegetation. And now Earth System models are letting us explore the growth and demise of ice sheets and changes in the carbon cycle. These developments have allowed paleoclimate research and modeling to more completely explore the mechanism responsible for changes seen in the paleoclimate records.

Using modeling developments together with the data has allowed significant progress in our understanding of the importance of regular variations in the Earth's orbit around the Sun, the so-called Milankovitch cycles, on climate. Early modeling of the role of summer insolation anomalies on the regulating the past African and Asian monsoons has been greatly expanded to include the complexities of the interactions, i.e. between the Northern and Southern Hemispheres, high and low latitudes, and the oceans and continents. Climate models forced with Milankovitch insolation anomalies can now simulate the polar warmth and its effects on the stability of the polar ice sheets and sea level during the past interglacial and the subsequent glacial inception. There is still much more exciting future work to be done to more fully understand Milankovitch and climate with Earth System models and all their new capabilities to simulate rather than prescribe – dust, CO2, wetlands, permafrost, etc. A grand challenge for the future decade will be to simulate glacial-interglacial cycles with these models.

Is there a politicization of atmospheric science?

Science should provide the basis for good political decisions. Scientists should communicate their science in clear and honest ways so that the public and policy makers can make informed decisions. I guess that it is inevitable that atmospheric science has become somewhat politicized because it is relevant to the lives of people and the sustainability of the Earth.

What constitutes "good" science?

Good science advances our understanding. It can be paradigm shifting or it can be incremental. It doesn't matter which, as long as the science is rigorous and honest.

The opinions expressed in this interview do not necessarily represents those of the reviewer or the AGU.

Writing in the "Cloud": how Google Docs can be used to write scientific manuscripts

Dr. Michel d. S. Mesquita[1,2] and Dr. Jüergen Bader[3]

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Cloud computing has become an ubiquitous term nowadays. It has also become part of new projects for storing and sharing climate data. Writing documents, preparing slideshows and spreadsheets have also made their way into the "cloud" world. One does not need to have a suite of programs installed on their computer to do that anymore - everything can be done or updated and stored online. Google has developed a set of products in the "cloud" that makes the collaboration process a lot easier. Your document is always updated. Collaborating on scientific papers could not get any better than that!

Writing Scientific Manuscripts

Working on multiple-author manuscripts or proposals can be very time consuming when it comes to the writing/editing phase: a) creating a first draft file; b) sending it by email to the other co-authors; c) the co-authors then use "Track Changes"; d) the co-authors send the text back; e) the first author reviews the changes and creates a new draft; f) then the endless sending a file back-and-forth. The first author normally spends a lot of time putting bits and pieces of the text together - and they may sometimes miss some information in all of that.

Collaborating on a document in the "cloud" is different. Your text is always updated! Whatever a co-author writes, edits or does, your document is updated! When another co-author logs on to that document, they see the newest draft! Comments can be added along the way for the other authors to see. If two or more authors are logged to the same document at the same time, they can even chat with one another and they can see where each co-author is editing the text. No more sending a file back and forth via email!

One example of a scientific paper where the collaboration was mainly done via Google docs is the recently published paper by Bader et al (2011), "A Review on Northern Hemisphere Sea-Ice, Storminess and the North Atlantic Oscillation: Observations and Projected

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Interview with Dr. Mong-Ming Lu

Hans von Storch

Dr Mong-Ming Lu gave a talk at CWB open house (2011).

Dr. Mong-Ming Lu received her B.S. degree from National Taiwan University, and completed her Ph.D. at UCLA, both in Atmospheric Sciences. Her early research focused on studies of interannual variability of equatorially trapped waves and their excitation mechanisms. Before returning to Taiwan in 1992, she did post doctoral research at GSFC/NASA, University of Munich, and the Paul Scherrer Institute in Switzerland. She is currently the chief researcher in the Research and Development Center at the Central Weather Bureau of Taiwan. Her research interests include analyzing and interpreting climate data and building statistical forecast models, and she is the leader of the research team on climate forecast. She oversees the development of CWB's monthly-to-seasonal climate forecast system and the design of operational products. She has published papers on seasonal prediction of typhoon activity, East Asian summer and winter monsoons, and analysis of the climate/weather extremes in Taiwan.

Dr. Lu, you are a Taiwanese atmospheric scientists with the Central Weather Bureau in Taipei. Could you describe your current interests for our readers?

The main focus of my current research is weather forecasts beyond two weeks. I am not a numerical modeler. My research is to develop conceptual and statistical tools that can be used for making sense of, or making use of, the products generated by the numerical weather/climate forecast systems of the Central Weather Bureau (CWB). Another research interest is studying the variability of long-term climate. The CWB has maintained a high-quality meteorological observation record since 1896. I am interested in knowing how Taiwan's climate, especially the extreme weather and climate events can be influenced by the variations of major climate patterns, in particular over the Asian and northwestern Pacific monsoon region.

Being a Taiwanese scientist means to be cut off the international scientific "business" to some extent; there is no membership at WMO, and no participation at IPCC, for instance. How do you deal with this isolation?

Unfortunately, during the past forty years, "isolation" is indeed a cruel reality to governmental agencies in Taiwan. We need to be pragmatic in dealing with such isolation. For example, we pay for some services that are free to the "members", and we work closely with research communities for capacity building.

There are still not many women among the "higher" ranks, such as professors, department heads and the like. Are meteorology and climate science still "male territory"?

AMS Tropical Meteorology Conference in Miami, at Steve Lord's Home. From left: Nitta, Lu, Esbensen's wife, Yanai, Esbensen, and Lord, Lord's wife and Lloyd Shapiro (1983). (Curtesy of the Michio Yanai Syposium Booklet)

The field of meteorology and climate science is rather small in Taiwan. In terms of the number of students and government employees, females may not be the minority. But in the "higher" ranks, it is certainly still mostly "male territory". I think the main reason is due to lack of interest or ambition. Most women I know who are trained in atmospheric science tend to put family at a higher priority than science or career. This often extends even beyond their own family of origin, to the family of the husband. Being a professor or department head implies depriving a woman of the time for her family or relatives. To settle in a more family centered life is much more preferred by most women.

Science is a cultural practice - and the Chinese culture differs strongly from the western culture - therefore the question: Is there a specific Chinese way of doing science?

It is not easy to define "Chinese culture" in Taiwan, as there are different roots and elements. In addition, Taiwan is strongly influenced by Japanese culture in doing science, particularly during the years before 1980s. Since the 1980s, many scientists trained in the United States have returned to Taiwan for faculty positions at universities. The American way of doing science gradually became Taiwan's mainstream. Even so, I think the cultural factor is very deep. For example, Taiwanese generally like practical or applied topics much more than theoretical or philosophical ones. Besides Chinese cultural influence, this preference is further rooted in the island and immigrant culture of the Taiwanese people.

What would you consider the most significant achievement in your career?

I feel the most significant achievement in my entire career is leading a team to establish the first monthly-to-seasonal dynamical-statistical climate forecast system at the CWB. Actually, I did not feel this way in the beginning. On the contrary, I often thought of my work as insignificant, since it was more or less a repetition of what has already been done at other leading operational centers. The forecast system we built is a multi-model multi-member ensemble forecast system, which generates the monthly and seasonal forecasts for the global atmosphere, with lead times of one to nine months. It also produces the categorical probabilistic temperature and precipitation forecasts at nine weather stations in Taiwan. The station forecast is done by a statistical downscaling module depending on the global forecast. The forecast calibration and evaluation are based on 25 years of retrospective forecasts. It took eight years (2002-2009) for us to establish the system. The operational run started in January 2010. After seeing the steadily produced forecast information, I began to realize the significance of the project. With the capacity of producing forecast information, CWB can on the one hand be an active promoter of monthly-to-seasonal forecasts for potential economic and societal applications, and on the other hand, be an active participant in the forecast business.

When you look back in time, what where the most significant, exciting or surprising developments in atmospheric science?

Looking back, I think the progress in numerical weather and climate prediction is the most significant, exciting and surprisingly successful in atmospheric sciences. I went to UCLA in 1980 to study equatorially trapped waves with Professor Michio Yanai. When my first paper was published in 1983, we used the dataset of 200 mb level winds of the latitude belt 25^{o}S-45^{o}N for two summer seasons of 1967 and 1972. The data was objectively analyzed by Professor Krishnamurti and his associates at Florida State University. At that time, it was the best dataset to our knowledge for studying planetary scale tropical waves. When FGGE Level III-b data became available in early 1980s, I witnessed an exciting period, during which some previously conjectured wave characteristics by few sounding stations were confirmed and detailed by the multi-variable multi-layer global data. The revived

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interest in Madden-Julian oscillation and its influence on the intraseasonal variability of Indian monsoons is one example, and the new research excited by the 1982-83 El Niño event is another. Think about the availability of so many fine-quality reanalysis datasets we have now. It is already an incredible achievement that would have been hard to imagine in the early 1980s. Although to forecast Madden-Julian oscillation remains a challenge today, history teaches us that pushing further to extend the forecast by one or two days can achieve much greater things than mere forecast.

Is there a politicization of atmospheric science?

In a democratic political system, the governmental power is legitimized by the agreement of the governed through election. In this sense, in any democratic country, being completely free from "politicization" seems impossible. The agenda perceived by the political entity will have influence on science, in particular the more publicly visible atmospheric science, and in places like Taiwan where typhoons and other natural disasters abound.

What constitutes "good" science?

Science helps people to think logically and to understand what the truth is. I think "good" science constitutes of facts and logic. Good science carries the power of revealing some simple rules that can be widely applied.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

Instinct and practice are cultivated by culture deeply. Culture and tradition can influence all aspects of human behavior, including science practice. I think the ability to think rationally and the belief in truth are important subjective elements in the practice of science. Such elements can be influenced by education and religion.

The opinions expressed in this interview do not necessarily represents those of the reviewer or the AGU.

Studying Boundary Layer and Air Quality Processes in a Suburban Environment

Everette Joseph[1], Kevin Sanchez[2], David Doughty[2], Demetrius Venable[1], Jose Fuentes[2], Rasheen Connell[1], Qilong Min[3], and Belay Demoz[1]

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Over the past ten years a unique multi-institutional and multi-agency partnership has endeavored to develop an observing program at the Howard University Beltsville Campus (HUBC) to study planetary boundary layer (PBL) processes in an evolving urban-rural interface that are particularly relevant to numerical weather prediction (NWP), and climate and air quality prediction. A second but equally important goal is training students with emphasis on understanding atmospheric processes through extensive experience with state of the art atmospheric observing systems and analytical methods. To these ends a suite of core observing systems have been deployed at HUBC. Government sponsors include NOAA, through the NOAA Center for Atmospheric Sciences at Howard University (NCAS), NASA through the Beltsville Center for Climate System Observation (BCCSO) – a NASA University Research Center (URC), and the Maryland Department of the Environment (MDE). University partners include Pennsylvania State University (PSU), State University of New York at Albany (SUNYA), University of Maryland Baltimore County, University Maryland College Park, University of Virginia at Charlottesville, and others. The 2008 National Academies study "Observing Weather and Climate from the Ground Up: A Nationwide Network of Networks" by the Board on Atmospheric Science and Climate called for a national effort to improve understanding of PBL processes for the purposes of NWP and air quality predictions. As noted by the study the effort at Howard University and its government, industry and university partners may represent a model of the types of partnership and focus that could be replicated toward this and other areas of national need. The following highlight accomplishments this past summer.

During summer 2011 an intensive observing period (IOP) was conducted at HUBC primarily focused on understanding processes that influenced local air quality. Although air quality was the focus the opportunity to leverage other research objectives was fully exploited.

The NASA Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER AQ) experiment was a central feature of the IOP. The scientific objectives of DISCOVER-AQ are to: relate column observations to surface conditions for aerosols and key trace gases (O3, NO2, and CH2O); characterize differences in diurnal variation of surface and column observations for key trace gases and aerosols; examine horizontal scales of variability affecting satellites and model calculations. DISCOVER-AQ measurements strategy included the deployment of aircrafts (NASA P3B-Orion and B-200) and surface sites with in situ and remote sensing instruments to acquire systematic and concurrent observation of column-integrated, surface, and vertically-resolved distributions of aerosols and trace gases as they evolve throughout the day with respect to air quality. Details on DISCOVER-AQ can be found at http://discover-aq.larc.nasa.gov/.

The HUBC was one of six sites that provided ground support for DISCOVER-AQ. Coincident with profiles of the NASA P-3B over HUBC, meteorological and ozone sondes were launched and a moored balloon was flown to provide profiles of volatile organic compounds (VOC), ozone and size resolved aerosol concentration. Four Lidars systems were deployed at the site. Continuous observations were recorded of surface trace gas concentrations, size resolved aerosol concentration, column integrated quantities from Multi-filter Rotating Shadowband Radiometers (cloud and aerosol), AERONET (aerosol) and Pandora (trace gas) sun photometers, and much more. Science and measurement objectives of DISCOEVER-AQ are synergistic with BCCSO and NCAS. Additional research pursued during the IOP, however, include for example studies to understand, monitor and inter-compare the evolution of the PBL properties from multiple sensors (Lidars, wind profiles, microwave radiometers, etc) and to understand aerosol-cloud interaction. A subset of the research conducted is highlighted below.

VOCs in Urban-Rural Environment

One of the unanswered questions for both air quality research and climate science, is the chemistry that occurs when rural and urban air masses interact. In theory, NOx limited air from the rural areas could mix with VOC limited air from the urban environments, and produce high amounts of ozone and other oxidants, but other factors, such as increased deposition and advection of cleaner air masses, also play an important role. In addition to the direct impacts of poor air quality, some of the eventual reaction products of VOCs are oxygenated compounds that have a low vapor pressure, allowing them to condense and cause

Figure 1: The PTR-MS operating in the shed at Beltsville, M.D.

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A G U A T M O S P H E R I C S C I E N C E S

Atmospheric Sciences Section of AGU Newsletter

Volume 5, Issue 4 November 2011

Interview with Dr. Thomas Knutson

Hans von Storch

What would you consider the most two significant achievements in your career?

I think the two most significant achievements have been the cumulative works done in two areas: the modeling of hurricanes and climate and the climate change detection problem, combining models and observations. This work has been very much a collaborative effort involving a number of colleagues, especially at GFDL, and I am very grateful to have been able to work with these colleagues to achieve much more than I could have done on my own.

In modeling of hurricanes and climate we have shown that it is possible to dynamically downscale the year to year changes in Atlantic hurricane activity surprising well using large scale climate forcings together with a dynamical model. We've worked to leverage the GFDL hurricane model—an operational model used for short-term (1-5 day) weather prediction – to simulate how storms may become more intense in a greenhouse warmed climate. My work in climate change detection has focused on several areas. Gabe Vecchi and I worked to assess the reliability of past Atlantic hurricane counts based on the evolving density of observing ship traffic since the late 1800s,

and we find an effect large enough to change a highly significant increasing trend into a non-significant trend. Suki Manabe and I documented the presence of substantial multi-decadal modulations of El Nino amplitude in the GFDL climate models. If such modulation also occurs in the real world, then there is a great need for caution in interpreting changes of El Nino amplitude as trends as opposed to background internal variability. We've assessed the consistency between historical climate simulations and past observed trends in regional surface temperature using methods that are fairly accessible to non-specialists. This latter work supports IPCC's general conclusion that there is already a detectable human influence on regional surface temperatures due to increasing atmospheric concentrations of greenhouse gases.

When you look back in time, what were the most significant, exciting or surprising developments in atmospheric science?

First of all, it was exciting to be a part of the science research effort as the global warming issue emerged over time. Not only has it been fascinating to watch the observational evidence mount over time, it was striking to witness the progress being made in climate modeling and analysis, which led to increasingly strong evidence that humans were responsible for much of the observed global climate warming. Moreover, it has been interesting to watch as this problem expanded into other disciplines in the social and natural sciences, and to see the growing interaction of climate science with the policy/political/private sector realms. I think these trends will only continue over the coming decades due to the long time scales and continued growth of the problem as well as its international dimensions. Among the more surprising developments have been the many innovative and clever methods that the community has developed to tease information out of models and out of available data of all kinds to learn more about the climate system. For example, it's amazing to see how scientists can use even

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tiny bits of geologic "proxy" evidence to piece together a history of past climates; how satellite data, ocean measurements, ground-based measurement, balloon based measurements, etc. are used together to build a coherent picture of the climate system; how statistical and numerical methods are used to analyze data, initialize models, confront models with data, improve model performance, uncover problems with observed records, probe mechanisms behind observed phenomena and much more.

Is there a politicization of atmospheric science?

Yes, I would say so, with a familiar specific example being the greenhouse warming problem. As climate science began to have stronger and more immediate policy implications, and as a more earnest policy debate began about whether to attempt to control greenhouse gas emissions through governmental actions, the science community in turn began to experience increased interaction with the public, policy arena, and vested interest groups (e.g., private industry). Not surprisingly, these interactions have become more vigorous, politically charged, and at times confrontational—perhaps more confrontational than many climate scientists were expecting. Humans are still in the relatively early stages of experiencing the greenhouse gas-induced changes, and of reducing or quantifying the uncertainties about what future climate changes may occur. We're still in the very early stages in terms of adaptation responses and mitigation. Therefore, I expect these interactions between scientists and society will grow and evolve over the coming decades in even more interesting ways. That is, climate science will continue to interact strongly with the political sphere for a long time to come due to the very nature of the problems that we face and their linkage to society in terms of both impacts and mitigation efforts. The days where climate scientists could work in relative isolation from the political implications of their work have now come and gone, especially for those scientists who either take on problems of great interest to policymakers or who take a special interest in communication between climate scientists and the society at large.

What constitutes "good" science?

Knutson at Shenandoah in 1978.

Good science truly advances understanding, perhaps not by providing proof, but by providing evidence and objective assessment of the evidence that allows for more informed understanding of a particular issue or physical phenomenon. Good science can be done in pursuit of problems that either may or may not have strong implications for society (i.e., knowledge for knowledge sake vs more practical problem areas). I prefer working on those areas which I see as having strong societal implications, such as future climate change and understanding and predicting the anthropogenic and natural influences on climate. For these areas, the importance of the communication of science to the broader science, policymaking, and public arenas should be recognized. In addition to conducting and reporting on science activity leading to improved understanding, it is the responsibility of scientists working in these more societally focused areas to communicate in such a way that the main points and uncertainties are understood, but without stretching statements (in either direction) beyond what is scientifically justified.

What is the subjective element in scientific practice? Does culture matter? What is the role of instinct?

I do see there being a subjective element with instinct playing a role. For instance, consider that a typical scientist will live ~80 yr and spend ~40 yr working during a typical scientific career. This means that your time is a limited resource. Deciding how to spend this limited resource requires choices to be made: What problem should one undertake? What is the best approach to the problem? Are there some approaches that, while intellectually more satisfying, are likely to be either too difficult or time-consuming to realistically pursue, given one's access to resources. How should one divide one's time between research and other related activities such as teaching/mentoring/communicating/service to the community, etc.? When choosing science problems to work on, there may be naturally a tension between exploring 'off-beat' hypotheses in pursuit of a big breakthrough vs maintaining focus and discipline that can lead to incremental increases in knowledge. In these and other areas, I think instinct and subjective judgment are very useful for guiding one's choices.

How did you come into the field of atmospheric sciences?

I was intrigued by the possibility of studying global climate change and greenhouse warming for quite a few years before I actually took the plunge into atmospheric sciences. For me studying atmospheric sciences was in fact mainly a vehicle I would use to study the global warming problem. I first became aware of the greenhouse warming issue as a teenager growing up in the mountains of Virginia, as I recall, reading a newspaper article in The Washington Post on one of Suki Manabe's early CO2 sensitivity studies. The thought of working on something as important as global climate change--something that could affect the entire planet--was really exciting. Growing up the son of a geologist, I already had a keen interest in the natural world and some conception of what a dramatic role climate change could play in shaping the world through ice ages and the like.

Although I wasn't prepared to take the plunge into climate science right at that moment, this remained in the back of my mind as I began my undergraduate studies in computer science at

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Announcement

STUDENTS: At the Atmospheric Sciences and Global Environmental Change banquet, Tuesday night, December 6, we will show slides featuring student presentations at the Fall Meeting. For all the students attending, please download this PowerPoint slide, http://www.agu.org/sections/atmos/YourNameAGUbanquet2011.ppt , fill in your information, change the file name to add your name, and email it to Alan Robock at robock@envsci.rutgers.edu by the end of the day on Friday, December 2, and we will show your slide during the banquet. Even if you will have already given your talk or poster by Tuesday night, please send a slide so we can tell people about your work. We look forward to seeing you all then.

the University of Virginia. There I had an opportunity to elect a minor course of study, and after looking through the course catalog, I settled on Environmental Sciences. One particularly influential course I took was Bruce Hayden's Holocene Climates course, which was fun and just fascinating to me. Bruce covered greenhouse warming briefly in the course as well as all sorts of interesting paleoclimate topics. I told Bruce I wanted to pursue the topic of climate change in graduate school and he gave me a list of programs to consider. Among those, I eventually chose the University of Wisconsin and John Kutzbach's group, where climate change was studied within an atmospheric sciences department. That's actually how I actually ended up in the field of atmospheric sciences. Although I started out doing my graduate research and an initial stint at GFDL working on the Madden-Julian Oscillations-- and even had a brief period away from science research, where I pursued graduate studies in management-- eventually I settled back on the greenhouse warming problem as my main career focus. As it turned out, I was fortunate enough to secure a position in Suki Manabe's group in 1990 and enjoyed several years of work with Suki before he retired from GFDL.

What would your advice be for young scientists coming now and the coming years into the field of atmospheric sciences?

Let me answer this question rephrased as "into the field of global climate change". I think that climate scientists have a special role to play in society now and going forward. The role is to use the power of the scientific method to inform decision-making and promote good stewardship of the planet. If climate science, over the long term, is to maintain credibility as a scientific endeavor and be a trusted source to inform decisions, this means above all that we must present highest quality science in as fair and clear a manner as possible, neither shying away from presenting findings that may make some in our audience (i.e., the world) uncomfortable, nor "stretching the truth" to attain some objective. Perhaps the advice of Bertrand Russell, from a 1959 BBC interview, suits the question best:

"When you are studying any matter, or considering any philosophy, ask yourself only: what are the facts and what is the truth that the facts bear out. Never let yourself be diverted, either by what you wish to believe or by what you think would have beneficent social effects if it were believed. But look only and solely at what are the facts."

Source:
http://www.youtube.com/watch?v=g3jnEqXhDNI&feature=player_embedded#!

The opinions expressed in this interview do not necessarily represents those of the reviewer or the AGU.

Extreme rainfall frequency in the Atlanta metropolitan area: An analysis of September 2009

Laura Belanger

National Weather Service, Peachtree City, Georgia

Extreme rainfall across north Georgia during

Atlanta Floods (September 2009): Downtown Flooding of I85/75 Connector (top, photo from Glenn Dyke, top). Six Flags Over Georgia (bottom, photo from MSNBC).

September 18-23, 2009 resulted in historic, catastrophic flooding. The most intense rainfall occurred in a 24-period from September 20-21, with amounts exceeding 10 inches in a large area of the western Atlanta metropolitan. Ten people perished in Georgia as a direct result of the flooding, and damage amounted to more than $300 million. To capture the statistical significance of this extreme rainfall event, a regional frequency analysis was performed using observed rainfall data from more than 30 state-wide locations to develop theoretical extreme value distributions via L-moments. This analysis supports the initial post-event conclusion that the 24-hour rainfall amounts during September 20-21, 2009 were in excess of a 10,000-year rainfall event.

Event Background

The September 20-21, 2009 extreme rainfall event fell within a prolonged rainy period for the Southeastern United States. Moisture from both the Atlantic Ocean and Gulf of Mexico contributed to a saturated atmosphere as a stalled upper-level low pressure system over the lower Mississippi River Valley began to lift out on September 20, 2009. A series of mid and upper-level disturbances moved over the area, providing a focus for shower and thunderstorm development (NOAA 2010). Precipitable Water (PW) values exceeded 2 inches at the peak of the event – more than two standard deviations above normal.[1] The combination of anomalous moisture and a strong low-level jet provided the ingredients for torrential downpours and training of storm cells over a particular area. In a 24-hour period, the western Atlanta Metropolitan area saw widespread 10-20 inches of rain, with isolated larger amounts. The maximum 24-hour rainfall total of 21.03 inches was reported at the Douglas County Water and Sewer Authority just west of Atlanta in Douglasville, Georgia (NOAA 2010).

Initial Frequency Analysis

The floods resulting from the extreme precipitation amounts were unprecedented in some cases, with historic and catastrophic impacts. Eleven people perished as a direct result of the event – ten of those in Georgia. In total, more than $300 million in property damage was reported (NOAA 2010). Following the event, a demand for the statistical significance of the event arose from Emergency Management Agencies, media, and citizens. A quick analysis was performed using a gamma distribution fit to the top 30, 24-hour rainfall events for the Hartsfield Jackson Atlanta International Airport observation site (KATL).[2]

The gamma distribution method achieved an unreasonably low return frequency for the 21.03 inch maximum observation, so the process was reproduced using 10 and 12 inches as a guideline. As a result, the Public Information Statement published by National Weather Service, Peachtree City stated that the chances of this event occurring "are less than one hundredth of one percent, or a 10,000-year event."

The National Service Assessment conducted by the National Weather Service highlighted the necessity for a more robust analysis of the September 2009 event in order to convey more statistically sound information. Rather than analyzing a single point using a limited data set, a regional frequency analysis was preferred in which data from several sites are used to estimate the frequency distribution at each site (Hosking 1990).

Regional Frequency Analysis

Previous studies indicate that for a regional frequency analysis, it is common and appropriate to comprise an Annual Maximum Series (AMS) and a Partial Duration Series (PDS) from the selection observed data for each site in the defined region. The AMS consists of the largest 24-hour rainfall total of each year for the length of the observed record. The PDS uses the highest N events where N is

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