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?

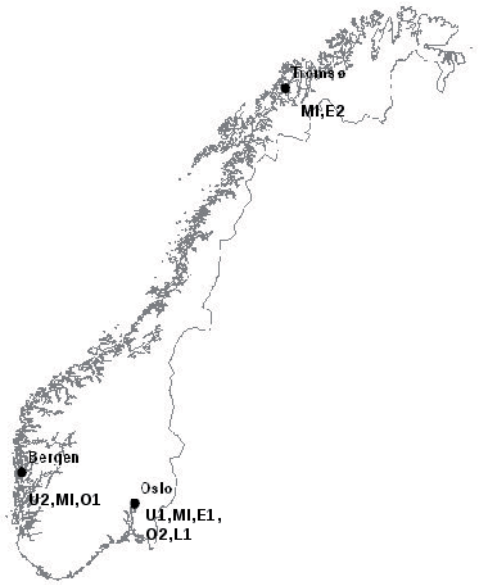
The subjective element is also present in science, but probably it is not very dominant, especially concerning the normal scientific communication. The internet has, however, opened an influential door for subjectivity. Culture may not matter very much in international science. Concerning the role of 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 unphysical, 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

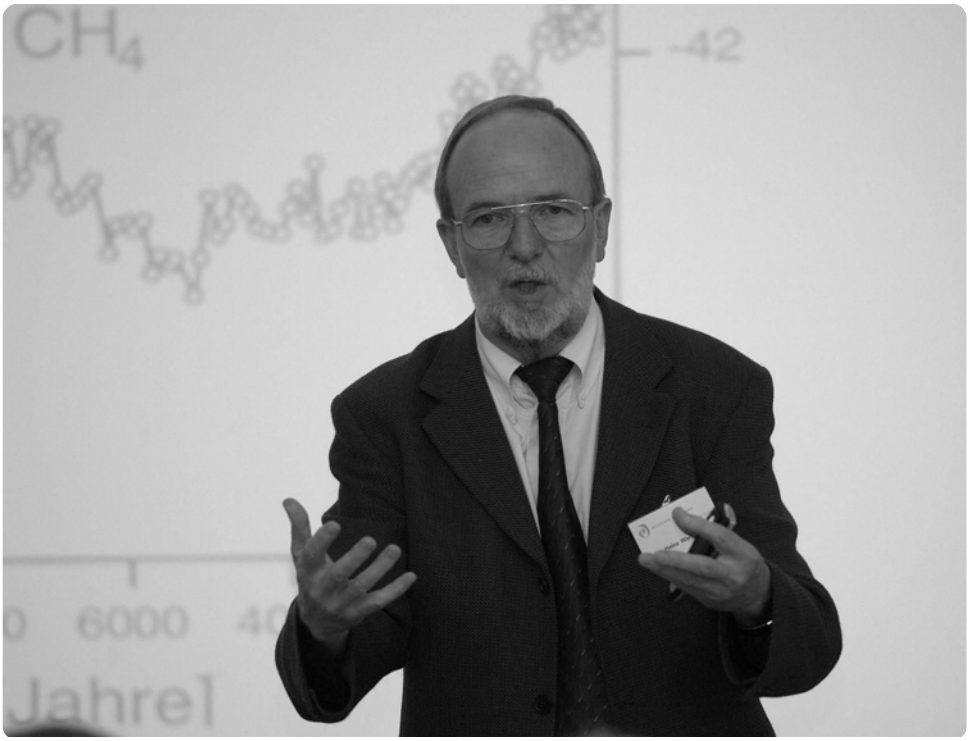
Interview with Heinz Wanner

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?

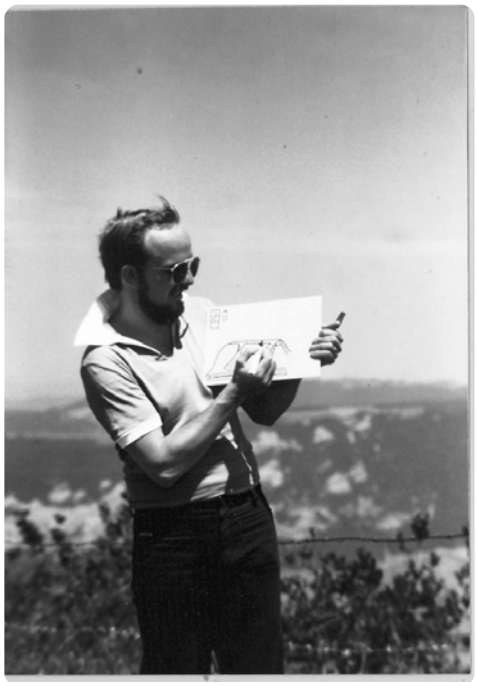
Undoubtedly, yes! Political parties want to increase their success with tendentious climate change issues, and scientists are besieged by journalists. This makes it difficult to remain fully independent or, in words of Roger Pielke Jr., to remain an "honest broker."

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.

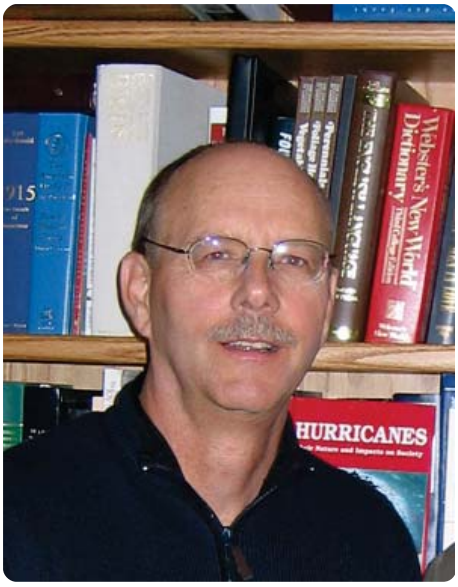
in reducing eutrophication in the Baltic Sea. The session on "Hydrological modeling, water management and extreme hydrological events" featured presentations on the variability of extreme events like storm surges, droughts and extreme precipitation, and recent attempts to forecast those events. A new 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.