Atmospheric Sciences Section of AGU Newsletter

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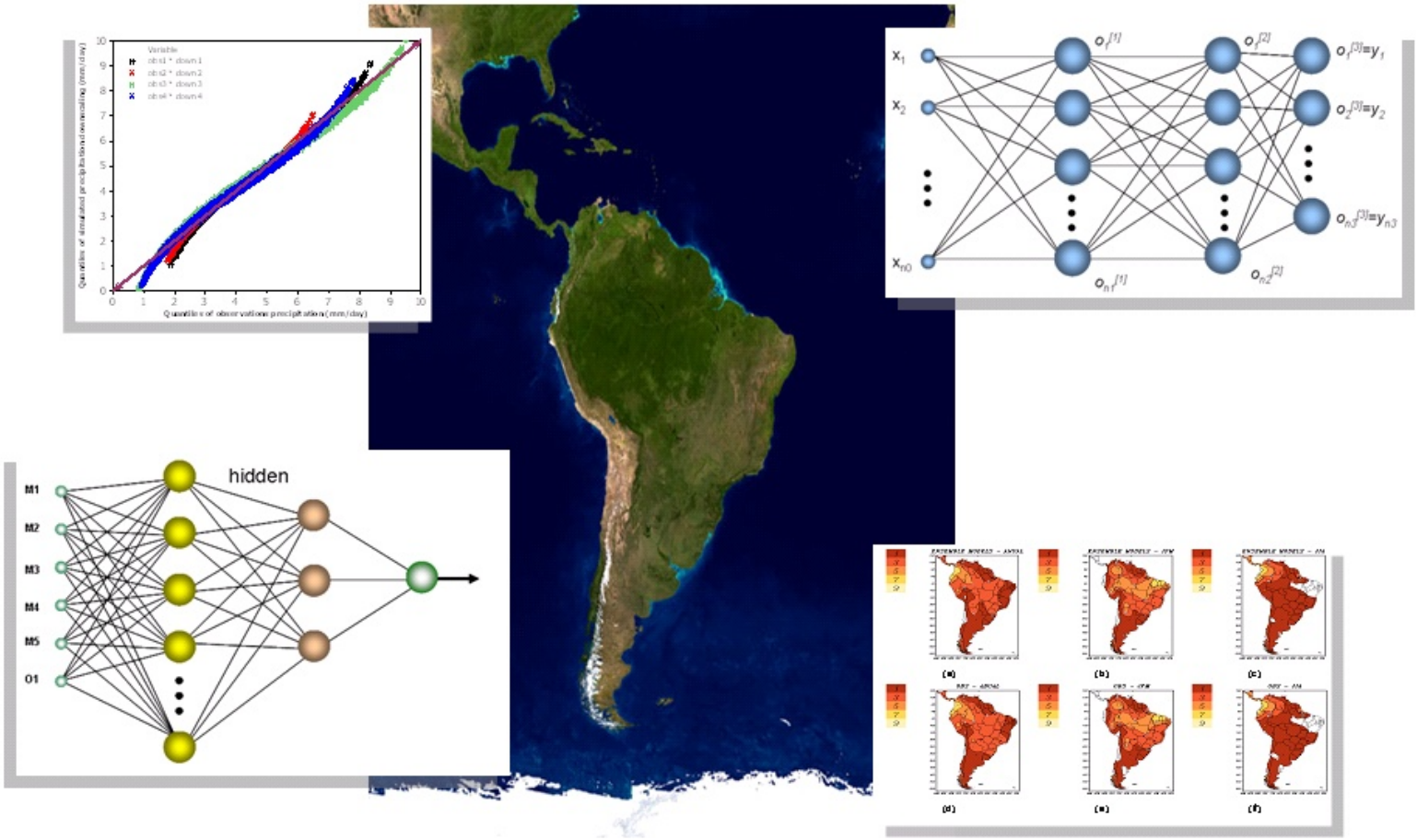


Meteorological downscaling methods & artificial neural networks models

Image from the PRID-SAR Project (see AS Horizons - page 3). Image provided by Dr. David Mendes.

AS Newsletter - Editorial -

Hello Readers,

In this issue the Newsletter a series of interviews with eminent atmospheric scientists begins on their subjective views about the state of science, its developments in recent years, and perspectives for the future. They are being prepared by Hans von Storch, who has published so far five extensive interviews with climate scientists, among them Klaus Wyrtki, Harry van Loon and Klaus Hasselmann – pdf files of these interviews are available from http://coast.gkss.de/staff/storch/Media/interviews.htm. This and other future short interviews will be added to that site.

We also include in this issue an article by Yolande Serra about the ideas and opinions of our two new JGR-Atmospheres editors.

Reports about a meeting on semi-arid lands in South America, work on downscaling methods with neural network models in Brazil and a school on wind power complete this issue.

Our Section News is also included, with the list of winners of the awards for best student presentations in the 2009 Joint Assembly which took place in May in Toronto.

Remember, we are looking for contributions, don't hesitate contacting us. Juan A. Añel <j.anhel@uvigo.es>.

Happy Reading,
Juan A. Añel, Editor-in-Chief
EPhysLab, Univ. of Vigo at Ourense, Spain, and CESAM, Univ. of Aveiro, Portugal.

Section News

Alan Robock

From the AGU 2009 Joint Assembly

2009 JOINT ASSEMBLY

The winners of the awards for the best students presentations at the Joint Assembly in Toronto are:

Cora Young - University of Toronto, Canada. - Atmospheric Chemistry of Perfluorobutenes.

Heather Andres - University of Toronto, Canada. - Surface Climate Effects due to Changing Estimates of Century-Scale Solar Variability.

Gray O'Byrne - Dalhousie University, Canada - Surface Reflectivity From OMI Using Aqua MODIS to Eliminate Clouds: Effects of Snow on OMI NO_2 Retrievals.

Katrine Gorham - University of California-Irvine, U.S.A. - Estimates of Cl and Br Concentrations in the Springtime Arctic From Hydrocarbon Measurements During ARCTAS.

Rodica Lindenmaier - University of Toronto, Canada - Springtime Arctic Trace Gas Measurements and Comparisons With the Atmospheric Chemistry Experiment on SCISAT.

Rachel Chang - University of Toronto, Canada - Chemical Properties of Aerosols in the Central Arctic.

Minghui Diao - Princeton University, U.S.A. - In situ Measurements of Ice supersaturation in the Upper Troposphere in START08 Campaign.

Congratulations!

AS Horizons

David Mendes, José A. Marengo, Michel d. S. Mesquita

Meteorological Downscaling Methods with Artificial Neural Network Models

The mathematical models used to simulate the present climate and project future climate when forced by greenhouse gases and aerosols are generally referred to as General Circulation Models (GCMs). While they have demonstrated significant skill in the continental and hemispherical scales and incorporate a large proportion of the complexity of the global system, they are inherently unable to present local subgrid scale features and dynamics [*Wigley el al.*, 1991].

The spatial resolution of GCMs still remains quite coarse: of the order of 300 x 300 km. At that scale, the regional and local details of the climate, which are influenced by spatial heterogeneities in the regional physiography, are lost. Therefore, there is a need to convert the GCM outputs into a reliable data set with higher spatial resolution. This includes outputs with daily rainfall and temperature time series at the scale of the watershed or of a region in which the climate impact is going to be investigated. The methods used to convert GCM outputs into local meteorological variables required for reliable climate modeling are usually referred to as downscaling techniques. There are various downscaling methods available to convert GCM outputs into meteorological variables appropriate for climate impact studies. Spatial downscaling means relating the large-scale atmospheric predictor variables simulated by GCMs to local or station-scale using numerical methods. Among the various downscaling techniques, two major approaches can be identified at the moment, namely, dynamic downscaling and empirical (statistical) downscaling. The dynamic downscaling approach is a method of extracting local-scale information by developing regional climate models (RCMs) with coarse GCM data used as boundary conditions. Empirical downscaling, on the other hand, starts with the premise that the regional climate is the result of interplay of the overall atmospheric and oceanic circulation as well as of regional topography, land-sea distribution and land use [e.g., *von Storch et al.*, 2000].

The empirical downscaling methods that are most widely used are the multiple linear regression and stochastic weather generation. However, the interest in nonlinear regression methods, namely artificial neural network (ANN), is increasing nowadays because of their high potential for complex, nonlinear and time-varying input-output mapping. Although the weights of an ANN are similar to nonlinear regression coefficients, the unique structure of the network and the nonlinear transfer function associated with each hidden and output node allow ANNs to approximate highly nonlinear relationships. The simplest form of ANN (i.e., multilayer perceptron) is reported to give similar results compared to multiple regression downscaling methods [*Schoof and Pryor*, 2001]. The ANN approach was found to account for some heavy rainfall events, while they were not identified by the linear regression downscaling technique [*Weichert and Burger*, 1998]. More recently, *Cannon and Whitfeld* [2002] found that an ensemble ANN downscaling model was capable of predicting changes in streamflows using only large-scale atmospheric conditions as model input.

There are, however, other categories of neural networks that have feedback connections and are thus inherently dynamic in nature. Dynamic neural networks are topologies designed to include time relationships explicitly in the input-output mappings. The application of feedback enables the networks to acquire state representations, which make them more suitable for complex nonlinear system modeling.

The neural network approach should determine which model contributes most to the output and to the extrapolation of the optimal combination of models to twenty-first century conditions.

1) The importance of an input to a trained variable is actually measured by the magnitude of the weights fanning out from the input. If the weights are small, the input contributes little, if the weights are large, the input contributes more.

2) The neural network parameters, also called weights, are optimized, based on a training dataset. If the distribution of the datasets changes dramatically, the method usually does not project, i.e., the method is considered to have good skills when the input data belong to a distribution similar or close to the distribution of the training dataset.

The advantages of the neural network for downscaling are:

a) Much less computationally demanding than physical downscaling using numerical models;

b) Ensembles of high resolution climate scenarios may be produced relatively easily.

The disadvantages are:

a) Large amounts of observational data may be required to establish statistical relationships for the current climate;

b) Specialist knowledge required to apply the techniques correctly;

c) Relationships only valid within the range of the data used for calibration projections for some variables may lie outside this range;

d) May not be possible to derive significant relationships for some variables;

e) A predictor which may not appear as the most significant when developing the transfer functions under present climate may be critical for determining climate change.

The Climate Change Group from the Brazil's National Institute for Space Research (INPE) is working on a project using the statistical downscaling technique based on the use of Artificial Networks for climate change. The models will be constructed using observed data (South America sector) and then applied to AOCGM output from IPCC AR4 in order to evaluate their ability to produce higher resolution climate change scenarios and improved short-term weather forecast over South America. For more information contact David Mendes: <dmendes@fc.ul.pt>

References

Cannon, A.J. and P.H. Whitfield (2002), Downscaling recent stream-flow conditions in British Columbia, Canada using ensemble neural networks. *J. Hydrol., 259*, 136–151.

Schoof, J.T. and S.C. Pryor (2001), Downscaling temperature and precipitation: A comparison of regression-based methods and artificial neural networks. *Int. J. Climatol., 21*, 773–790.

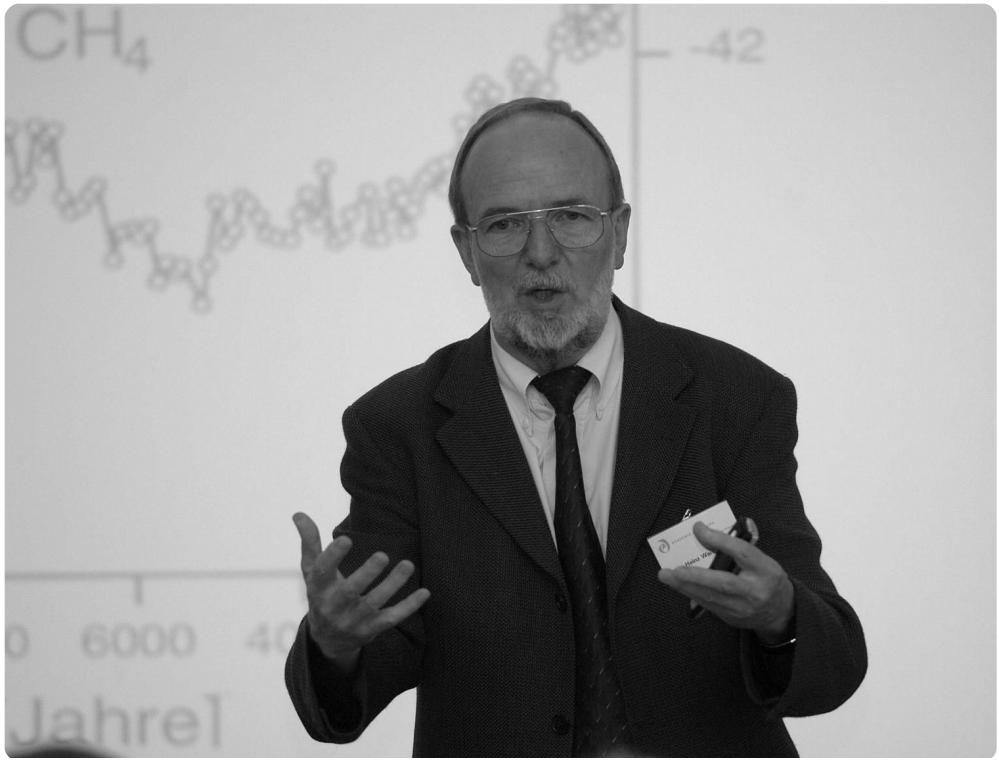
von Storch, H., Cubasch, U., González-Rouco, F., Jones, J. M., Voss, R., Widmann, M., and Zorita, E. (2000), Combining paleoclimatic evidence and GCMs by means of data assimilation through upscaling and nudging (DATUN). *Proc. 11th Symposium on Global Change Studies*, American Meteorological Society, Long Beach, CA.

Weichert, A. and G. Burger (1998), Linear versus nonlinear techniques in downscaling. *Clim. Res., 10*, 83–93.

Wigley, T.M.L., J. Jäger, and H.L. Ferguson (1991), in *Climate Change: Science, Impacts and Policy*, edited by J. Jäger and H.L. Ferguson, pp. 231-242, Cambridge Univ. Press, Cambridge, U.K.

Interview with Heinz Wanner

Hans von Storch



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

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.

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?

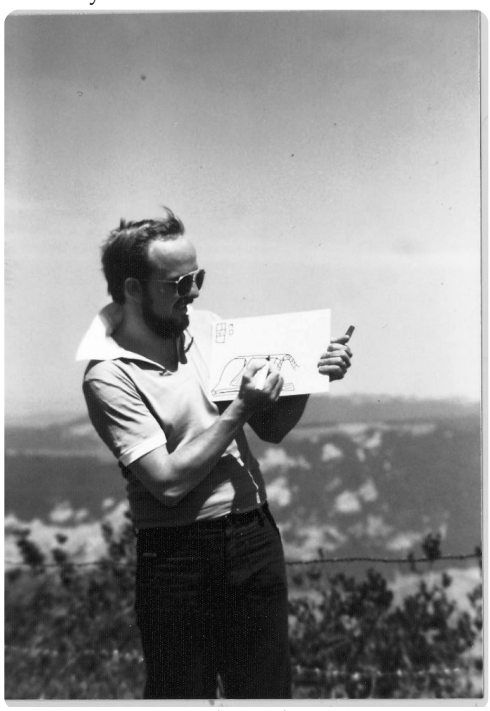
Undoubtedly, yes! Political parties want to increase their success with tendentious climate change issues, and scientists are besieged by journalists. This makes it difficult to remain fully independent or, in words of Roger Pielke Jr., to remain an "honest broker."

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.

A Few Words From JGR Atmospheres

Yolande Serra

Nowadays, *JRG-Atmospheres* has two new editors this year, Joost de Gouw from NOAA's Earth System Research Laboratory and Renyi Zhang from Texas A&M University. Both Renyi and Joost have their expertise in atmospheric chemistry. They (each) took a moment to discuss their goals for the journal, as well as the challenges that they (themselves as well as the) and the journal face over the next four years.

When discussing his goals for the journal Renyi has a very proactive view of the role of an editor. He believes that an editor should be aware of important directions in their field of expertise and attract articles from these areas. He also believes that to attract these papers it is important to have editors that are connected with the scientific community and to encourage the submission of interesting work.

Renyi is very aware of the competition *JGR-Atmospheres* faces, especially as more journals become available on-line. He believes *JGR-Atmospheres* can compete if it maintains its standards and publishes articles with better efficiency. At the same time he wants to maintain or even improve the reputation of the journal, attracting readership and submissions not only for the timeliness of publication but also because of the quality of the articles found in the journal. To this end, Renyi goes through all the papers he receives and reviews them himself first , sending back the articles that he feels are not ready for the review process. Whenever possible, Renyi offers specific suggestions to the authors on how to improve their article so that they are ready for the review process. He feels it is important not to burden the reviewers with poorly written articles or articles that are not appropriate for *JGR-Atmospheres*. He hopes that in return, the articles that he does send out to be reviewed will be returned with quality comments and in a timely manner.

Joost also prioritizes making the review process more efficient while maintaining *JGR-Atmospheres* as a "high-quality journal for extended research articles." His biggest challenge so far has been finding quality reviewers. While he thinks that the reviews he receives are of high quality, detailed and on time, finding these reviewers is not easy. Steve Ghan, an editor for *JGR-Atmospheres* since 2006, confirms this new editor's woes, revealing that in his experience with climate papers half of the reviewers decline. He emphasizes that, in order to get an article through review faster, it is very helpful to suggest referees that will provide a thorough review. If a cursory review is provided, the editor must often find another reviewer in order to make a fair decision about the article, and this slows down the review process. It is also helpful to suggest alternative reviewers should you need to decline a review.

The statistics available from AGU suggest that *JGR-Atmospheres* has already improved the efficiency of its review process. Steve reports that since 2006 the days that pass until the first decision have gone from 100 to 65, and days that pass until the acceptance are down from 170 to 153. The AGU website indicates that the weeks from submission to publication have gone down from about 38 to about 33 since 2006. Steve states that production numbers should continue to improve, depending on how AGU decides to handle software issues related to the production process. In particular AGU does not use the PDF file format published on-line as the final record. Instead, proprietary software is used to produce the published version, which AGU then uses as the final record of the article and this can slow down the production process. This is an issue that the new editors will face over the next few years.

In addition to the efficiency of the review process, authors also consider a journal's impact factor when deciding whether to submit an article to a journal. The impact factor is the ratio of the number of citations to the number of published articles. According to the AGU website, the impact factor of *JGR* journals is 3.147. Renyi remarks that considering the number of articles *JGR* publishes (around 4000 in 2008), this is an impressive number. One of Joost's goals is to see an impact factor for just *JGR-Atmospheres*. Currently, the impact factor for *JGR* journals is calculated based on all the subspecialty journals combined (Atmospheres, Biogeosciences, Earth Surface, Oceans, Planets, Solid Earth, and Space Physics). Joost believes that a separate impact factor for *JGR-Atmospheres* will make it easier for authors to compare journals in the atmospheric sciences and hopefully choose *JGR-Atmospheres* over other journals.

In the future, *JGR-Atmospheres* will continue to move forward in the electronic age. We already have papers that are published on-line as soon as they are accepted. The journal also offers the option of having black and white figures in the printed article but color figures in the on-line version, reducing the publication costs for the authors. Additional challenges the new editors face include providing accessibility of their articles to the widest possible audience at a reasonable cost. As competition increases among on-line publications, the editors hope that authors will choose *JGR-Atmospheres* for its reputation of a quality readership and the high standards of the published articles.

I would like to thank the editors of *JGR-Atmospheres* for their comments and to wish Renyi and Joost luck over the next four years as editors of *JGR-Atmospheres*.

The Current Situation of Arid and Semi-arid Lands in South America

Humberto A. Barbosa, Holm Tiessen and Michel d. S. Mesquita

What is the current research situation on arid and semi-arid lands in Latin-America? How should this field of science be best developed? These questions were the core concern of an important meeting that gathered experts from Latin-America to discuss issues on arid and semi-arid lands. The meeting was held in Brazil (http://iaibr3.iai.int/twiki/bin/view/TISemiArid09), and it was sponsored by the Inter-American Institute (IAI) for Global Change Research and supported by Brazil's National Institute for Space Research (INPE).

The main objective of the meeting was to identify future scientific needs based on the researchers' interests and the demands of satellite remote sensing applications. There were about 30 participants in the IAI/INPE meeting. It gathered university students, lecturers, researchers, (senior) Governmental Officers, public and private sectors. The presentation topics ranged from monitoring glaciers to specimens surveillance. The attendees identified the need to establish a satellite remote sensing users' network. This would involve all of the stakeholders and also the need for training in satellite data processing and in accessing and downloading satellite data available through the Web. The main interest is to see whether these data would improve their knowledge on the arid and semi-arid lands, and of the mechanisms affecting the climate in these regions.

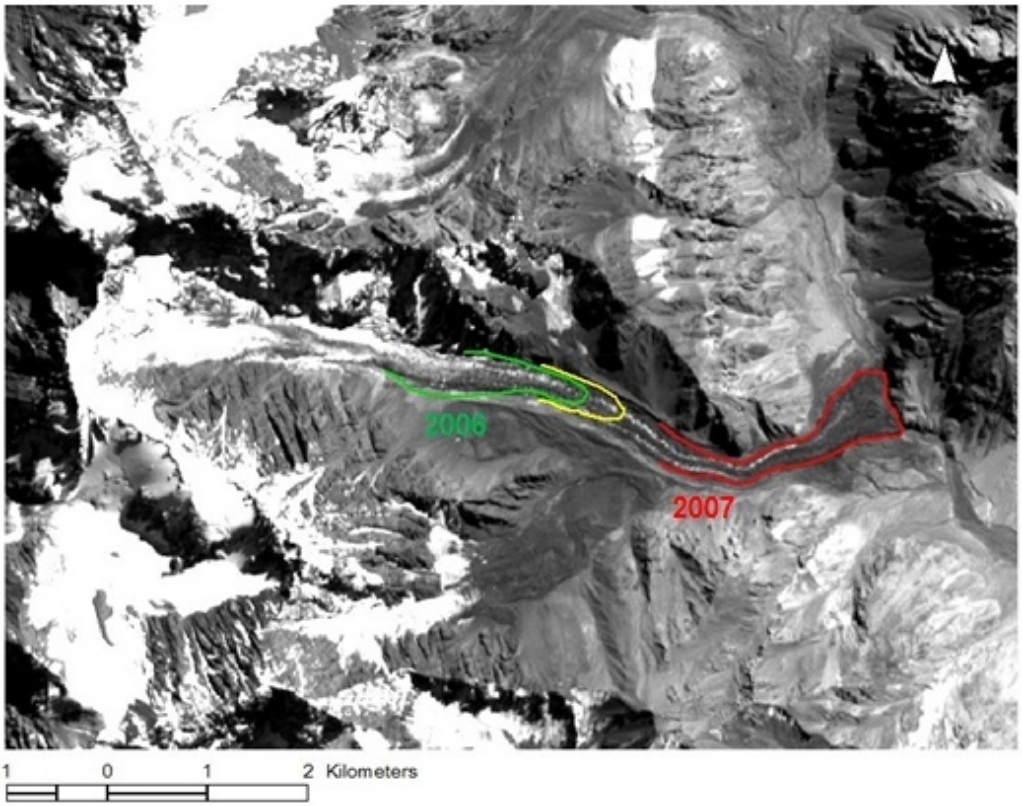
Hydrological datasets were another point of concern raised during the meeting. It is generally difficult to assess these data with reasonable accuracy when it comes to water balance in arid and semi-arid regions. The need for hydrological data is critical. In many parts of the Latin America, hydrological data gathering has decreased. While remote sensing is a useful supplement to some station measurements, it is not, as of yet, a substitute for streamflow data.

Satellite remote sensing observations of assimilated climate variables, such as land surface temperature, precipitation and soil moisture are freely available on the Web, but there is no equivalent dataset of hydrologic variables. Translating rainfall data into streamflow data requires information on (changing) land cover, including patterns of land use and management, requiring ground observations while also benefiting from satellite remote sensing data. Effective incorporation of satellite remote sensing information in water resource mitigation efforts requires agreement among users and suppliers on the kind of data which will be used in policy-making.

Using satellite remotely sensed data as an integrated part of hydrological studies may provide new understanding on climate variations. It may also help broaden the perspective on meteorological and biological processes that influence the ecological balance of arid and semi-arid lands, and thus the shortage of water. At present, links between hydrology and climate science are weak. The discussion covered examples of the use of remote sensing applications, such as recent fluctuations of the Grande del Nevado del Plomo identified by satellite image, which has become an important source of proxy data in climate change research. The present challenge is to understand the potential impacts of climate change on water management. Uncertainties multiply at each step of the hydrological cycle, from temperature predictions to estimates of rainfall, evaporation, infiltration and runoff.

The outcome of the meeting was an unquestionable contribution to the use of satellite for studying arid and semi-arid lands in South America. Many of the projects have already taken satellite data into use, while others are still exploring this as a possibility. It is hoped that this meeting may have helped foster the use of satellite remote sensing data in arid/semi-arid studies in South America.

Participants in the meeting.



Perspective views of the Grande del Nevado del Plomo from 2006 through 2007, acquired by aerial photography. This glacier produces a surge and an ice dam that confines the Plomo river valley and forms a glacier-dammed lake. [Courtesy: Lidia Ferri Hidalgo, Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales (IANIGLA)].

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

* Director, Division of Atmospheric Sciences, National Science Foundation, Arlington, VA.

* Facility Instrumentation Specialist for the National Suborbital Education and Research Center (NSERC) (#09-292).

* Postdoc in Cloud Physics, University of California Santa Cruz (http://people.ucsc.edu/~pchuang/).

* Postdoctoral fellowship position for a mesoscale modeler. Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University.

* Postdoctoral Researcher Position in Atmospheric Remote Sensing and Radiative Transfer. Department of At-mospheric Sciences, Texas A&M University. References to Prof. Ping Yang.

* Research Associate/Research Scientist (2 Positions). Kummerow Research Team, Department of Atmospheric Science, Colorado State University.

* Lectureship in Climate Science. Department of Geography, University of Sussex, UK.

* Postdoctoral Research Scientist in the field of Tropical Atmosphere

Dynamics, Lamont-Doherty Earth Observatory.

* Carbon Cycle and Economy Postdoctoral position at LSCE, France.

* Post-Doc Opportunity 2 years: Development of a Greenhouse Gas Ocean-Atmosphere Flux Sensor with MEMS-based Photoacoustic Technology. National University of Ireland, Galway.

* Scientific assistant to work on renewable energy potential for solar energy and wind power in Belgium. The Royal Meteorological Institute of Belgium.

* Research scientist / Graduate student. Finnish Meteorological Institute <Johanna.Tamminen@fmi.fi>

* Post-doctoral position in regional climate modeling. Climate System Research Center, Department of Geosciences, University of Massachusetts, Amherst, Massachusetts.

* Post-Doctoral position in climate modelling. Barcelona Supercomputing Center (BSC), Barcelona, Spain.

* Post-Doctoral position in probabilistic nowcasting of rainfall using weather radar measurements. MeteoSwiss, Locarno-Monti, Switzerland. <urs.germann@meteoswiss.ch>

* Climate Program Manager. Lawrence Livermore National Laboratory.

* Full Tenured Professor. Earth System Science Interdisciplinary Center (ESSIC), University of Maryland.

* Program for Climate Model Diagnosis and Intercomparison Leader. Lawerence Livermore National Laboratory.

* Director of the Department for Climate Projections and Data Analysis. GKSS Research Center, Germany. <Joachim.Krohn@gkss.de>

Interdisciplinary

* Meteorologist – Wind Energy Forecasting, Renewable Energy. Garrad Hassan and Partners Ltd, Bristol , UK.

* Senior Meteorologist for a very well known Utility/Trading House based in London trading in physical and financial energy markets <ldeegan@connectresourcing.com>

* Postdoc in Computational Science (Earth, Climate and other). Argonne National Laboratory. More information available: http://www.cels.anl.gov/about/opportunities/

* Young Scientist/Software Engineer (3 positions available) to work in the project GEOLAND-2 (EU FP7). National Meteorological Institute, Lisbon, Portugal. <isabel.trigo@meteo.pt>

Student Opportunities

* Funded PhD Opportunity: Development of a Greenhouse Gas Ocean-Atmosphere Flux Sensor with MEMS-based Photoacoustic Technology. National University of Ireland, Galway.

* PhD studentship: Ice nucleation in the Earth's atmosphere. Supervisor: Dr. Ben Murray. School of Chemistry, University of Leeds.

* PhD position on "Extreme storms and coastal evolution under accelerated sea-level rise". Faculty of Geosciences, Utrecht University. <g.ruessink@geo.uu.nl>

* PhD position on "Analyses of airborne Doppler wind Lidar observations for ADM-Aeolus". DLR, Institute of Atmospheric Physics, Oberpfaffenhofen, Germany. <oliver.reitebuch@dlr.de>

* PhD Position in Climate Science. Institute for Atmospheric and Climate Science, ETH Zürich, Switzerland. <sven.kotlarski@env.ethz.ch>

* PhD Scholarship in Micrometeorology. Univ of Queensland. Australia. <h.mcgowan@uq.edu.au>

* Ph.D. Graduate Assistantship available with the POLENET project. Center for Earthquake Research and Information at the Univ. of Memphis. <rsmalley@memphis.edu>

Schools

Data Assimilation and its applications in engineering

Sibiu, Romania. 27 July - 7 August 2009.

http://ta.twi.tudelft.nl/wagm/users/remus/summerschool2009/

2nd International Summer School: Climate changes in the Mediterranean area

Villa Gussio, Leonforte (EN), Italy. 11 - 15 September 2009.

http://www.unikore.it

Joint NCAR-NCAS WRF Users Workshop and Tutorial

Cambridge, UK. 28 September - 2 October 2009.

http://www.ncas.ac.uk/wrfworkshop

Conferences

// MOCA-09: IAMAS - IAPSO - IACS Joint Assembly //

Montreal, Canada. 19 - 29 July 2009.

http://www.moca-09.org

// Workshop on High Resolution Climate Modelling //

Trieste, Italy. 10 - 14 August 2009.

http://www.ictp.it

// 18th International Conference on Nucleation & Atmospheric Aerosols //

Prague, Czech Republic. 10 - 14 August 2009.

http://www.icnaa.cz

// 1st IEEE GRSS Workshop on Hyperspectral Image and Signal Processing - Evolution in Remote Sensing - //

Grenoble, France. 26 - 28 August 2009.

http://www.ieee-whispers.com/2009/

// WMO Symposium on Nowcasting //

Whistler, B.C., Canada. 30 August - 4 September 2009.

http://www.nowcasting2009.ca

// World Climate Conference-3 //

Geneva, Switzerland. 31 August - 4 September 2009.

http://www.wmo.int/wcc3

// EcoHCC'09 - International Conference on Ecohydrology and Climate Changes //

Tomar, Portugal. 10 - 12 September 2009.

http://www.ecohcc09.ipt.pt/

// First Workshop on Open Source and Internet Technology for Scientific Environment: with case studies from Environmental Monitoring //

Trieste, Italy. 7 - 25 September 2009.

http://www.ictp.it

// European Conference on Applications of Meteorology - EMS Annual Meeting //

Toulouse, France. 28 - 29 September 2009.

http://meetings.copernicus.org/ems2009/

// Joint ICTP/IAEA Workshop on Alternative Response Actions to Climate Change and Energy Options //

Trieste, Italy. 5 - 9 October 2009.

http://www.ictp.it

// The Extra-tropical UTLS: observations, concepts and future directions //

Boulder, CO, U.S.A. 19 - 22 October 2009.

http://www.acd.ucar.edu/utls/workshop.shtml

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