

# Atmospheric Sciences

## Section of AGU Newsletter

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## AS Newsletter - Editorial -

Hello Readers,

This is my first issue as Editor-in-Chief of the Newsletter. I would like to thank Anna for all her hard work and also our contributing editors for their invaluable collaboration. The newsletter will be released bimonthly, so you should have our next issue by May 15, just before the AGU Joint Assembly held in Toronto. We will be looking closely at President Obama's stimulus bill and the possible increase in research funding.

Recently, our Newsletter presented exciting information about the LHC. But sadly we also have bad news, such as the total loss of the OCO satellite after crashing into the sea off Antarctica. Therefore, we have lost a huge amount of data that could have been very useful for the study of the Earth's atmosphere and climate change.

In the present issue you will find our usual Section News, which includes a profile of the Kaufman Award winners, highlights of CIRCE, a big collaborative project in AS Horizons and information about the Year of Tropical Convection. Take a look at the interesting opportunities, schools, conferences and announcements.

Happy Reading,

Juan A. Añel, Editor-in-Chief

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CESAM, Univ. of Aveiro, Portugal, and Group of Atmospheric and Ocean Physics, Univ. of Vigo at Ourense, Spain.

#### Newsletter Editors:

\* Morgan Brown - Center for Global and Regional Environmental Research, Univ. of Iowa, U.S.A.

\* Anna Harper - Colorado State Univ., U.S.A.

\* Michel dos Santos Mesquita - Bjerknes Centre for Climate Research, Bergen, Norway

\* Yolande Serra - Univ. of Arizona, U.S.A.

\* Hans von Storch - Univ. of Hamburg, Germany

## Section News

### AGU 2009 Joint Assembly

Alan Robock

The next AGU 2009 Joint Assembly, The Meeting of the Americas, is from 24 to 27 May 2009, in Toronto, Ontario, Canada. Please visit the meeting website at <http://www.agu.org/meetings/ja09/> for more information. There are many interesting sessions including the Atmospheric Sciences ones, as well as Union sessions of interest to our section such as "Breakthrough Ideas and Technologies for a Planet at Risk" and "Exploring the Vulnerabilities of Populations to the Manifestations of Climate Change."

The new Atmospheric Sciences Fellows will present invited lectures in a special Atmospheric Sciences session, and Inez Fung will deliver the Charney Lecture. So please plan to participate.

### James R. Holton Award

Nominations for the 2009 James R. Holton Junior Scientist Award are now open. To be eligible, candidates should be a member of AGU, and be no more than three years past the award of the Ph.D. degree. Members of the AGU are encouraged to nominate deserving individuals. For details about sending the nomination package visit our web page (<http://atmospheres.agu.org>).

### Yoram J. Kaufman Award

Ralph Kahn (NASA Goddard Space Flight Center, Greenbelt, Maryland) and Ross Salawitch (University of Maryland, College Park) have each been selected to receive the first Yoram J. Kaufman Unselfish Cooperation in Research Awards. We had two equally strong candidates and have decided to make awards to both deserving scientists. This award is named in honor of Yoram J. Kaufman, an outstanding atmospheric scientist, mentor, and creator of international collaborations who worked on atmospheric aerosols and their influence on the Earth's climate for his entire 30-year career. The citation will read: "The Yoram J. Kaufman Award for broad influence in atmospheric science through exceptional creativity, inspiration of younger scientists, mentoring, international collaborations, and unselfish cooperation in research." The awards will be presented at the

Atmospheric Sciences reception, Monday evening, May 25, during the AGU Joint Assembly in Toronto, Canada. Please join us at that reception.



Ralph Kahn



Ross Salawitch

### You make the Newsletter

We are looking for more contributions and new Contributing Editors (CE) for the newsletter. We are specially interested on contributions and new editors from the regions where we do not have too much input in the newsletter, as Asia, Africa, South America and Oceania. Moreover if you think that you have a relevant idea or project and that it could be included in any of our sections don't hesitate contacting us with an abstract. Also we want to hear from you, so if you would like to see included any other thing in the newsletter or you have any criticism, let us know about it. For all these questions contact Juan A. Añel ([j.anel@uvigo.es](mailto:j.anel@uvigo.es)).



## AS Horizons

### *CIRCE: European Research Project on Climate Change and Impact in the Mediterranean Environment*



Hans von Storch

Climate change could pose serious questions on the sustainability of the whole development process in the Mediterranean. Regional water resources are already under significant economic and demographic pressure. Increased severity of weather extremes and land-use change may be added to the existing problems of desertification, scarcity of water and food production, bringing new challenges to human health, ecosystems, and national economies.

Thus, the project CIRCE has been set up to deal with the particular features of the Mediterranean area and to fit the climate research according to the needs of the Mediterranean population. CIRCE is a European project, funded under the Sixth Framework Programme (FP6). It is coordinated by Istituto Nazionale di Vulcanologia e Geofisica (INGV), Italy, and led by Antonio Navarra from INGV and Laurence Tubiana from IDDRI- Institut du Développement Durable et des Relations Internationales, France.

CIRCE runs climate change simulations in the Mediterranean area to properly understand not only the changes in temperature, radiative fluxes, precipitation, humidity, wind conditions, cloudiness, aerosol presence, ocean waves, sea-level rise, and the regional water cycle, but also extreme events such as intense precipitation or floods), nutrient discharges into the sea and sensitivity to water stress. Thanks to the integrated approach of CIRCE, the project produces a regionally disintegrated assessment of the various expected changes.

The main objectives of CIRCE are to

describe and to quantify the possible and plausible physical impacts of climate change in the Mediterranean through a comprehensive set of data. These impacts will then be used to assess the consequences of possible climate change for human society and ecosystems. In particular, CIRCE will study economically meaningful variables such as productivity changes, variation of resource stocks, and shifts in technology and demand patterns so as to describe better how climate changes may affect our future lives.

In order to test its ability to envisage the impacts and assess strategies of mitigation, CIRCE has foreseen a number of case studies. A risk-based approach will be used to try to identify, with the involvement of local institutions, experts and citizens, the strengths and weaknesses of potential adaptation strategies.

The final product of CIRCE will be a "Regional Assessment of Climate Change in the Mediterranean" (RACCM), a decision support system tool used for the adaptation and mitigation strategies that are specifically tailored for the Mediterranean environment.

Web page: <http://www.circeproject.eu>

### *Supercomputers Going Green?*

Michel dos Santos Mesquita

Supercomputers have become an important asset in atmospheric/climate research: for example, they can run fine-scale regional models such as WRF, GCMs or aid deliver weather forecasting in time. They have become ubiquitous and essential for the everyday scientific work. However, they consume 30 times more electricity than older scientific computers [Grier, 2008]. Increased costs in electricity may have a huge impact on smaller climate centers. The question is: are there greener supercomputers?

In the age of computers, machines are smaller and faster. According to Grier [2008], the big scientific processors used nowadays are 300 times more efficient (per watt) than were computers 15 years ago. But in spite of using less energy, they are faster and thus, they consume more. However, there is still hope! A new type of supercomputer produced by SiCortex uses a new approach to save energy when processing [Paulson, 2008]. It was purchased by Purdue University and the US Argonne National Laboratory. Purdue is using the SC5832 in various scientific disciplines including climate research. According to the SiCortex website, the SC5832 offers 5,832

1.4GFlops 64-bit processors (dissipating 900 milliwatts of power per processor). In addition to that, it has 8 Terabytes of system memory and, best of all, it fits in a single cabinet and only needs around 20 kilowatts of wall power.



SC5832 at the Argonne National Laboratory

According to Halvor Utby, System Engineer at the Bergen Center for Computational Science (Norway), power and cooling costs are always considered when buying a new supercomputer. He also added that "a computer like this one (the SC5832) would help reduce energy costs... without knowing too much about how this computer performs, my guess from the specs is that it will perform well in climate research... it is hard to say exactly without a benchmark at hand." Utby also pointed out that, since its clock frequency is lower than in other supercomputers, the job might run longer than on a supercomputer with higher clock frequency; it depends on the scalability of the application.

The SiCortex and industry experts have also developed an index to measure how green supercomputers are: the Green Computing Performance Index (GCPI). It analyzes the computing performance (per kWatt) across industry-standard benchmarks. This initiative and many others to come will help boost atmospheric/climate research towards "greener environments." Yes, supercomputers can go green!

#### References

- Grier, D. A. (2008), Click Here to Empty Trash, *Computer*, 41(9), 6-8.
- Paulson, L. D. (2008), Supercomputers Get Energy-Efficient, *Computer*, 41(9), 19-20.
- SiCortex SC5832 and GCPI websites:  
[http://sicortex.com/products/high\\_capability\\_system\\_sc5832](http://sicortex.com/products/high_capability_system_sc5832)  
[http://sicortex.com/green\\_index](http://sicortex.com/green_index)

# Pooling Resources to Study Tropical Convection and its Effects on World Weather

Anna Harper

Convection occurring in the tropical regions of the world can be both essential for life and a threat to it. For example, about half of the world's population lives in a monsoonal precipitation regime. Agrarian economies such as India strongly depend on when the monsoon season begins, whether it is interrupted, and how long it lasts. On the other hand, tropical storms, especially when not forecasted correctly, can cause catastrophic damage to people and property through winds and floods.

Tropical convection is a complex area of atmospheric physics that brings together small and large scales, and has clear importance to society. Recently, both observations of the tropics (both in-situ and satellite) and the computational ability to study them have increased dramatically as a result of faster computers. For example, the number of instruments operating through the EOS program more than tripled between 1997 and 2005.

For these reasons, the attendees of the workshop on the "Organization and

Maintenance of Tropical Convection and the Madden-Julian Oscillation," held in Trieste, Italy in March 2006, proposed a Year of Tropical Convection (YOTC: [http://www.wmo.int/pages/about/sec/resc/rosscut/resdept\\_yotc.html](http://www.wmo.int/pages/about/sec/resc/rosscut/resdept_yotc.html)). The idea behind the YOTC is to consolidate research efforts toward observing, modeling, and forecasting tropical convection. To kick things off, each day (from May 1, 2008 – October 31, 2009) the ECMWF in the UK is archiving products from its T799 global weather forecasting model (approximately 25 km grid-spacing): six-hourly global analysis, 10-day forecasts, and extra six-hourly diagnostic and diabatic fields for the 5-day forecast. The YOTC researchers can access these data online.

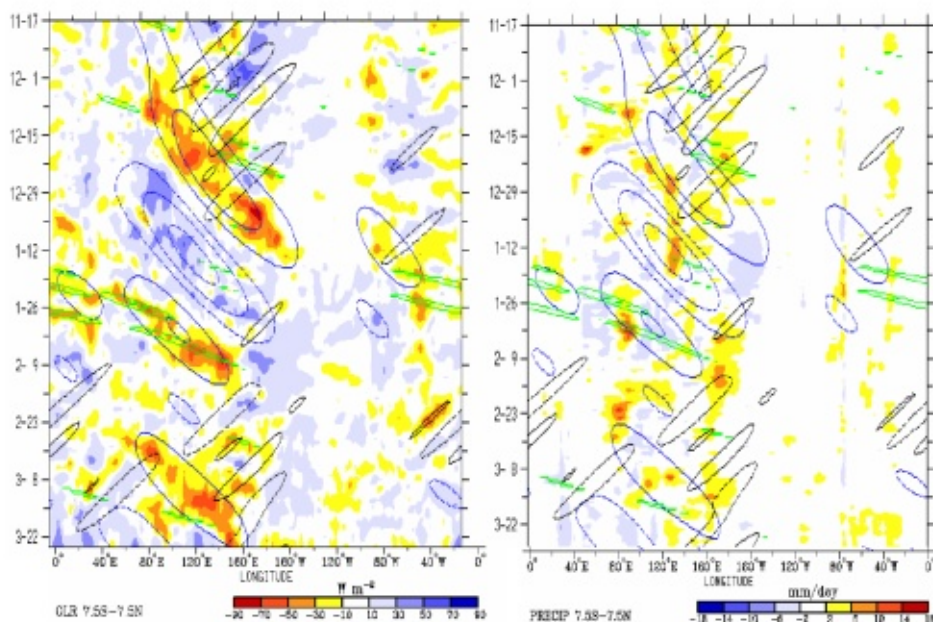
The organizers of the YOTC realize that their task will take much longer than a year to complete because of its challenging nature. Their goals include greatly improving forecast skill by 2012 in the areas of short- and medium-range tropical weather forecasts, extended-range forecasts of the MJO, and medium- to extended-range extratropical forecasts. The expected research foci are MJO/convectively-coupled waves; easterly waves and tropical cyclones; diurnal cycles of convection; tropical/extratropical interactions; and monsoons.

Special sessions focused on tropical convection were held during both the AGU Fall Meeting December 2008 in San Francisco and the AMS Annual Meeting in January

2009 in Phoenix. The AGU session included 20 talks and 27 posters and was chaired by Chidong Zhang from the University of Miami, Mitch Moncrieff and James Done from the National Center for Atmospheric Research, Duane Waliser from the Jet Propulsion Laboratory/Caltech, and George Kiladis of the Earth System Research Laboratory at NOAA. Topics ranged from observations of tropical clouds and water vapor from CloudSat, MODIS, TRMM and Aqua to the use of simple dynamical models and global cloud-resolving models to study tropical convection and the MJO. According to Moncrieff, results presented at the AGU meeting include: i) the MJO is driven not by randomly distributed clouds but by organized cloud patterns that travel like atmospheric waves; ii) "busted weather forecasts" in weather models over the U.S. sometimes have their roots in the tropics and how tropical convection is represented in the models; iii) atmospheric rivers of moisture flow from the tropics/subtropics to the U.S. (e.g., the "pineapple express" from Hawaii) and cause prolonged heavy rain and severe flooding.

Moncrieff and Waliser are also the Co-Chairs of the YOTC. Moncrieff works on mathematical models of organized tropical convection, and how such models help understand how tropical convection should be represented in next-generation global prediction models (presently it is poorly represented). Waliser's focus is on satellite analysis and modeling.

The YOTC is a joint international initiative between the World Climate Research Programme and the World Weather Research Programme's The Observing System Research and Predictability Experiment (THORPEX). The YOTC overlaps with and complements the Asian Monsoon Years (2007-2012), the THORPEX Pacific Area Regional Campaign (TPARC) and the U.N. Year of Planet Earth (<http://www.yearofplanetearth.org/>). The latter is an international effort to promote and disseminate research by earth scientists that relates to the areas of health, climate, groundwater, ocean, soils, deep earth, megacities, hazards, resources and life. There is a YOTC Implementation Workshop at the University of Hawaii, Oahu in July 2009, and a YOTC session at the 2009 AGU Joint Assembly in Toronto.



Left, 3-day running-mean anomalies of the outgoing long-wave radiation (OLR), a proxy for precipitation, averaged across 7.5N-7.5 S from 17 November 17, 2003 - March 23, 2004. Blue hues and contours are an MJO. Right, forecast of precipitation from a global model. Comparing these diagrams shows that a much-improved representation of organized tropical convection in global prediction models is required. This is a leading objective of the YOTC project. [Courtesy: Klaus Weickmann, NOAA/CDC.]



## Workshop Spotlight: Western Boundary Currents

Meghan F. Cronin, Michael Alexander, Kathie Kelly, Bo Qiu, and Yolande Serra

The U.S. CLIVAR Western Boundary Current (WBC) Ocean-Atmosphere Interaction Workshop was held on January 15-17, 2009 in Phoenix, AZ. The workshop was sponsored by the U.S. CLIVAR WBC Working Group and the U.S. CLIVAR Program (<http://www.usclivar.org/>). Approximately 50 scientists from the U.S., Japan, China, France, and Germany attended the workshop, which included 35 oral and 16 poster presentations on topics ranging from observations of air-sea interaction over fronts to global-scale modeling studies.

The overall objective of the workshop was to identify both broad consensus regarding WBC ocean-atmosphere interactions and new provocative ideas and concepts that may affect climate predictability. During the past five years there have been two process studies that have observed WBC dynamics, thermodynamics and interactions with the atmosphere: the Kuroshio Extension System Study (KESS) <http://uskess.org>, which focused on the Kuroshio Extension in the western North Pacific from June 2004-June 2006; and the CLIVAR Mode Water Dynamic Experiment (CLIMODE) <http://climode.org> which focused on the Gulf Stream in the western North Atlantic from November 2005 – November 2007. At the workshop, KESS and CLIMODE results were presented and there was considerable discussion regarding the similarities and differences between the Gulf Stream and Kuroshio Extension systems.

One finding of note was the strong evidence, based on several groups' results, that the WBC sea surface temperature (SST) fronts project onto the atmospheric boundary layer, affecting surface winds and cloud formation. Furthermore, several groups showed evidence that effects of the sea surface temperature (SST) fronts appear to extend beyond the atmospheric boundary layer, to the top of the troposphere. In particular, analyses were presented showing that SST in the WBC regions influences the location of the storm tracks at low-levels. Much of the observed impact of the WBCs on the atmosphere has been derived from analyses of QuikSCAT sea-level winds, which provide the best coverage of surface winds at sufficiently small scales of any existing satellite measurement system. This led to discussions about the difficulties in

observing the deep response of the troposphere to WBCs, especially during wintertime when extratropical storms are very energetic, and in observing the remote response, particularly to variations in the Gulf Stream. Modeling challenges were also discussed, as were recommendations for how WBC regions should be monitored for improved climate predictability.

Several action items resulted from the workshop and WBC WG. A web page (<http://www.cdc.noaa.gov/WBC/>) has been created that displays atmosphere and ocean fields relevant for the study of the Gulf Stream and Kuroshio Extension. A special issue of the Journal of Climate is planned that will include more than 20 studies presented at the workshop and two review papers on frontal-scale and large-scale air-sea interaction in WBC regions. The working group is drafting a Community White Paper (CWP) for the OceanObs09 conference titled "Monitoring ocean – atmosphere interactions in western boundary current extensions." The first draft of this CWP will be posted at <http://www.oceanobs09.net> for public comment after March 31, 2009. Finally, a set of metrics for evaluating climate models is being developed.

## Wind Power Research Incentive in Norway

Idar Barstad and Michel dos Santos Mesquita

Producing "environmentally friendly" energy has become a widespread topic nowadays. Reducing emissions in order to comply with environmental agreements requires a bigger effort from governments and politicians to invest in alternative sources of energy. When it comes to the production of electricity, wind power has proved to be among the viable solutions. It has been studied since the end of the 1800s [Price, 2005] and it is now used in many countries. By stimulating research in that field and thereby reduce the risks for commercial exploration of wind power, many countries may help to reduce CO<sub>2</sub> emissions. In Norway, as an added incentive, new research centers connected with wind power studies have been created.

In Bergen, Norway, the Norwegian Centre for Offshore Wind Energy (NORCOWE) aims at assisting the industry in challenging aspects regarding offshore, deep water wind parks. In NORCOWE, the Bjerknes Centre for Climate Research will work on all aspects of wind resources and optimization.

The research work will be focused on high-

resolution numerical modeling of the atmosphere coupled with a wave and on computational fluid dynamics models. In This way, a better understanding of the potential and optimisation of offshore wind energy will be achieved.

Governments may promote environmentally friendly conditions by stimulating research in alternative energy systems. The hope is that the new center for wind power studies contribute to that.

## References

Price, Trevor J. (2005), James Blyth - Britain's first modern wind power engineer, *Wind Engineering*, 29 (3), 191–200, doi:10.1260/030952405774354921.



A windmill. Image by Wagner Christian under the Creative Commons Attribution ShareAlike 2.5 License. Obtained from:

<http://en.wikipedia.org/wiki/File:Windenergy.jpg>

## Understanding $PM_{2.5}$ in the Midwestern United States

Morgan Brown

In 2006, the Environmental Protection Agency (EPA) tightened its air quality standards on particulate matter (PM) smaller than 2.5 microns ( $PM_{2.5}$ ). The standard changed from 65 micrograms per cubic meter ( $\mu\text{g m}^{-3}$ ) to  $35.5 \mu\text{g m}^{-3}$ . Nonattainment is determined by averaging a  $PM_{2.5}$  monitor's 98th percentile values over a period of 3 years. If the averaged value is above the  $35.5 \mu\text{g m}^{-3}$  threshold, the EPA considers the monitor in nonattainment. The EPA is particularly concerned with  $PM_{2.5}$  because people with respiratory or heart problems can be adversely affected by fine airborne particles.

Although  $PM_{2.5}$  has not been an uncommon problem in parts of the United States (particularly the Eastern U.S. and parts of California), the Midwest has had very few areas of nonattainment, with exception of larger cities like Chicago and St. Louis. With the new EPA  $PM_{2.5}$  standards, some areas of the Midwest with smaller cities (like Davenport, Iowa) are now in danger of falling into nonattainment status. Since the Midwest differs from the Eastern U.S. in that it has a higher proportion of agricultural land and a lower population density, the conditions that lead to the formation of  $PM_{2.5}$  are different.

The most intense  $PM_{2.5}$  episodes happen under cold-weather conditions. Cold-weather  $PM_{2.5}$  episodes occur during a persistent high-pressure system that brings cold temperatures and calm winds across the region, which prevents transport and mixing of  $PM_{2.5}$ . The most common  $PM_{2.5}$  events occur preceding a frontal system, during short-lived periods of calm winds, increasing humidity and low turbulent mixing.



Iowa Department of Natural Resources air quality monitors in Davenport, IA. Photo by Alex Bender.

$PM_{2.5}$  is formed through chemical processes. A combination of nitric acid, a reaction product of nitrogen oxides ( $NO_x$ ; generally formed via combustion) and ammonia (agricultural sources in the Midwest) are required for the formation of the ammonium nitrate  $PM_{2.5}$ . Whichever compound (nitric acid or ammonia) has the lowest concentration in the atmosphere is the limiting reagent of  $PM_{2.5}$  formation. If the limiting reagent is decreased in concentration,  $PM_{2.5}$  concentrations will also go down. In Eastern Iowa, the limiting reagent is not certain, so controlling  $PM_{2.5}$  does not have an obvious solution. To the east (in Illinois) episodes are generally nitric acid limited, while to the northwest (in Wisconsin and Minnesota) episodes are generally ammonia limited. Charles Stanier, assistant professor of Chemical Engineering at the University of Iowa explains that "there is likely variability from place-to-place within Iowa and from episode-to-episode on which compound is more limiting to aerosol formation."

Understanding the process of  $PM_{2.5}$  formation in the Midwest United States is important to control  $PM_{2.5}$  concentrations now. However, Stanier says this could be important for future reevaluations of the particulate matter health hazards. "It is reasonable to assume that at some point in the future, these limits will be reconsidered and that the scientific and public health communities will advise lower limits."

More information on this preliminary work can be found online (see references) in a report on the Eastern Iowa Air Quality  $PM_{2.5}$  issue. The research for the report was done by the University of Iowa and the Center for Global and Regional Climate Change under the leadership of Professor Charles Stanier and Professor Gregory Carmichael.

### References:

Bender, A., G. Carmichael, A. Beranek-Collins, M.E. Brown, T. Holloway, A. Jamroensan, S.R. Lee, P. Marrapu, A. Pettibone, S. Sousan, S. Spak and C. Stanier (2009), Understanding Episodes of High Airborne Particulate Matter in Iowa. Report for the Bi-State. Available online at

[http://www.engineering.uiowa.edu/~cs\\_proj/iowa\\_pm\\_project/iowa\\_pm.htm](http://www.engineering.uiowa.edu/~cs_proj/iowa_pm_project/iowa_pm.htm).

EPA (2009)

<http://www.epa.gov/air/particlepollution/>

## 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: <http://atmospheres.agu.org> click on Job Listings/Resources.

**These job postings and others can be found at:**

[http://www.agu.org/cgi-bin/membership\\_services/joblistings.cgi](http://www.agu.org/cgi-bin/membership_services/joblistings.cgi)

### Atmospheric Sciences

\* Assistant/Associate Professor of Applied Climate Science and Director, High Plains Regional Climate Center. University of Nebraska-Lincoln.

\* Earth Science Education and Public Outreach Coordinator. NASA/Goddard Space Flight Center in Greenbelt, Maryland.

\* Faculty Position in Atmospheric Sciences. National Central University (NCU) in Taiwan.

\* Faculty Position in Atmospheric Sciences. Department of Marine, Earth, and Atmospheric Sciences (MEAS) at North Carolina State University.

\* Postdoc Scientist for Utah State University's Space Dynamics Lab to develop multiwavelength LIDAR retrieval algorithms relevant to air quality measurement.

\* Postdoctoral Fellow at the University of North Dakota in Grand Forks.

\* Postdoctoral research position in the Climate, Atmospheric Science, Physical Oceanography Division of Scripps Institution of Oceanography.

\* Project Scientist. IPCC working Group II Technical Support Unit.

\* Research scientist to work on Numerical Weather Prediction and Satellite Data Assimilation Techniques. Joint Center for Satellite Data Assimilation (JCSDA), Camp Springs, Maryland.

\* Research Scientist/Postdoctoral Position in Air Quality and Climate Science. HARC (<http://www.harc.edu>).

\* Tenure Track Position in Atmospheric Science. Department of Geosciences at Texas Tech University, Texas.

\* Director of Institute for Multidimensional Air Quality Studies (IMAQS). University of Houston Department of Earth and Atmospheric Sciences.

\* Summer and part time positions. JPL, NASA. <https://careerlaunch.jpl.nasa.gov/>

### Interdisciplinary

\* Postdoctoral Science Teaching Fellow in Science Education. Department of Geological Sciences at the University of Colorado, Boulder.

\* Postdoctoral researcher and visiting research scientists. Atmospheric and Oceanic Sciences. Princeton University, GFDL.

\* Scientist/Scientific Programmer with expertise in High-Performance Computing - postdoctoral research associate - University of Hamburg.

\* Climate and Climate Change scientist. JPL/Caltech.

\* Molina Fellowship in Environmental Science. Department of Earth, Atmospheric and Planetary Sciences, MIT, Cambridge, MA.

\* Professorship for Physics of the Climate System. University of Bremen & Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany.

\* Postdoctoral Physical Scientist Position-Agricultural Research Service. Hydrology and Remote Sensing Laboratory, Beltsville, Maryland.

\* Senior Program Manager and Senior Scientists. Pacific Northwest National Laboratory.

\* Chair in Climate Change. Department of Geography, University of Sussex.

\* Postdoctoral Fellows in Experimental Geophysics and Atmospheric Science. Department of Earth and Atmospheric Sciences, University of Houston, Houston, TX.

\* Research Physicist in snow physics. US Army Cold Regions Research and Engineering Laboratory - Snow Modelling Program.

### Student Opportunities

\* Graduate Assistantships in Bioclimatology and Environmental Science. Department of Geography and Regional Studies, University of Miami.

\* Ph.D. Assistantships Available to Study Environmental Management. Montclair State University, New Jersey.

\* Research & Discover Undergraduate Summer Internships and Graduate Fellowships in Earth System Science. University of New Hampshire.

## *Schools*

**## Summer School on Environmental Dynamics: Rain, Rivers & Turbulence ##**  
Venice, Italy. 12 - 19 June 2009. Application deadline: 20 April 2009.

<http://www.istitutoveneto.it/ssed/>

**## International Polar Field School in Svalbard ##**

Svalbard, Norway. 15 June - 3 July 2009. Application deadline: 27 March 2009.

<http://arcticportal.org/apecs/svalbard2009>

**## Summer School on Spectroscopy of the Atmospheres ##**

Jaca, Spain. 29 June - 10 July 2009.

<http://www.iem.csic.es/departamentos/fismol/Jaca2009/Jaca2009.htm>

**## Heliophysics Summer School 2009 ##**

Boulder, CO, USA. 22 - 29 July 2009. Application deadline: 1 April 2009.

<http://www.vsp.ucar.edu/HeliophysicsSummerSchool/2009announcement.html>

**## 2<sup>nd</sup> Int. Conference and Advanced School on Turbulent Mixing and Beyond ##**

Miramare - Trieste, Italy. 27 July - 7 August 2009. Application deadline: 30 March 2009.

<http://users.ictp.it/~smr2049/>

**## Summer School in Atmospheric Measurement 2009 ##**

Isle of Arran, Scotland. 6 - 18 September 2009. Registration deadline: 1 May 2009.

<http://ncasweb.leeds.ac.uk/arransummerschool/>

**## UJCC-NCAS Climate Modelling Summer School ##**

Cambridge, UK. 14 - 25 September 2009. Registration deadline: 15 May 2009.

<http://ncasweb.leeds.ac.uk/climatesummerschool/>

**## Cargese International School: Water Vapour in the Climate System ##**

Cargese, Corsica (France). 14 - 26 September 2009. Registration deadline: 4 May 2009.

<http://ncasweb.leeds.ac.uk/climatesummerschool/>

## *Conferences*

**// European Geosciences Union General Assembly 2009 //**

Vienna, Austria. 19 - 24 April 2009.

<http://meetings.copernicus.org/egu2009/>

**// 3<sup>rd</sup> THORPEX International Science Symposium //**

Monterey, CA, USA. 4 - 8 May 2009.

[http://www.wmo.int/pages/prog/arep/wwrp/new/thorpex\\_ttiss.html](http://www.wmo.int/pages/prog/arep/wwrp/new/thorpex_ttiss.html)

**// AGU Chapman Conference on Effects of Thunderstorms and Lightning in the Upper Atmosphere //**

The Pennsylvania State University, University Park, Pennsylvania, USA. 10 - 14 May 2009.

<http://www.agu.org/meetings/chapman/2009/bcall/>

**// CCMVal workshop 2009 //**

Toronto, Canada. 1 - 5 June 2009. Abstracts submission deadline: 31 March 2009.

<http://www.atmosp.physics.utoronto.ca/SPARC/CCMVal2009/>

**// AGU Chapman Conference on Abrupt Climate Change //**

Columbus, Ohio, USA. 15 - 19 June 2009. Abstracts submission deadline: 20 March 2009.

<http://www.agu.org/meetings/chapman/2009/ccall/>

**// International Conference on Fluxes and Structures in Fluids: Physics of Geospheres //**

Moscow, Russia. 24 - 27 June 2009.

<http://lfm-ipm.ipmnet.ru>

**// 7<sup>th</sup> International Conference on Urban Climate //**

Yokohama, Japan. 29 June - 3 July 2009.

<http://www.ide.titech.ac.jp/~icuc7/>

**// PAGES 1<sup>st</sup> Young Scientists Meeting: Retrospective views on our planet's future //**

Corvallis, USA. 6 - 7 July 2009.

<http://www.pages-osm.org>



**// PAGES 3<sup>rd</sup> Open Science Meeting: Retrospective views on our planet's future //**

Corvallis, USA. 8 - 11 July 2009.

<http://www.pages-osm.org>**// NCAR ECSA Junior Faculty Forum on Future Scientific Directions 2009 //**

Boulder, CO, USA. 14 - 16 July 2009.

<http://www.asp.ucar.edu/ecsa/jff/jff09.php>**// 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>**// 18<sup>th</sup> International Conference on Nucleation & Atmospheric Aerosols //**

Prague, Czech Republic. 10 - 14 August 2009.

<http://www.icnaa.cz>**// 1<sup>st</sup> IEEE GRSS Workshop on Hyperspectral Image and Signal Processing - Evolution in Remote Sensing - //**

Grenoble, France. 26 - 28 August 2009. Application deadline: 31 March 2009.

<http://www.ieee-whispers.com/2009/>**// WMO Symposium on Nowcasting //**

Whistler, B.C., Canada. 30 August - 4 September 2009. Abstractsw submission deadline: 31 March 2009.

<http://www.nowcasting2009.ca>**// World Climate Conference-3 //**

Geneva, Switzerland. 31 August - 4 September 2009.

<http://www.wmo.int/wcc3>**// First Workshop on Open Source and Internet Technology for Scientific Environment: with case studies from Environmental Monitoring //**

Trieste, Italy. 7 - 25 September 2009. Application deadline: 30 April 2009.

<http://www.ictp.it>**// European Conference on Applications of Meteorology - EMS Annual Meeting //**

Toulouse, France. 28 - 29 September 2009. Abstracts submission deadline: 8 May 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. Application deadline: 10 June 2009.

<http://www.ictp.it>

## Announcements

**Computing Resources at NCAR for Universities**

NCAR's Computational and Information Systems Laboratory (CISL) invites NSF-supported university researchers in the atmospheric, oceanic and closely related sciences to submit requests for projects needing more than 16,000 GAUs. Application Deadline: 14 April 2009.

<http://www.cisl.ucar.edu/resources/overviewalloc.shtml>

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Front cover: lightning strikes off the coast of Darwin, Australia in Feb. 2006. Picture taken by Jim Benedict from Colorado State University, during the Tropical Warm Pool International Cloud Experiment (TWP-ICE).