

Atmospheric Sciences Section of AGU Newsletter

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The New Face of Computer Simulations

In the last issue, Will Anderson told you about the Earth Simulator's history and structure. This is Part 2 of the Article.

Will Anderson

The Earth Simulator (ES), one of the world's most powerful supercomputers, is housed at the Earth Simulator Center (ESC) in Japan. The ES illustrates the changing state of contemporary science. In the 21st century, high-performance computing technology is being embraced for its ability to reproduce and predict physical phenomena.

Under the Hood

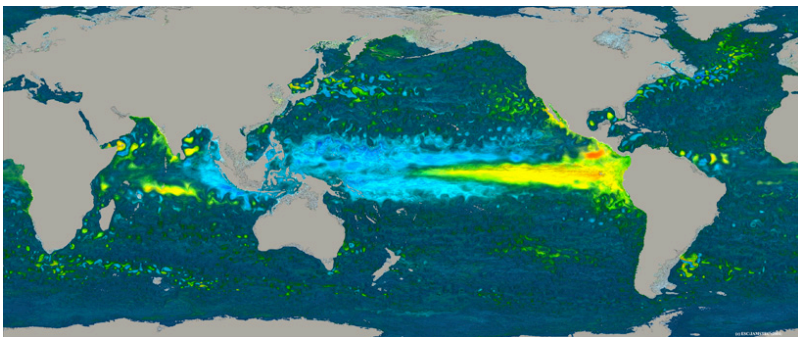
The ES is a massively-parallel system of 640 processor nodes interconnected by a Single-Stage Crossbar Network. It has a peak

performance of 40 teraflops, although it is typically run at 90% of peak performance. This remarkable power allows for a global resolution of 10 km for simulations of the atmospheric boundary layer.

The TOP500 project (<http://top500.org>), which tracks and records statistics about the world's most powerful supercomputers, currently places the ES at position 14 on the top-500 list, following a 2.5 year reign at the top of the list (from June, 2002 through September 2004). The ES was eventually surpassed by IBM's Blue Gene/L, which was built by IBM for the US Department of Energy, and is housed at the Lawrence Livermore National Laboratory. As we know, 2.5 years is a relatively long time in high-performance computing.

and atmosphere. For example, because the ES simulates the entire system, the effect of a hurricane in the Gulf of Mexico can be correlated with other atmospheric events around the globe. Not only can the ES reproduce such physics, but it can also predict natural events (such as tropical storms), one of the most exciting aspects of the ES. Such applications have social, political, and economical implications. For example, correct numerical predictions of European heat waves would allow authorities to plan for this event, and numerical prediction of global weather patterns may allow for a deeper understanding of the ENSO phenomena.

More information can be found at: www.es.jamstec.go.jp/esc/eng/.



A snapshot of SST anomalies in Jan. 1998, obtained using a volume rendering technique, taken from an OFES (Oceanic General Circulation Model for the ES) hindcast simulation. The simulation ran from 1950 and was forced by daily mean reanalysis (NCEP I), following a 50-year climatological spin-up. The hindcast simulation well represents oceanic variations on time scales from intraseasonal to decadal. For sources on this research, see Page 6.

Outcomes and Predictions

By simulating the whole system, the ES has the unprecedented ability to reproduce the physics of the solid earth, ocean

HIGHLIGHTS

AGU Fellows Committee nominations deadline is Aug. 15:

<http://www.agu.org/inside/fellguides.html>

2007 Fall AGU Meeting abstracts due Sept. 6:

<http://www.agu.org/meetings/fm07/?Content=registration>

2007 Fall AS Section Banquet is planned for Tuesday, December 11, at the Empress of China.

AS Newsletter

This month's newsletter is short but still full of exciting information. Will Anderson concludes his two-part article on the Earth Simulator in Japan, and Michel dos Santos Mesquita describes the difficulties of obtaining data above 18,000 feet. Also, there is information on registering for the AGU Fall meeting on Page 5.

One of the strengths of this newsletter is the diversity of its reporters. Including myself, there are four of us - each from a different country, and each studying different aspects of the atmosphere. To highlight that diversity, this issue has short profiles on three of us, and more will follow on the fourth member of the team, Juan Añel.

I hope we can continue to bring you interesting stories from around the world. Help us in this goal by sending me suggestions for articles. This can be something you personally are working on, or just something you find interesting and would like to know more about.

Send me an e-mail (abharper@atmos.colostate.edu). Also, we are still accepting submissions for a newsletter logo.

*Happy Reading,
Anna Harper, Editor*

Newsletter Reporters:

*Will Anderson - Texas Tech University
Juan A. Añel - University of Vigo, Spain
Michel dos Santos Mesquita - Univ. of Alaska, Fairbanks*

Meet the Press

An introduction to the newsletter reporters

Michel dos Santos Mesquita

Hometown: Pelotas, Rio Grande do Sul state, Brazil

Background: BS in Meteorology (from Brazil), BS in Linguistics (from Brazil), MS in Geophysics (Climatology) from the University of Bergen, Norway. Now working as a research assistant and a PhD student at the International Arctic Research Center / Univ. of Alaska Fairbanks.

Currently studying: I am studying the dynamics of storm tracks in the North Pacific. I work with storm tracking algorithms which track storms using the relative vorticity (instead of the MSLP).

Interests: I love riding my bike around Fairbanks during weekends. I also like reading, watching movies and traveling. I have traveled a lot in my life, mostly South America, Europe and the US.

What I like about science and doing research: I love statistics and probability. I really enjoy being able to run statistical packages, such as R (www.r-project.org) and see my dataset through the eyes of statistics. I also enjoy investigating my storms, especially the ones that are extreme, because these have a huge impact on the coast of Alaska, causing erosion problems. I enjoy doing this kind of "forensics of storms", that is, to find elements which give me clues on the dynamics of these systems. It is like being a detective! I also like that great feeling of submitting a paper to a journal. It is the feeling that the work I have done may be used in the scientific community, that is, my small contribution to science. That feeling is priceless!

Will Anderson

Hometown: Cairns, Queensland, Australia

Background: B.E. in Civil Engineering, James Cook University, Australia; M.S. in Civil Engineering, Texas Tech University, U.S.

Currently studying: In Lubbock, Tex., studying atmospheric boundary layer flows, although in the fall I'm starting a Ph.D. in mechanical engineering at The Johns Hopkins University in Baltimore, MD.

Interests: Swimming, riding my bike, staying in touch with my family, spending time with my girlfriend.

What I like about science and doing research: Being close to the "information age", finding new understanding of physical prob-

lems through high performance computing, traveling and meeting new and interesting people from all over the world. (<http://www.webpages.ttu.edu/wianders>)

Anna Harper

Hometown: Atlanta, Georgia

Background: B.S. in geology and journalism from the University of Georgia. Worked as a geologist for a geophysical company for 18 months in Atlanta.

Currently studying: I'm working on my Master's in atmospheric science at Colorado State University in Fort Collins. I study vegetation-atmosphere interactions, particularly how these interactions can affect large-scale precipitation patterns in the Amazon Basin.

Interests: Colorado is a great place for hiking, camping, biking, and snowboarding. I also love to travel and have a long list of places I want to see. My husband enjoys all of these activities, too, so we have a lot of fun together.

What I like about science and doing research: I love learning about the world we live in. While studying geology, I was constantly amazed by the story of our planet's past. I am the type of person who can't go on a road trip without a Roadside Geology book. I enjoy trying to tease out the answers to questions through research, and there is nothing like that "AHA!" moment, when all of your work pays off. In the long run, I hope that my research will help educate the general public about the climate and climate change. I think that climate change a major issue facing my generation and I hope science will play a role in how people chose to act toward our environment.

Pass It On

Anna Harper

As the preceding profiles indicate, all of us have our reasons for working in this field. And no matter how varied these reasons might be, I'm sure that most of us share one common thread - a teacher or mentor from our childhoods who initially sparked this interest in science or research.

In upcoming issues, we will share with you some ideas for passing this spark on to young students. If you have something to share about how you or someone you know is impacting the next generation, please send an email to abharper@atmos.colostate.edu, subject: Pass It On. Thank you!



Mount McKinley

A New Source of Data

Michel dos Santos Mesquita

Mount McKinley, located in Denali National Park in Alaska, is the highest peak in North America at an elevation of 20,320 ft (6194 m). It has taken the lives of many who have dared to climb it. A well-known Japanese climber, N. Uemura, went missing on McKinley in 1984. In February 1989, three experienced Japanese climbers fell to their death near Denali Pass. The cause? Some say it was the extremely high winds over that area.

Such events prompted both scientists and climbers to record the conditions on Mount McKinley and to find out if wind gusts capable of blowing people off the mountain exist in this area. However, the task of monitoring the weather on Mount McKinley has proven to be as difficult as climbing to the lofty summit.

In 1990, a team of climbers from the Japan Alpine Club (JAC), lead by Y. Okura, was permitted by the National Park Service (NPS) to place a meteorological station on the mountain. The weather station was installed on a ridge at an altitude of about 18,734 ft (5710 m) in 1991, and was allowed to operate for 10 years by the NPS. Although originally the station had a rectangular base, this fell over

within the first year. In 1992, a tetrapod-type base was placed with stronger guide wires.

The station was donated to the International Arctic Research Center (Fairbanks, AK) in 1999, so that the operation could be extended and improved, with real-time data available on the internet. The NPS allowed the continuation of this project with the condition that the data should be made available to the Park Service, the National Weather Service and other interested parties.

The weather station was upgraded to include a sonic anemometer for the first time in June 2002. This station would transmit real-time weather data, such as temperature, wind speed and direction. An ultrasonic sensor was used because it had no moving parts and was expected to last longer under the extreme conditions. On June 18, 2002, the station began transmitting the data. Some of the readings were assumed inaccurate under stormy conditions. One of the reasons was because the ultrasonic sensor is sensitive to turbulence, and the winds were often higher than the sensor could handle. On January 7, 2003, the station stopped transmitting the data during stormy weather. The combination of icing and strong winds broke the antenna off from the transmitter.

In 2003, an upgraded ultrasonic anemometer made to withstand stronger winds (60 m/s) and a satellite system for more frequent transmission were installed to the weather station, but the weather station failed to transmit soon after the installation for un-

known reasons. A static discharge was thought to have caused damage to the CPU.

A new approach was adopted in 2004 - multiple redundant systems, similar to instruments used in spaceflight. Two CPUs and two transmission systems with independent power supplies were installed. The data were then transmitted every 4 hours by satellite and a terrestrial link sent data every 30 minutes. During this season the satellite transmission also failed.

In 2005, with continuous support from the Park Service, a new approach was taken with the whole system. Because of the location of the weather station, previous weather station components were minimized to reduce the weight to make it easier to carry up the mountain. However, Park Rangers in Talkeetna, AK regularly fly a helicopter to the Medical Camp at 14,000 ft. By having more direct contacts with the rangers, the station's technicians were able to fly instruments and batteries to the camp, allowing them to carry heavier equipment and more batteries for the weather station. Unfortunately the CPU was damaged, making the batteries run down earlier than expected. The transmission stopped at the end of October.

In 2006, using the multiple redundant systems, the weather station successfully transmitted data until February 2007. The reason for the ceased transmission was evident when the technicians reached the weather station in 2007. After nearly 15 years of successfully supporting the instruments, the entire mounting base (tetra-pod) of the weather station had collapsed and the antenna cables were broken. The poles and guide wires that supported the tetra-pod was completely destroyed.

"We were told that the weather station was broken by rangers and other climbers,



Left: The path followed by the climbers to reach the weather station: a dangerous and risky operation. Photo courtesy of Dr. Syun Akasofu.

Top of Page: The weather station sits on a ridge below McKinley's summit. Photo courtesy of Tohru Saito.

but ... the weather station was secured solidly to the rocks and every year when we are told that it's broken, it ends up just being the cup anemometer or the antenna that was broken. It never occurred to us that the entire weather station could be destroyed by the wind," said Tohru Saito, a climber and technician with the IARC. Although the team was prepared to equip the weather station with new sensors and transmitters, they were not ready to repair the entire station. As the technicians worked on a possible solution for the destroyed components, bad weather was moving in. In the end, it was agreed that it was impossible to secure the anemometer to the weather station, so only the temperature sensors and pressure sensors were left on the mountain for 2007.

In hindsight, Saito says they learned a valuable lesson. "The lesson we learned was to be prepared for the worst. Especially when you only have one chance to visit the station in a year and the opportunity to work is very limited by weather," he pointed out.

Saito has also mentioned that if any of the AGU Atmospheric Sciences Newsletter readers have any comments or suggestions about equipment to be used on Mt. McKinley, they may contact him at: saito@iarc.uaf.edu.

Mount McKinley is now a new source of data. It is hoped that this data can be used to improve research but also to remind climbers of the dangerous conditions on the mountain.



Above: The weather station in 2006, located at 18,734 feet.

Below: The site as climbers found it in 2007 - the tetrapod had been blown away by high winds. Photo courtesy of Makoto Kumagai.

Opportunities

Compiled by Anna Harper

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://www.agu.org/sections/atmos/> click on Job Listings/Resources.

AGU job postings can be found at:

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

Below is a list of the postings in Atmospheric Sciences:

- Research Scientist Positions, Goddard Earth Sciences and Technology Center, University of Maryland/NASA: Aerosol retrievals from satellite remote sensing; Remote sensing of precipitation - apply prior to Aug. 15
- Research Associate Positions, Cooperative Institute for Research in Environmental Sciences, NOAA Space Environment Center in the areas of solar UV imaging, solar x-ray and EUV irradiance, and the impacts of solar irradiance on the terrestrial atmosphere - reviews begin Sept. 4
- Postdoctoral Research Associate, Climate Impacts Group and Department of Atmospheric Sciences, University of Washington: regional climate modeling and climate impacts assessment - apply by Aug. 20
- Postdoctoral scientist, Center for Ocean-Land-Atmosphere Studies, Institute of Global Environment and Society, Maryland: regional climate modeling - deadline Sept. 15
- Postdoctoral research position, Atmospheric Chemistry, University of British Columbia: ice nucleation kinetics
- Research positions, Atmospheric and Space Technology Research Associates: modeling of upper atmospheres of Earth and Mars; ionosphere-thermosphere-magnetosphere research; data assimilation; instrument development - reviews begin immediately
- Postdoctoral Fellowship, Jet Propulsion Laboratory / Caltech - deadlines July 1 and Nov. 1, 2007

- Postdoctoral position, Institute of Environmental Physics and Remote Sensing, University of Bremen, Germany - deadline Aug. 30, 2007

Biogeosciences

- Postdoctoral (or more experienced) researcher positions, Princeton University: Southern Ocean processes; carbon sources and sinks; applications of satellite observations; the response of ocean biology to global warming; and more - reviews begin immediately

Ocean Sciences

- Researcher, NOAA's Geophysical Fluid Dynamics Laboratory and Princeton University: ice sheets, sea level, and climate change - deadline Oct. 15
- Physical Oceanographer, U.S. Department of Commerce/ NOAA's Atlantic Oceanographic and Meteorological Laboratory, Miami, Fla.: physical oceanography and the ocean's role in climate variations
- Physical Oceanographer/Permanent research position, Rossby Centre, Swedish Meteorological and Hydrological Institute: advanced ocean modeling and analyses for climate and climate change applications - deadline Aug. 20

Interdisciplinary/Other

- Associate Director, Center for Remote Sensing of Ice Sheets, University of Kansas
- Director of the Gaylord Nelson Institute for Environmental Studies, The University of Wisconsin - Madison - applications and nominations deadline Aug. 15
- Assistant Professor (tenure-track), environmental history, Department of History and the Program of Environmental Studies at Yale University - deadline Oct. 15.
- Information Systems Associate, Woods Hole Oceanographic Institute
- Media and Public Relations Coordinator, the School of Earth and Space Exploration at Arizona State University - deadline Aug. 12
- Project Earth Scientist/Technical Coordinator, Earth Knowledge, Inc., Tucson, Arizona
- Senior Program officer, World Wildlife Fund, Climate Change Global Program Unit
- Director, Center for the Environment, Plymouth State University - reviews begin July 27, 2007

- Tenure-track faculty, Appalachian Laboratory, University of Maryland Center for Environmental Science - reviews begin Sept. 1, 2007

Student Opportunities

- PhD student scholarship, Atmospheric Research Group, Department of Physics, National University of Ireland, Galway: aerosol radiative parameters
- Scholarship opportunities, school of Environmental Systems Engineering, The University of Western Australia, Perth - deadline Aug. 15

Conferences

- **AGU Fall Meeting** (Dec. 10-14) - San Francisco, Calif.
<http://www.agu.org/meetings/fm07/>

Below is a list of the pre-planned sessions in Atmospheric Sciences. However, there are many more sessions relevant to our section. Visit the website above for more.

- Aerosols and clouds general contributions
- Climate and dynamics general contributions
- Composition and chemistry general contributions
- Light scattering and radiative transfer: Basic research and application
- Atmospheric column radiative energy budget
- The radiative forcing of anthropogenic aerosols
- Aerosols and climate
- Atmospheric aerosol nucleation and new particle formation
- Trace components in atmospheric particulate matter: Monitoring and modeling
- Aerosol water: Important for weather and climate?
- Physics and chemistry of the upper troposphere and lower stratosphere
- First results from the Tropical Composition, Clouds, and Climate Coupling experiment (TC4)
- Ten years of SHADOZ (Southern Hemisphere Additional Ozonesondes) Tropical Soundings
- Nitrogen oxide emissions and effects on tropospheric chemistry
- Narrowing uncertainties in estimates of global OH abundance and trace gas lifetimes

- Tropospheric halogen chemistry
- Atmospheric compositional changes recorded in firm air: Histories and mechanisms
- Atmospheric chemistry of ice and snow
- Space observations of atmospheric carbon dioxide: Retrieval, validation, modeling, and assimilation
- Frontiers in atmospheric instrumentation and measurement
- Multi-sensor atmospheric data intercomparison, synergy, and fusion: Aerosols, trace gases, clouds
- Evaluation of cloud parameterizations using multi-constellation satellite platforms
- Source and state data assimilation of satellite and in situ measurements of atmospheric chemistry
- High-resolution modeling for hurricane prediction and impact studies
- Extratropical and polar storms: Synoptic-scale perspective and linkage to large-scale climate variability and change
- Microscale atmospheric process dynamics and the link to macroscale climate
- SI-traceable climate measurements from space: Realization and applications
- Studying climate dynamics with idealized atmospheric GCM's
- Atmospheric chemistry and climate
- Understanding the cross-ocean evolution of emissions from continents and their interactions with maritime weather
- Troposphere gaseous composition in the regional and global perspective
- Transport and transformation of air pollution from regional to global scales
- Evaluation of air quality models and assessment of emission inventories using bottom-up and top-down approaches
- Day and nighttime chemical processing in polluted atmospheres
- Transport and mixing affecting air quality in coastal and complex terrain urban areas
- Satellite observations for air quality applications
- Urban effects on radiative forcing by aerosols and clouds
- Cloud effects on aerosol
- Urban dispersion modeling for chemical, biological, and radiological releases: Current status and research needs

• Making Science Global: Reconsidering the Social and Intellectual Implications of the International Polar and Geophysical Years

AS section members interested in Polar issues and the history of science may wish to attend this free two day conference to be held on Oct. 31 and Nov. 1, 2007 at the Smithsonian Institution's S. Dillon Ripley Center on the National Mall in Washington, DC.

This NSF-supported conference examines the impetus for (and the impact upon) science, society, and culture of the International Polar Years (IPYs) of 1882-83 and 1932-33, and the International Geophysical Year of 1957-58, as well as how historical perspectives might be useful for those involved in the current IPY in 2007-2008.

Speakers will explore the origins of these efforts, their political dimensions, and their consequences. Themes will include the place of the poles in human imagination; discipline formation; cultural nationalism, politics, and trans-nationality; the emergence of the modern geosciences; the uses of new technologies to explore the poles; changing assessments of the nature of human cultures in high latitudes; and polar contributions to environmental awareness.

A number of papers and posters focus specifically on atmospheric issues, and all speakers will address international, political, and technological dimensions of Polar science. The final session of the conference, "Polar History: Perspectives on Globalization in the Geosciences," intended to address recent history leading up to the current IPY, will be the opening session of the annual meeting of the History of Science Society, to be held at the Crystal Gateway Marriott.

For a detailed program complete with speaker bios and paper abstracts go to the following URL:

<http://www.nasm.si.edu/getinvolved/making-scienceglobal/>

Registration is free, but required. Please download the registration form at:

<http://www.nasm.si.edu/getinvolved/making-scienceglobal/ipyregistration.doc>

and send your information to the following e-mail address:

makingscienceglobal@si.edu

Completed forms may also be mailed to:

David DeVorkin
Dept. of Space History, MRC 311
National Air and Space Museum
Smithsonian Institution
PO Box 37012
Washington DC 20013-37012 USA

On behalf of conference organizers David DeVorkin, Roger Launius, and myself, I look forward to your participation in this meeting.

James Fleming
AS section member

golsonbooks2@hotmail.com. Please include a very brief summary of your background in environmental and geographic issues.

In the News

- **Polar Dynamics: Monitoring, Understanding, and Prediction** (Aug. 29-31, 2007) - Bergen, Norway. Visit: <http://web.gfi.uib.no/conference2007/program.html>, or email Dr. Tore Furevik (tore.furevik@gfi.uib.no)
- Following in the footsteps of Al Gore, Leonardo DiCaprio has produced a documentary, *The 11th Hour*, which comes out on August 17. The film documents and offers potential solutions for issues such as global warming, deforestation, and mass species extinction.

<http://wip.warnerbros.com/11thhour/>

www.imdb.com/title/tt0492931/

Other Opportunities

- Call for abstracts: AGU 2007 Fall Meeting (Dec. 10-14), San Francisco, Cal. Deadline Sept. 6
<http://www.agu.org/meetings/fm07/?Content=registration>
- The Committee on Space Research (COSPAR) of the International Council for Science is seeking nominees for various awards and medals which recognize the outstanding achievements of space scientists throughout the world. Details of the awards and past recipients can be found at <http://cosparhq.cnes.fr/Awards/awards.htm>. Awards will be presented at the 37th COSPAR Scientific Assembly to be held in Montreal, Canada, July 13-20, 2008.

Nomination forms and instructions can be found at http://www7.nationalacademies.org/ssb/COSPAR_nominations2007.html. Completed nomination packages must be submitted to the National Research Council's Space Studies Board, the U.S. National Committee for COSPAR, no later than September 28, 2007.

- Call for papers on "Diagnosing and Modeling of the Tropopause: Structure, Dynamics, and Variability" for JGR-Atmospheres - deadline Dec. 12, 2007. <http://www.agu.org/pubs/call/TROPO1.html>
- Call for authors: Encyclopedia of Global Warming and Climate Change. The work will be marketed to public and academic libraries. Each article will range from 550 to 5,000 words. Payment for the articles are honoraria that range from a \$50 book credit at Sage Publications for article submissions totaling 500 to 1,000 words up to a free set of the finished encyclopedia (a \$400 value) for contributions totaling 10,000 words. For more information, please contact Dr. Maria Siano by email at

ES Caption - References of OFES hindcast simulation

Sasaki, H., M. Nonaka, Y. Masumoto, Y. Sasai, H. Uehara, and H. Sakuma: An eddy-resolving hindcast simulation of the quasi-global ocean from 1950 to 2003 on the Earth Simulator. *High Resolution Numerical Modeling of the Atmosphere and Ocean*, W. Ohfuchi and K. Hamilton (Eds.), Springer, New York, in press.

Sasaki, H., Y. Sasai, S. Kawahara, M. Furuchi, F. Araki, A. Ishida, Y. Yamanaka, Y. Masumoto, and H. Sakuma, 2004: A series of eddy-resolving ocean simulations in the world oceans - OFES (OGCM for the Earth Simulator) project: *Oceans '04. MTS/IEEE Techno-Ocean '04*, 3, 1535-1541.

http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?isnumber=30473&arnumber=1406350&count=110&index=64