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

Atmospheric Sciences Section of AGU Newsletter

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Predicting Arctic Sea Ice in 2008

Michel Mesquita

In a 2008 *Eos* article by Stroeve et al., a discussion about sea-ice reduction shows some alarming concerns: "Arctic sea ice declined rapidly to unprecedented low extents in the summer of 2007, raising concern that the Arctic may be on the verge of a fundamental transition toward a seasonal ice cover." They also conclude that given model results and the events of 2007, a seasonally ice-free Arctic Ocean might become a reality as early as 2030.

It is thus of interest to climate researchers to know what the situation could be for the current year. In order to understand more about that question, we interviewed Dr. Igor Polyakov, a Research Professor at the International Arctic Research Center in Fairbanks, Alaska. Dr. Polyakov is also the Principal Investigator of the Nansen and Amundsen Basin Observation System (NABOS) Project (http://nabos.iarc.uaf.edu).

***Viktor Buynitsky,* the research vessel used during the 2007 NABOS field season.**

According to Dr. Polyakov, the ocean's long-term impact on ice has often been underestimated in climatic studies – it is not all about surface air temperature. With the shift to a seasonal ice cover, the short-term (seasonal scale) impact of oceanic heat on ice becomes increasingly important. Thanks to the IPY and many contributing scientists, there are enough data to support a better understanding of our climate system. It is now more feasible to discuss future changes in Arctic sea-ice.

The Arctic Ocean plays a fundamental role in preconditioning of ice. For example, a decrease in air temperature and intermediate Arctic Ocean water temperature was observed in the 1960's. Since then, both ice and ocean temperatures have been gradually increasing. Arctic researchers believe that this warming of the entire Arctic system played

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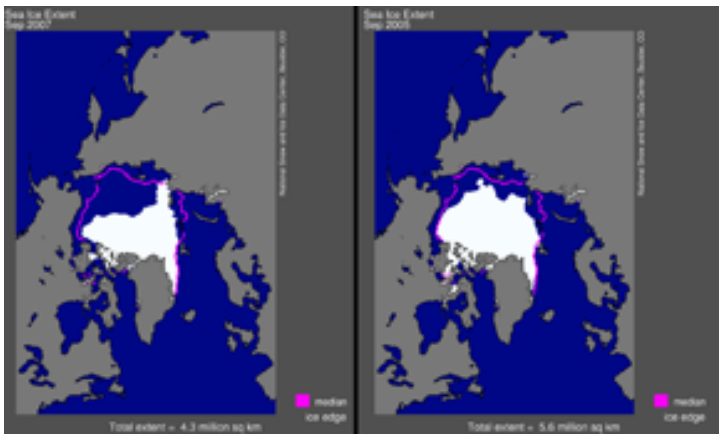

This image compares the average sea ice extent for September 2007 to September 2005; the magenta line indicates the long-term median from 1979 to 2000. September 2007 sea ice extent was 4.28 million square kilometers (1.65 million square miles), compared to 5.57 million square kilometers (2.14 million square miles) in September 2005. Image courtesy of the National Snow and Ice Data Center (http://nsidc.org/arcticseaicenews).

HIGHLIGHTS

2008 Fall Meeting abstract submission deadline is Sept. 10, 2359 UTC. The sessions are listed here:

http://www.agu.org/meetings/fm08/?content=search

AS Newsletter

Hello Readers,

I would like to introduce to you several new Editors for the Newsletter. We now have a wide range of both new and accomplished scientists on board to bring you information from many disciplines and from many countries. Welcome to:

Morgan Brown, who recently received her M.S. focusing on mesoscale weather simulations from the University of Alaska, Fairbanks, and will soon be pursuing her Ph.D. in science education at the University of Iowa

Rob Cifelli, a senior research scientist in the radar meteorology group at Colorado State University

Charles Gatebe is an atmospheric scientist in the Goddard Earth Science and Technology Center, University of Maryland Baltimore County, and a Principal Investigator of the Cloud Absorption Radiometer (CAR)

Yolande Serra, an associate research professor focusing on tropical meteorology at the University of Arizona

Hans von Storch, a director of the Institute for Coastal Research of the GKSS Research Centre and professor at the Meteorological Institute of the University of Hamburg

Yi Wang, a postdoctoral investigator at the Pacific Northwest National Laboratory interested in climate, atmospheric radiation, climate feedbacks

Happy Reading,
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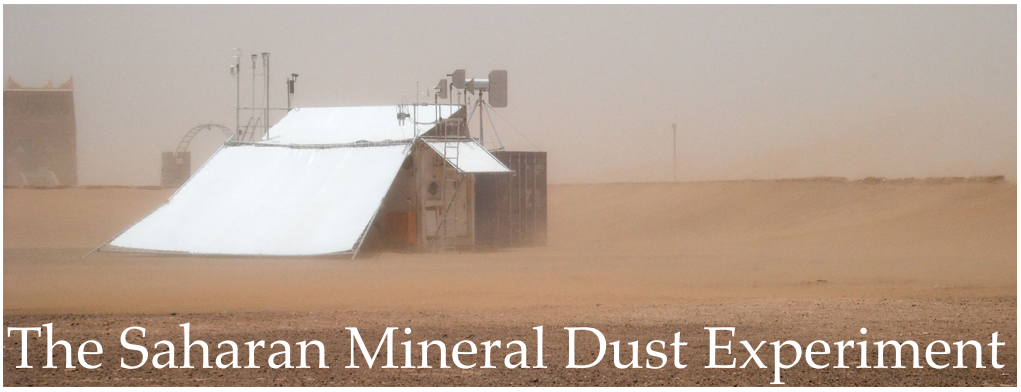

The Saharan Mineral Dust Experiment

AS Horizons: Saharan Mineral Dust Experiment (SAMUM)

Juan A. Añel

SAMUM (Saharan Mineral Dust Experiment) is a project with the participation of ten different laboratories/institutions from four countries: Germany, Morocco, Portugal and USA. Members of the project include five university research groups, about 50 researchers and the Barcelona Supercomputing Centre. The project is funded by the German Research Foundation (DFG) with 4 million euros for the period 2004-2010.

SAMUM is focused on the measurement and analysis of the effect of mineral dust from the Sahara desert on the atmospheric radiation budget. Sunlight and the wavelength-transformed light reflected from the ground and from atmospheric particles ("terrestial radiation") are strongly influenced by the presence of mineral dust in the atmosphere. This is believed to have a significant impact on global climate change. However, neither the sign nor the amount of this influence is known, according to the last IPCC report in 2007. Therefore, more intense research is needed on this subject.

Dr. Jost Heintzenberg from the Leibniz-Institute for Tropospheric Research is the Speaker of the SAMUM Project. As he says, the direct radiative effects caused by mineral dust are complex. The magnitude and even the sign of the net dust radiative forcing depends on the optical properties of the dust, its vertical distribution, the presence of clouds, and the albedo of the underlying surface.

Ground-based mineral dust measurements and sampling in SAMUM-1 near Zagora, Morocco, June 2006. Photo courtesy Jost Heintzenberg.

Large-scale effects of mineral dust on energy balance and climate can only be assessed through numerical models with sufficient coverage, resolution and physical completeness. They need to be constrained by detailed physical dust characteristics, in particular spectral optical properties of the dust particles (such as their size and single scattering albedo). Therefore, the two first field campaigns of the SAMUM project, SAMUM-1 and SAMUM-2, focused on a detailed physical characterization of dust particles.

In May/June 2006, the Saharan Mineral Dust Experiment, SAMUM-1, the largest mineral dust experiment to date, was conducted in southern Morocco. The location was chosen because of its proximity to the Sahara desert, which is the strongest natural source of mineral dust in the world. The particular sites (Ouarzazate and Zagora) were chosen because they offer the best infrastructure for the experiment.

The aim was to characterize dust particles near the world's largest mineral dust source and to quantify dust-related radiative effects.

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Roll-out of the German research aircraft Partenavia on the airport of Ouarzazate, Morocco, May 2006. Photo courtesy Jost Heintzenberg.

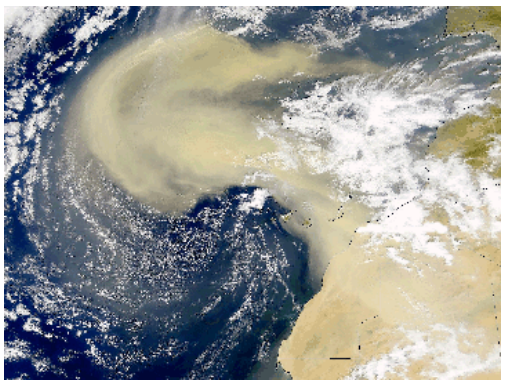
***AS Horizons**: Continued from Prev. Page*

At one of the two ground-based measurement sites, dust particle size distribution, optical, hygroscopic, chemical, and structural particle characteristics were measured. At the other site, three ground-based lidars determined optical dust properties, particle shape and the temporal development of dust layers. Columnar, ground-based sun photometer measurements complemented the lidar data. Two research aircraft were used to measure solar spectral irradiances, surface albedo, aerosol physical characteristics, and lidar profiles through the dust layers. Additionally, a station in Évora, Portugal monitored dust outbreaks from the north African source region to the Iberian Peninsula during SAMUM-1. These detailed measurements were used in volumetric and columnar closure exercises, as well as in optical and radiative transfer models. Also, developments of a mesoscale dust transport model were validated.

In January-February and June 2008, the SAMUM-2 experiment took place with the same set of measurements at Praia, Cape Verde Islands. The second experiment was directed at the Saharan dust plume as it travels over the Atlantic to the Americas mixed with biomass burning emissions from fires in West Africa. Presently a third phase of SAMUM on Barbados in 2010 is being discussed.

There will be a special issue of Tellus-B on the SAMUM-1 experiment coming out in January 2009. More information about SAMUM can be obtained from its web page: http://samum.tropos.de.

About AS Horizons: Remember, you can submit your projects or suggest one that you know of to be highlighted in *AS Horizons*. Submission procedures can be consulted in the AGU/AS section webpage (http://atmospheres.agu.org) in the Volume 2, issue 2 of the AGU AS Newsletter.

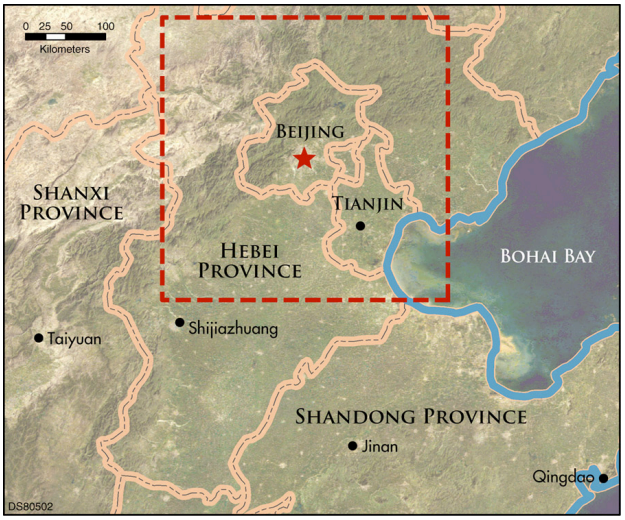


Dust outbreak as seen by NASA Terra/ MODIS satellite sensors Jan. 4, 2003.

Beijing Focuses on Air Quality for the 2008 Summer Olympics

Anna Harper

Starting with the Opening Ceremonies on August 8, the world's eyes will be on Beijing for the 2008 Summer Olympics. Beijing is situated along the northwestern borders of the Great North China Plain. Summer pollution is affected by local meteorology and topography. The city of 14 million people [http://en.beijing2008.cn] is surrounded by mountains to the west, north and east. During the summer months, the Pacific High is located to the southwest of Beijing, resulting in dominantly southeasterly and southwesterly winds. Located to the south are the cities of Tianjin (9.3 million people), Shijiazhuang (9.1 million) and other large industrial, coal-burning cities [National Bureau of Statistics of China, 2004].



Map of Beijing and the surrounding provinces. Courtesy David Streets.

Summer ozone formation is aided by hot and humid conditions. Ozone formation in Beijing is usually either NO_x-limited or both NO_x- and VOC-limited, due to high biogenic emissions of VOC's [*Wang et al.* 2006]. Ozone precursors include photochemical production, regional transport, and possible biomass burning [*Ding et al.,* 2007]. In addition to ozone, the pollution problems in Beijing include high particulate matter and sulfur dioxide emissions due to coal burning, fugitive dusts, and increasing traffic.

The city of Beijing has worked hard since winning the Olympic bid in 2001 to reduce local pollution sources. Traffic restrictions began in late June, when half of the government cars were taken off the road until July 19. Between July 20 and September 20, odd-even license plate restrictions will reduce private vehicle traffic by up to 70%. Beijing plans to add public transport to assist commuters. Industries are cutting emissions as well. For example, one of China's leading steel makers in Beijing plans to cut its output and pollution by 70% during the Games.

Traffic restrictions from November 4-6, 2006 give an idea of what the effect will be of this summer's restrictions. During this time, 800,000 of Beijing's 2.82 million vehicles (about 28%) were removed from the roads and NO_x emissions were reduced by approximately 40%.

Jenni Vanos, a research assistant at the University of Guelph, used a photochemical model to calculate ozone concentrations during the Olympic Games based on no pollution controls and based on the November 2006 restrictions. In the former, the 1 PM and 6 PM levels were 350 and 196 ppb, respectively. These levels were reduced under transportation restrictions but were still high (1 and 6 PM values were 206 ppb and 118, respectively) and the 8-hour average was 153 ppb (Beijing's 8-hour standard is 100 ppb) [*Vanos et al.,* 2008].

Local pollution controls are not enough because not all of the ozone and ozone precursors come from Beijing. During periods of sustained southerly winds, 50 to 70% of Beijing's $PM_{2.5}$ and 20 to 30% of the ozone and ozone precursors originate from the Hebei Province (where Shijiazhuang is located) [*Streets et al.,* 2007].

David Streets, a senior scientist at the Argonne National Laboratory, ended his 2007 paper in *Atmospheric Environment* with the recommendation to consider "additional emission control measures for Beijing's neighboring provinces in plans for healthful air during the 2008 Olympic Games." Guo Jinlong, the mayor of Beijing, took this advice and has asked officials from the Hebei, Shandong and Shanxi Provinces, and Inner Mongolia to help him curb pollution during the Games. According to Streets, Mayor Guo's efforts involve even more provinces than the study recommended.

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Beijing, *Continued from Previous Page*

Vehicular and other local and regional controls will help reduce the ozone and particulate pollution. However, it is still uncertain as to whether or not the measures will be effective since pollution in Beijing is highly dependent upon prevailing winds and rain. "We don't know if the measures will work," said Streets. "A lot depends on the weather – whether you get this build up of pollution in Beijing." Pollution builds up during times of persistent southerly winds, warm temperatures, high humidity, and fair weather. Officials in Beijing plan to keep an eye on the weather and be flexible about imposing last-minute pollution controls if necessary.

Note: Look for a follow-up article after the Olympic Games, which run from Aug. 8 – Aug. 24.

From *Streets et al. 2007*, Fig. 2: Contrasts between clean and dirty days in Beijing. Left: Oct. 29, 2005, Air Pollution Index (API) = 38, [PM_{10}] approximately 50 μg/m^3. Right: Oct. 26, 2005, API=176, [PM_{10}] approximately 300 μg/m^3. Thank you to David Streets and Joe Paisie of the U.S. Environmental Protection Agency.

References

Streets, D., J.S. Fu, C.J. Jang, J. Hao, K. He, X. Tang, Y. Zhang, Z. Wang, Z. Li, Q. Zhang, L. Wang, B. Wang, and C. Yu (2007), Air quality during the 2008 Beijing Olympic Games, *Atmos. Environ.*, 41, 480-492.

Vanos, J. (2008), Modeling air pollution in Beijing for the 2008 Olympic Summer Games, *Studies by Undergraduate Researchers at Guelph*, 1(2), 26-34.

Wang, T., A. Ding, J. Gao, and W.S. Wu (2006), Strong ozone production in urban plumes from Beijing, China, *Geophys. Res. Lett.*, 33, L21806.

Section News

Alan Robock

It's Fall Meeting time again! And we will be continuing our tradition with the Third Annual Atmospheric Sciences Chinese Banquet, which will be held on Tuesday, December 16, 2008. The pre-registration deadline for the 2008 AGU Fall Meeting is November 14. Please sign up for our banquet when you register. As always, we will offer a discount for students and will have entertainment, as well as the presentation of the Holton Award.

The deadline for abstract submission is September 10, 2359 UT. Please submit your abstracts here. You can see all the Atmospheric Science and other session descriptions here.

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Arctic Sea Ice

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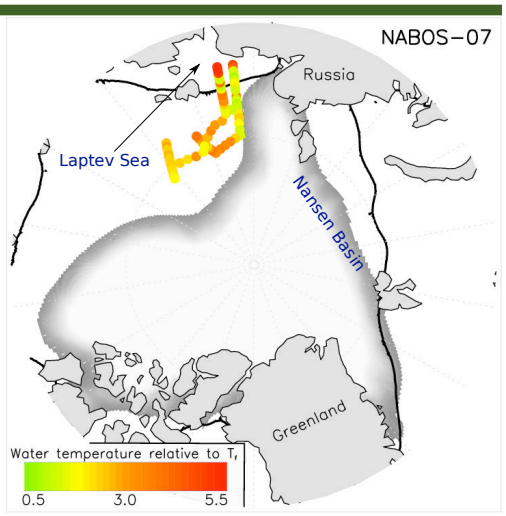
an important role in the recent trends in melting sea ice. Therefore a better understanding of the atmosphere-ocean interaction is crucial for improving future predictions.

Dr. Polyakov co-authored a paper [*Walsh et al. 2007*] published by the *Journal of Marine Research* entitled "Thermohaline structure and variability in the eastern Nansen Basin as seen from historical data." They emphasize the importance of an intermediate layer in the ocean, called the Atlantic water (AW), which has a warm temperature core. This intermediate layer is found below the thermocline (approximately at 250m) and it has a prominent temperature of approximately 2˚C. The AW is transported through the Nansen Basin and Laptev Sea.

According to Dr. Polyakov, the oceanic heat should be considered, since it helps decrease sea-ice in the future. For example, the upper ocean warming could lead to a short-term impact on the ice: because of the positive feedback loop when the loss of ice enhances the absorption of summer heat by the upper ocean and further decreases the Arctic ice. Therefore, because of the impact



Satellite-based image of ice cover and NABOS cruise measurements of upper 20m ocean temperatures. The upper ocean was exceptionally warm delaying freezing, making the next year's ice thinner than normal. Figure courtesy of Igor Polyakov.

of the oceanic heat, we should expect a larger sea-ice reduction in 2008.

References

Stroeve, J., M. Serreze, S. Drobot, S. Gearhead, M. Holland, J. Maslanik, W. Meier, and T. Scambos (2008), Arctic sea ice plummets in 2007, *Eos*, 89(2), 13-14.

Walsh, D., I. Polyakov, L. Timokhov. and E. Carmack, 2007: Thermohaline structure and variability in the eastern Nansen Basin from historical data, *Journal of Marine Research*, 65 (5), 685-714.

Section News

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The Education Special Interest Group of AGU now has a newsletter. If you are interested in receiving it, you can log onto your membership profile on the AGU website (http://www.agu.org) at any time and join the Education Special Interest Group there.

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

These job postings and others can be found at:

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

Atmospheric Sciences

- Algorithm scientist in atmospheric science, Jet Propulsion Laboratory and the California Institute of Technology
- Assistant Professor in mesoscale meteorology, Dept. of Geosciences at the University of Nebraska - Lincoln. Reviews begin Aug. 15
- Atmospheric and climate researcher related to the hydrologic cycle, Jet Propulsion Laboratory and the California Institute of Technology
- Atmospheric scientists in Earth system modeling and data assimilation, Science Applications International Corporation, Greenbelt, Maryland
- Two climate modeling scientist positions (one senior level and one early career level), NCAR, Boulder, Colo. Apply by Aug. 15
- Meteorology Instructor, Dept. of Marine, Earth, and Atmospheric Sciences at North Carolina State University
- Postdoctoral position in cloud remote sensing at the Joint Institute for Regional Earth System Science and Engineering at UCLA in collaboration wit the Jet Propulsion Laboratory
- Postdoctoral associate under Prof. Kerry Emanuel at the Massachusetts Institute of Technology and Michael Iacono of Atmospheric and Environmental Research, Inc.
- Postdoctoral position in physical and chemical properties of aerosol particles, Pacific Northwest National Laboratory beginning around Aug. 2008
- Postdoctoral researcher on "Learning About the Tail of the Probability Density Function for Equilibrium Climate Sensitivity", Dept. of Atmospheric Sciences at the University of Illinois at Urbana-Champaign
- Program Director, Antarctic Research Integration and Support, National Science Foundation, Arlington, Va.
- Program Manager, IceCube Project, NSF's Office of Polar Programs. Apply by Aug. 15

Biogeosciences

- Postdoctoral Research Associate in carbon cycle data assimilation, University of Bristol. Apply by Sept. 5

Student Opportunities

- Ph.D. opportunities in paleo-climatic reconstructions, Dept. of Geography, University of Idaho

Conferences

- **Chapman Conference on Lakes and Reservoirs as Sentinels, Integrators, and Regulators of Climate Change**, September 8-10, 2008; Lake Tahoe, Incline Village, Nevada, USA http://www.agu.org/meetings/chapman/2008/dcall/
- **Chapman Conference on Atmospheric Water Vapor and Its Role in Climate**, October 20-24, 2008, Kailua-Kona, Hawaii, USA http://www.agu.org/meetings/chapman/2008/ecall/
- **2008 Fall Meeting**, December 15-19, 2008, San Francisco, California, USA http://www.agu.org/meetings/fm08/
- **Chapman Conference on Effects of Thunderstorms and Lightning in the Upper Atmosphere,** May 10-15, 2009, University Park, Pennsylvania http://www.agu.org/meetings/chapman/2009/bcall/