The past few months have been exceptionally busy for AOSS, as you’ll see by the size of this issue of the Daily Planet. Professor Nilton Renno has been actively searching for water on Mars as a Co-Investigator of the Phoenix Mars Scout Mission, as well as conducting and publishing research regarding dust devils, electricity and climate change. Working with Nilton have been AOSS Research Scientist Natasha Andronova and graduate students Jasper Kok and Manish Mehta.

Professor Thomas Zurbuchen has been busy as project leader of the Fast Imaging Plasma Spectrometer (FIPS) onboard MESSENGER, which has been measuring charged particles in Mercury’s magnetic field. Down on Earth, he has had students in AOSS 583, the space system design course, designing a low-cost system for Internet connectivity to the rural populations of Africa.

Professor Richard (Ricky) Rood and his student Gabriel Thoumi approached climate change from a public policy perspective in an article that explores some of the challenges we face in developing carbon markets and a successful CO₂ market. He, along with Assistant Professor Christiane Jablonowski, continued in the realm of policy as invited participants to the World Summit for Climate Prediction.

AOSS undergraduate Brad Charboneau was the meteorologist for the University of Michigan Solar Car that won the North American Solar Car Challenge; the University’s sustainable energy initiative Planet Blue came to the Space Research Building; and the AOSS Team participated in the Ann Arbor sustainable commuter challenge.

On the communications side, we launched the AOSS News Digest, sent to AOSS alumni and friends about significant happenings within the Department. To take advantage of matching scholarship funds from the U-M President’s Office, you may have received a letter and donation card asking for your donation to the Thomas M. Donahue Memorial Student Fund. President Coleman will match every dollar you donate. See the back cover for more information.

It’s been a busy few months, so take some time and enjoy this “bursting at the seams” issue of the Daily Planet. And don’t forget to plan a visit to Ann Arbor for the SPRL at 60 Celebration: Universities and Space Exploration, October 16–17, 2008.
AOSS Accolades

Faculty
Christiane Jablonowski was one of the primary organizers of NCAR’s Advanced Study Summer Colloquium on Numerical Techniques for Global Atmospheric Models held in June 2008. The colloquium surveyed the latest developments in numerical methods for the dynamical cores of atmospheric general circulation models. This event attracted graduate students with backgrounds in atmospheric science, applied mathematics, and/or computer science, and introduced them to the latest developments in weather and climate modeling. An elite group of lecturers, model developers, and mentors provided input and guidance for the two weeks of intensive work.

Nilton Renno was interviewed on WDET Detroit Public Radio’s Detroit Today on Monday, July 14, discussing the new equation for predicting the intensity of severe storms, developed with AOSS Research Scientist Natasha Andronova. See page 12 for the complete story.

Richard (Ricky) Rood and Christiane Jablonowski were invited participants in the World Summit for Climate Prediction held at the European Centre for Medium-Range Forecasts (ECMWF), Reading, England last May. The Summit was organized to develop a strategy to revolutionize prediction of the climate through the 21st century to help address the threat of global climate change, particularly at the regional level, bringing together leading scientists from a number of disciplines to discuss what must be done to address society’s urgent needs.

Chris Ruf was elected Editor-in-Chief of the IEEE Transactions on Geoscience and Remote Sensing. The journal, which is the primary international journal in the field of remote sensing, focuses on the theory, concepts, and techniques of science and engineering as applied to sensing the earth, oceans, atmosphere, and space; and the processing, interpretation, and dissemination of this information.

Associate Chair Perry Samson has been appointed by U-M President Mary Sue Coleman to the Student Learning Environment Committee, one of five accreditation working groups as the University seeks re-accreditation by the Higher Learning Commission of the North Central Association.
AOSS Research Scientist Gabor Tóth has received the University’s prestigious Research Faculty Achievement Award. Gabor is being recognized for outstanding scholarship and his significant contributions to atmospheric and space sciences. The selection committee was “particularly impressed with your leadership in the development of techniques to model both the atmospheric and space environments and congratulates you on your many contributions to the University of Michigan and to the broader scholarly community.”

Thomas Zurbuchen has been elected to a two-year term as the Vice Chair of the Universities Space Research Association Council of Institutions. He also testified before Congress this past spring regarding “Understanding the issues surrounding Export Control/ITAR”. His remarks are online at http://aerostates.org/wp-content/uploads/hearing_march_11_2008_hyperlinks.pdf.

Staff
AOSS Administrative Assistant Sandra Pytlinski received a 2008 Distinguished Service Honor Roll certificate for her, “service, spirit, and initiative … contributions to [AOSS] and the University.” Several staff members were honored this past June (2008) for their long years of service at the University of Michigan.

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<th>Name</th>
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<tr>
<td>Bruce Block</td>
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<td>Marie Cooper</td>
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<td>Steve Rogacki</td>
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Students
AOSS undergraduate student Amanda Mims was awarded the National Weather Association Meteorological Applications Award for 2008 for her paper *WindSat Ocean Surface Emissivity Dependence on Wind Speed in Tropical Cyclones*. She has been invited to present the paper at the annual meeting October 12-16 in Louisville. The paper reports results from a research project worked on by Amanda and Professor Chris Ruf.

Dalal Najib has received one of the highly competitive NASA Earth and Space Science Fellowships. The NESSF was established to ensure continued training of a highly qualified workforce needed to achieve NASA’s scientific goals in Earth and space science. Dalal was one of only 16 students who received fellowships related to space science. Her advisor is Professor Andy Nagy.

Aaron Preston received the 2009 NOAA Ernest F. Hollings Undergraduate Scholarship, which includes scholarship funding and a summer internship at a NOAA facility during the summer of 2009. The Hollings scholarship program is designed to increase undergraduate training in oceanic and atmospheric science, research, technology, and education and foster multidisciplinary training opportunities, as well as increase public understanding and support for stewardship of the ocean and atmosphere.

The new U-M virtual exhibit, *Changing Climate*, developed from a 2007 exhibit at the U-M Exhibit Museum of Natural History, features research by AOSS atmospheric science faculty members. Climate Change: Upsetting the Balance, featured in the Spring ’07 issue of the Daily Planet, was part of a semester-long slate of events organized around the theme “Wild Weather, Changing Climate.” The exhibit is now a virtual exhibit on the U-M web site.

On the Web
Visit the U-M climate change virtual exhibit at: http://umich.edu/news/research/climate_08/
An AOSS meteorology student and the winning U-M Solar Car

by Brad Charboneau, AOSS Undergraduate Student and meteorologist for the ’08 U-M Solar Car Team

Due to record gas and oil prices this summer the demand for an affordable, environmentally friendly alternative energy source has skyrocketed. As a result, hybrid vehicles have become a hot commodity for consumers trying to shave a few dollars off their enormous gas costs and help the environment by cutting down on their emissions. While hybrid vehicles are a step in the right direction, all of these cars still require at least a small amount of gasoline to operate. However, a group of University of Michigan students has taken this idea one step further by harnessing a completely different energy source to power a vehicle — the sun.

The University of Michigan Solar Car Team, along with other college teams, has been building and racing solar powered cars since 1989, and is the most successful team in North America, having won five out of the nine North American Solar Challenges that it has entered. 2008 was no exception, as our car Continuum defeated its nearest competitor by a record 9 hours 56 minutes, which is nearly double the previous largest margin of victory.

As one might expect, solar powered cars depend heavily on the amount of incoming solar radiation at any given time. On a sunny day, racing a solar powered car comes down to who has the fastest and most reliable car. However, clouds make racing very interesting, and forecasting where and when these clouds will occur is incredibly important to team strategy. How one team reacts to the weather on a given day can be the deciding factor in who wins the entire race. As the team meteorologist, it was my job to predict incoming solar radiation for the duration of the race, not to mention precipitation and wind speed, both of which dramatically affect the performance of the vehicle.

In order to make accurate solar radiation forecasts, a meteorologist must take into account several factors. On a sunny day, incoming solar radiation follows a very predictable curve depending on the time of day, time of year and latitude of a given location. It is important to understand this curve in order to know the maximum possible incoming radiation at any given time. Once you have this established, you have to take into account the expected sky cover percentage and the type of clouds you anticipate seeing. Although all clouds tend to reduce the incoming radiation, the amount of reduction varies widely from cloud to cloud, which makes forecasting radiation very difficult. Although a forecast calling for partly cloudy skies may be enough for most other purposes, this not enough information for someone operating a solar powered car.

It is obvious why forecasting solar radiation is important, but wind and rain also dramatically affect the performance of the car. Checking in at roughly 700 lbs, Continuum is very light in comparison to other vehicles, yet is very capable of surpassing the speed limit. As a result, relatively light winds and a slippery road can be potentially hazardous and require the driver to reduce speed, which is the last thing that any team wants to do on the race.

As one could imagine, one of the biggest hurdles in forecasting on

On the Web

Find out more about the U-M Solar Car Team at: http://www.engin.umich.edu/news/solarcar08win/
the road is finding ways to constantly monitor the weather. Thanks to numerous sponsors, including AOSS, I was able to use a variety of meteorological equipment to help with this task. Two of the four vehicles in our support caravan were equipped with WeatherHawk all-in-one base stations that measure a variety of different meteorological parameters. These base stations allowed me to take my own real-time data, and helped me tweak my forecasts as the day progressed. In addition to the WeatherHawks, I also used a program called Mobile Threat Net, which allowed me to view radar and local surface observations via XM® Satellite Radio. I was even able to use a portable weather balloon launching system donated from InterMet Systems. This was especially helpful while in Canada since radiosonde data is a bit more difficult to access and is very helpful in identifying moisture in the upper atmosphere.

Although there were definitely days when the weather did not cooperate (including a severe thunderstorm one night that soaked all of us while camping in Omaha), our team was very prepared to handle whatever was thrown our way. Combine that with a car that had almost no mechanical failures and a team of experienced engineering, strategy and operations crewmembers and you get the most convincing win in North American Solar Challenge history. I can’t thank the faculty and staff in AOSS enough for their support and dedication to its students, since they have provided me with the education that I needed to help make this happen. Hopefully I will continue to be a part of the team into next season, when they will race their latest car, Infinium, in the World Solar Challenge in Australia.

THE UNEXPECTED HAPPENS IN THE PURSUIT OF SCIENCE

On April 7, AOSS Associate Professor Aaron Ridley sent the following email regarding weather balloons launched by his AOSS 584 class:
“Oh.... In case you hadn’t heard yet this morning, one of the 584 balloons landed in the Milan Federal Prison yesterday. It was unbelievable. We have pictures that I will send around as soon as they give them to me. They are fantastic.”

And then, on the 14th, Aaron sent: “The other team found their balloon with a very interesting story also! ‘Against all odds the Blue to Black Balloon has been found and returned to us by the Marblehead, OH U.S. Coast Guard.’” This balloon has landed in Lake Erie.

Two teams. Two unusual trips. Unusual goings on for one department.

But, AOSS didn’t stop there. On August 4, Administrative Assistant Sandra Pytinski received a call from a French Canadian scientist who was going to attend the Mercury Measurement Workshop. Immigration had detained him, and his equipment at the Blue Water Bridge in Port Huron. It took the University’s Office of the General Counsel and Homeland Security (plus plenty of pleading by Sandra) to have him released. No word yet on his re-entry into Canada.
Faculty Promotions

Kenneth (K.C.) Hansen has been promoted to Associate Research Scientist. Prior to completing his PhD at the University of Michigan, Dr. Hansen received his BS and MS degrees from Brigham Young University. He is a member of the Magnetospheric and Plasma Science (MAPS) interdisciplinary science team of the Cassini-Huygens mission to Saturn and is leading the development of a database of key parameter data to be collected at Saturn. Dr. Hansen was selected as a member of an International Space Science Institute (ISSI) team for Comet Modeling, which is working to understand and characterize the plasma and dust environments of comets. In 2006, he was selected in the first class of NASA Early Career Fellow in Planetary Science, 2006 and was the first recipient outside the U-M Department of Astronomy to receive the Ralph Baldwin Prize in Astrophysics and Space Sciences for excellence in research activities, PhD thesis and publications.

Nilton Renno has been promoted to Professor. After graduating from MIT, Professor Renno remained at MIT as a Postdoctoral Associate, later moving as a Postdoctoral Scholar to Lawrence Livermore National Laboratory and finally as a Research Fellow in Planetary Sciences at the California Institute of Technology. Prior to joining the AOSS faculty in 2002, Professor Renno was a member of the faculty in the Department of Planetary Sciences at the University of Arizona. He is a member of the NASA Student Collaboration Program Definition Team and the NRC Research Associateship Review Committee. Professor Renno is also a member of the International Scientific Organization for Soaring Flight. Professor Renno is a Co-Investigator and Lead of the Atmospheric Science Theme Group on the Phoenix Mars Scout Mission that is currently exploring the polar cap of Mars. He is also a Co-Investigator on the Mars Science Laboratory Mars Mission, scheduled to launch in September 2009.

Thomas Zurbuchen has been promoted to Professor. In 1996, after receiving his PhD and the Young Researchers Award from the Swiss National Science Foundation, Professor Zurbuchen came to the University of Michigan as an Assistant Research Scientist in the Space Physics Research Laboratory. He was the recipient of the Presidential Early Career for Scientists and Engineers (PECASE) Award in 2004 and a NASA Team achievement award for Ulysses, which is orbiting the Sun. In 2007 he was named the first director of the College of Engineering’s Center for Entrepreneurship. Professor Zurbuchen led the design, manufacturing and testing of a low-weight time-of-flight mass spectrometer, FIPS, part of the spacecraft MESSENGER payload that will begin a second flyby of Mercury in October and will be inserted into orbit in 2011. He is a member of two standing committees of the National Academy, science and technology definition teams of new NASA missions.
Lennard Fisk named 2009 Henry Russel Lecturer

Lennard Fisk, Thomas M. Donahue Distinguished University Professor of Space Science, has been selected as the 2009 Henry Russel Lecturer, the highest honor the University of Michigan bestows upon a senior faculty member. Faculty honored with this award are being recognized for exceptional research, scholarship, teaching, mentoring and service. Professor Fisk joins only 82 U-M faculty named as Russel Lecturers; Thomas Donahue was the only other AOSS faculty member to receive this honor.

Professor Fisk has introduced new ideas and concepts in the understanding of the atmosphere of the Sun and its extension into space to form the heliosphere. In 1974 he introduced a theory for the origin of anomalous cosmic rays, which predicted that the particles would be singly-charged, a controversial concept at the time that was confirmed years later. In 1976 he pioneered the development of numerical models for the acceleration and propagation of energetic particles in the heliosphere and the modulation of cosmic rays. These models form the basis of many cosmic ray transport models of today. Since 1996, he has been developing a solar magnetic field based model on the conservation of open magnetic flux, which explains a wide range of observations including the magnetic field reversal of the Sun.

Professor Fisk was named a National Associate of the National Academies, a lifetime distinction, was elected member of the International Academy of Astronautics (IAA) and a foreign member of Academia Europaea, the pan-European academy for the arts, sciences and letters. He is a fellow of the American Geophysical Union, twice the recipient of the IAA Basic Science Award (1997, 2007), and recipient of the Space Science Award of the American Institute for Aeronautics and Astronautics (1994). Professor Fisk also received the Atwood Award in 2007, the highest award of the College of Engineering.

The 2009 Henry Russel Lecture will be delivered by Professor Fisk on Tuesday, March 10, 2009 in the Rackham Building Amphitheatre, 4:00 – 5:00 PM. A reception will follow.

New Research Faculty

Kiran Bhaganagar has joined AOSS as an Assistant Research Scientist. Dr. Bhaganagar, who received her PhD in Mechanical Engineering from Cornell University, with a major in fluid mechanics and a minor in computer sciences, was most recently an assistant professor in Mechanical Engineering at the University of Maine. She was also a Postdoctoral Researcher at UCLA and a Fellow at Caltech. Her research interests lie in the development of large-scale numerical algorithms to simulate turbulent flow, numerical algorithms, parallelization, turbulence physics, direct numerical simulation, roughness in turbulent flows, transition to turbulence, mathematical modeling of fluid phenomena, application to biomedical problems, coastal engineering including sediment transport, and aerodynamic flows.

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Don’t “Sell Short” the Earth: Carbon tax will ease transition to sensible climate policy

by Richard B. Rood and Gabriel Thoumi
Originally published on Mongabay.com

Summary:
The management of carbon dioxide and the climate represent both an economic development challenge and the ecological problem of the next hundred years. Energy use, economic success and carbon dioxide emissions are, currently, intertwined. A carbon market that represents the true cost of energy and the disposal of our waste products in the environment is a potential long-term policy mechanism for carbon dioxide management. However, the strong interconnection between carbon dioxide emissions and economic success distinguishes the carbon market from other environmental markets used to control pollution. Therefore, evolution to that solution is not straightforward; there are a series of necessary steps needed to develop a market.

A number of “carbon markets” have been started, for example the European Union Emissions Trading Scheme (EU ETS), and a number of new markets are proposed, for example the Western Climate Initiative in the United States. Point Carbon provides news and analysis of carbon markets. For these markets to achieve their ultimate goals of valuation of carbon dioxide emissions and reduction of carbon dioxide emissions, significant evolution and expansion of the markets must be realized.

This article explores some of the hurdles that are necessary to cross in order to realize a successful CO2 market.

The analysis converges to a set of conclusions. A stable evolution of policy to support the development of a carbon market is needed. Part of the development of the market is the use of fee-based policy; that is, taxes and tax credits. These taxes help to provide valuation to efficient use of energy, to bridge the cost gap between carbon intensive and carbon free fuels, and to develop viable abatement strategies. The fees also help to provide a link between energy policy and climate policy. This recognizes that the urgency of energy policy will trump climate policy, and that there are solutions to energy security that negatively impact the climate. Ultimately, it is required that energy security and climate security be de-correlated if we are going to maintain economic stability on a planet supporting billions of consumers.

You’re Invited ...

To the annual AOSS-Geological Sciences Alumni/Friends Reception at the AGU Fall Meeting, Wednesday, December 17, 6:00 – 8:00 PM in the Westin St. Francis Hotel’s Tower Salon. Please forward the invitation to AOSS alumni and friends. Stop and visit the AOSS booth, in the Academic Showcase — at the back of the Exhibit Hall, Level One, Moscone Center West — under the "Academic Showcase" sign.
Planet Blue is a campus-wide educational and outreach campaign that is introducing the university's Environmental and Energy Initiative. The EEI seeks to make the campus more sustainable in the wake of rising energy costs, climate change concerns, and depleting resources.

Myth: Leaving a light on uses less energy than turning it off and on.

Truth: Every light that is off helps to save energy. Leaving lights on for any amount of time uses more energy than turning them off when not needed. When you leave a room, turn off the lights.

Myth: Paper with staples or paperclips cannot be recycled.

Truth: Neither staples nor paper clips need to be removed from paper. Both are removed at the paper mill using magnets, screens and filters during the pulping process. Recycle all your office paper and newspapers.

Obituary
Margaret E. Greenfield
Retired AOSS employee Margaret E. Greenfield, 82, died suddenly on July 29, 2008. Margaret moved to Bradenton, FL after retiring from the University of Michigan in 1991. Margaret is survived by her daughter Cheryl Odbert (James) of Ann Arbor, Michigan.
U-M instrument shows what planet Mercury is made of

By Nicole Casal Moore, U-M News Services

By measuring the charged particles in the planet Mercury’s magnetic field, a University of Michigan sensor enabled the first observations about the surface and atmospheric composition of the closest world to the sun.

“We now know more about what Mercury’s made of than ever before,” said Thomas Zurbuchen, a professor in the departments of Atmospheric, Oceanic and Space Sciences and Aerospace Engineering. “Holy cow, we found way more than we expected!”

Zurbuchen is project leader of the Fast Imaging Plasma Spectrometer (FIPS), a soda-can sized sensor on board the MESSENGER spacecraft, which performed the first of three scheduled Mercury flybys in January. A paper on FIPS’ results from this flyby was published in the July 4 edition of Science.

Since the Mariner 10 spacecraft’s 1975 discovery of Mercury’s magnetic field, scientists have speculated about how this magnetic field and the solar wind interact with the planet’s surface and exosphere, or thin atmosphere.

FIPS detected silicon, sodium, sulfur and even water ions around Mercury. Ions are atoms or molecules that have lost electrons and therefore have an electric charge.

Because of the quantities of these molecules that scientists detected in Mercury’s space environment, they surmise that they were blasted from the surface or exosphere by the solar wind. The solar wind is a stream of charged particles emanating from the sun. It buffets Mercury, which is 2/3 closer to the sun than the Earth, and it causes particles from Mercury’s surface and atmosphere to sputter into space. FIPS measured these sputtered particles.

“It’s like we did a forensic analysis of Mercury,” Zurbuchen said. “This flyby got the first-ever look at surface composition.

The Mercury magnetosphere is full of many ionic species, both atomic and molecular, and in a variety of charge states. What is in some sense a Mercury plasma nebula is far richer in complexity and makeup than the Io plasma torus in the Jupiter system.”

Io is a volcanically active moon of Jupiter that is often considered one of the most exciting space environments, Zurbuchen said. Images and other measurements made by MESSENGER suggest that Mercury’s surface composition was determined at least in part by volcanic processes.

More than 10 U-M engineers and technicians built FIPS in the Space Physics Research Laboratory with help from more than 50 students. The paper is called MESSENGER Observations of the Composition of Mercury’s Ionized Exosphere and Plasma Environment.

To learn more about Mercury visit: http://www.nasa.gov/mission_pages/messenger/main/index.html

Image credit: NASA
Simulations predicted Phoenix would hit sub-surface

by Nicole Casal Moore, U-M News Services

U-M simulations correctly predicted that the pulsed jets of the Mars Phoenix lander would strip the soil to the subsurface ice or rock as the craft touched down. Photos of the area beneath the craft revealed a hard surface that scientists say may be ice. It could also be rock, and researchers won’t know until the Phoenix can dig into the dirt. But it’s evident the craft cleared away soil as it landed.

“This is exactly what was predicted by our group,” says Nilton Renno, an associate professor in the Department of Atmospheric, Oceanic and Space Sciences. “We’ve seen the most amazing photos of the hard surface under the thrusters. The brightness and smoothness suggest it is ice.”

This would mark the first time a spacecraft has touched ice on another planet, Renno says.

Renno and Manish Mehta, a doctoral student in the same department, performed a series of tests for NASA over the past year in part to determine how the lander would affect the place it touches down. Phoenix’s pulsed jet steering and braking system is unique.

Mehta performed the most recent simulations in April at NASA Ames Research Center using properly sized crushed walnut shells and other fine dust particles to simulate the Martian soil. Mehta showed that the pulsed jets could cause a different, more explosive erosion than the continuous jets of the Viking spacecraft, which landed on Mars in 1976. The Phoenix landing process involved thrusters firing in bursts to slow the craft and guide it.

“In our simulations, the pulsed jets excavated to the hard, icy surface within less than a second. The pulses fluidized the bed under the thrusters, so that the soil behaves like water,” Mehta says.

These results were presented May 19 at the Phoenix Science Team Meeting at Tucson, Ariz., and a site-alteration report was submitted to JPL and Lockheed Martin. Mehta suggested to the Phoenix science team that they check under its deck on Mars to find exposed ice.

To watch simulations of the effects blowing Mars dust had on the Phoenix lander visit: http://www.ur.umich.edu/0708/Jun09_08/19.php

Phoenix landed May 25 on Mars and will spend the next three months analyzing soil and ice to uncover the history of water on the planet. Its mission is to determine whether the arctic plains there could support microbial life.

Renno is a co-investigator on the mission and lead of the Atmospheric Science Theme Group. He is studying the chemical composition of the soil and clouds in an effort to determine how much water Mars has today and had in the past. Mehta is currently working on the reconstruction of the mission landing with NASA engineers at JPL.

Phoenix continues to dig in Mars soil

Since landing on Mars May 25, 2008, the scoop on Phoenix’s robotic arm has continued to deliver soil samples to the lander’s microscope and “bake-and-sniff” analyzer. In July, the Phoenix Science Team, including AOSS Professor Nilton Renno, confirmed that water had been identified in a soil sample. The mission, now close to the end of the third month of operations, has been extended through September, with the promise of more exciting discoveries under the Mars polar cap.

You can follow the Phoenix search for water online at the mission site: http://www.nasa.gov/mission_pages/phoenix/main/index.html

Image credit: NASA / JPL-Caltech / University of Arizona / Texas A&M University
Electricity can change dust levels in the air affecting levels of climate warming or cooling

An article published in the IEEE (Institute of Electrical and Electronics Engineers) publication *Spectrum Online* describes the work of Professor Nilton Renno and graduate student Jasper Kok, which showed that "electric fields as strong as 160 kilovolts per meter could double the amount of dust that makes it into the atmosphere." The article, "New Sensor Shows Electric Nature of Dust Devils," by Willie D. Jones, is in the March 2008 issue. Renno and Kok developed a new sensor that measures the strength of an electric field with little or no disruption, showing the role of electricity in lifting dust into the air.

The complete article is available online at: http://www.spectrum.ieee.org/mar08/6030.
How intense will storms get? New model helps answer question

by Nicole Casal Moore, U-M News Services

A new mathematical model indicates that dust devils, water spouts, tornadoes, hurricanes and cyclones are all born of the same mechanism and will intensify as climate change warms the Earth’s surface. The new equation, developed by AOSS Professor Nilton Renno, could allow scientists to more accurately calculate the maximum expected intensity of a spiraling storm based on the depth of the troposphere and the temperature and humidity of the air in the storm’s path. The troposphere is the lowest layer of Earth’s atmosphere.

This equation improves upon current methods, Renno says, because it takes into account the energy feeding the storm system and the full measure of friction slowing it down. Current thermodynamic models make assumptions about these variables, rather than include actual quantities.

“This model allows us to relate changes in storms’ intensity to environmental conditions,” Renno said. “It shows us that climate change could lead to increases in how efficient convective vortices are and how much energy they transform into wind. Fueled by warmer and moister air, there will be stronger and deeper storms in the future that reach higher into the atmosphere.”

Renno and research scientist Natalia Andronova used the model to quantify how intense they expect storms to get based on current climate predictions. For every 3.6 degrees Fahrenheit that the Earth’s surface temperature warms, the intensity of storms could increase by at least a few percent, the scientists say. For an intense storm, that could translate into a 10 percent increase in destructive power.

Renno’s model is what scientists call a “generalization” of Daniel Bernoulli’s 18th-century equation that explains how airplane flight is possible. Bernoulli’s equation basically says that as wind speed increases, air pressure decreases. It leaves out variables that were considered difficult to deal with such as friction and energy sources (which, in the case of a whirling storm, is warm air and condensation of water vapor.) And in certain idealized situations, omitting that information works fine.

But by including these additional variables, Renno was able to broaden Bernoulli’s equation to apply it to more general phenomena such as atmospheric vortices.

“The laws of physics are generally very simple,” Renno said. “When you make assumptions, you are not representing the simple, basic law anymore. If you don’t make assumptions, your equations have those simple, basic laws in them. It gets a little more complicated to get to the solution, but you don’t introduce error, and your answer is more elegant, more simple.”

Renno’s work bolsters studies by others who say hurricanes have grown stronger over the past 50 years as sea surface temperatures have risen. This effect has not been extreme enough for humans to notice without looking, scientists say. Hurricane Katrina and Cyclone Nargis were not the most intense storm to hit land in the past half century. Other factors contributed to the devastation they caused.

This new model helps explain the formation of spiral bands and wall clouds, the first clouds that descend during a tornado. It’s clear now that they are the result of a pressure drop where the airspeed has increased. Renno says unifying convective vortices from dust devils to cyclones will help scientists better understand them.

“This is the first thermodynamic model that unifies all these vortices,” he said. “When you unify them, you can see the big picture and you can really understand what makes them form and change.”

A Co-investigator on NASA’s Mars Phoenix Lander mission, Renno has used his new model to calculate the intensity of dust storms in Mars’ polar regions. He found that at the Phoenix landing site dust storms can have winds in excess of 200 mph.

On the Web

A paper on the new model, A Thermodynamically General Theory for Convective Vortices, is available on the Swedish journal Tellus A web site:

http://www3.interscience.wiley.com/journal/119879028/abstract
Bruce Block Receives Staff Service Award

by D.K. Eddy

Need an instrument for a space mission? Go see Bruce Block. Need a new tool to build your space instrument with? Go see Bruce Block. Need someone to guide your students through the labyrinth of creating an instrument to put on a spacecraft, fly to Pluto, and see what or who is there, go see Bruce Block.

For more than 30 years (since 1977), Bruce has been an invaluable member of the staff of the Atmospheric, Oceanic and Space Sciences’ Space Physics Research Lab. And on May 2, 2008 the College caught on to what many here have known for years, and awarded Bruce the University of Michigan College of Engineering Excellence in Staff Service Award for his “dedication, professionalism and exceptional contributions to his unit.”

Charles Edmonson, Bruce’s boss at SPRL, lauded Bruce’s performance not only as an engineer and teacher, but also as a project manager. “SPRL’s technical, cost, and schedule performance, on projects led by Bruce, have been excellent and have significantly enhanced the Laboratory’s reputation as a highly desirable partner for space instrument developments,” Charles told the award selection committee.

Bruce has given his time and experience as a member of multiple teams and planning committees to improve the procedures, processes, goals, and strategies of SPRL. He has mentored graduate and undergraduate student, and supported AOSS faculty both in the lab and as a classroom instructor. A OSS Chair Tamas Gombosi did not hesitate to say, “Bruce is probably the best space engineer at Michigan.”

After hearing from many of his supporters, the awards committee acknowledged Bruce’s international reputation for the innovative and successful design and execution of spaceflight scientific hardware systems.

Bruce Block’s touch has improved the learning experience for an abundance of students and professors, the management tools of SPRL, and the reputation of the University of Michigan.

Were it not for the stringent standards for cleanliness necessary for space missions, Bruce’s fingerprints might be found circling Earth on the Dynamics Explorer; orbiting Saturn on the Cassini Ion and Neutral Mass Spectrometer; resting on what’s left of the Cassini-Huygens Gas Chromatograph Mass Spectrometer after landing on Titan; toddling along on a 10-year trip to comet 67P/Churyumov-Gerasimenko aboard the Rosetta Orbiter Spectrometer for Ion and Neutral Analysis; and dancing around Jupiter on the Galileo Probe’s mass spectrometer. These are just a few of the many space instruments he has had a hand on.

Bruce Block is definitely an AOSS treasure and eminently deserving of the 2008 Excellence in Staff Service Award.
AOSS hosts Mercury Measurement Intercomparison and Workshop

For two weeks this summer, seven research groups from the U-M, University of Nevada-Reno, USEPA, NOAA, National Atmospheric Deposition Program, Clarkson University (NY), and Environment Canada descended upon the University of Michigan’s Matthaei Botanical Gardens to perform a field measurement intercomparison of a variety of direct and indirect approaches for measuring the dry deposition of mercury. This is one of the first times that an attempt has been made to compare the results of different mercury dry deposition measurement techniques.

The purpose of the project, spearheaded by AOSS Associate Research Scientist Frank Marsik, was to compare the results from different measuring techniques to:

1. Evaluate the capabilities of each technique
2. Determine if the differences between measurements could be quantified
3. Identify additional research needed in this area.

The measurement intercomparison study was accompanied by a two-day workshop during which participating groups presented their approaches and data previously collected using these approaches. In addition to the intercomparison participants, there was a mix of representatives from state, federal and Canadian environmental agencies attended the workshop. A final project report should be available in December 2009.

New Grants

March — May 2008

Stephen Bougher, TGE Extended Phase A, $16,390, NASA-SwRI
Stephen Bougher, Christopher Parkinson, Venus Middle and Upper Atmosphere Dynamics and Chemistry: Nightglow and Tracer Species Studies, $387,772, NASA
Richard Frazin, Particle Filtering to Tomography, $68,297, NSF-U-Illinois
Brian Gilchrist, Langmuir Probe Team Phase A: Extension Support to the TGE Mission, $27,000, NASA-SwRI
George Gloeckler, Lennard Fisk, Thomas Zurbuchen, SWICS and SWIMS Instruments for the Advanced Composition Explorer (ACE): Mission Operations and Data Analysis, $120,000, NASA-Cal Tech
Tamás Gombosi, U.S. Rosetta Project for Phase E, ROSINA INSTRUMENT, $194,997, NASA-JPL
Ward (Chip) Manchester IV, Adding Density to the Wang-Sheeley-Arge Model, $122,236, NASA
Andrew Nagy, The Interaction of Fast Flowing Plasmas with Non-magnetic Solar System Bodies, $30,000, NASA
Nilton Renno, Effects of Wind on Sample Delivery: A Study in Support of the Phoenix Mission — Cost Growth for Phase E, $201,407, NASA-U-Arizona
Christopher Ruf, FASR Year 1 Design and Development - Modification N. 4, $14,208, NSF-NRAO, PALS-ADD: University of Michigan RFI Mitigation Sub-System for Airborne Soil Moisture and Sea Salinity Mission Testbed, $199,760, NASA-JPL
AOSS Happenings

Allow me to introduce Andrew Guang’ao Wang, born August 9, 2008, at 7:17 p.m. to Susan and AOSS graduate student Minghuai Wang. Andrew joined us at 8 pounds 13.3 ounces and 20.5 inches long. When he wakes up, tell him "hi" from AOSS.

Here we have Royal Edison Seale, born July 7, 2008, at 5:50 PM, at 7 lb 9 oz, to Asst. Professor Allison Steiner and her husband Deryl Seale. Allison tells us, “We’re happy to welcome him to the world – now we just have to break it to him about global warming.” From that scowl, looks like he already knows, and is busily working on the solution.

This issues’ princess is Jiaqi Sophie Huang, born to AOSS programmer Shun Han and hubby, Asst. Professor Xianglei Huang, on July 8, 2008, at 11:55 a.m. at 6 lbs 7.4 oz. We hope by now Mom and Pop are somewhat less sleep-deprived.

A big birdie tells us Asst. Research Scientist Sue Lepri and her husband Nathan Foster are expecting TWINS next February.

“IT is our great pleasure to announce the birth of our second grandson, Jacob Arnold Pomerantz (Jake). He was born today (August 6, 2008) at 2 pm CDT in Chicago. He weighs 7 lbs and 11 ozs (3.5 kg) and he is 21 inches (53 cm) long. Mother and son are doing great. Dad and big brother Ben are also excited about the new arrival.”

Proud Grandparents, Eszter and Tamas

Grandpapa Gallery

Here we have Royal Edison Seale, born July 7, 2008, at 5:50 PM, at 7 lb 9 oz, to Asst. Professor Allison Steiner and her husband Deryl Seale. Allison tells us, “We’re happy to welcome him to the world – now we just have to break it to him about global warming.” From that scowl, looks like he already knows, and is busily working on the solution.
Heck, She’s Always Been An Honest Woman!

by D.K. Eddy

The weather forecast was dire, storm warnings were up, and that morning the rain had poured down.

Even as we gathered the afternoon of July 12, 2008, on the beautiful Sandhill Crane Farm, with its lush green fields stretching out in all directions, stately conifers, and structures steeped in the sweet scents of apples and cider, more black clouds gathered on the horizon and headed our way.

Yet, on this little spot of Dexter, Michigan, the sun shown brightly upon a festive group. We had come to share in the joining of Kathy Norris (AOSS weaver of contracts and budgets) and Charley Brace (furniture restoration magician), and storm clouds hadn’t a chance of dampening the mood. Kathy and Charley were wed beneath twinkling lights, surrounded by fairy-gauze drapes and the good wishes of their many friends, two-legged and four, in a stately old barn with years of memories storied in its timbers that no doubt bestowed on their joining a propensity for endurance and patience that will serve them well in their life together.

A magic dome shuttled the storm clouds around us as we dined on a wide variety of delicious foods and toasted Kathy and Charley with ribald tales and sage advice. I understand the toasting went on into the wee hours of the morning, and still the rain stayed away.

After a brief honeymoon, Kathy did come back to AOSS.

Now, if we could just shuffle off that dome and let the rains come back too.
AOSS Team wins Commuter Challenge

A team of 43, “mostly” from AOSS, won the Ann Arbor Commuter Challenge this past May. The challenge, which was run by getDowntown, a Chamber of Commerce program, was a month-long competition to see which teams could log the most sustainable commutes. Points were earned and prizes awarded every time a sustainable commute was logged throughout May. The AOSS Team logged 10,179 miles and avoided creating 8,712 pounds of CO₂ in the 100–499 employees category — beating out even the Ann Arbor US EPA National Vehicle and Fuel Emissions Laboratory.

The team member who burned the most calories was Bertalan Zieger, a visiting research scientist. Julia Jackson, a CoE staff member, logged the most sustainable miles and AOSS graduate student Erika Roesler had the highest number of points awarded for her effort. While he didn’t win the “Super Commuter” award, Team Captain and AOSS IT Manager Faye Ogasawara nominated Dave Boprie. Coincidentally, Dave’s wife Martha also was nominated as the Super Commuter of her team — and they both still do sustainable commuting!

AOSS Commuter Challenge Team

Elena Adams
John Barker
Kiran Bhaganagar
David Boprie
Darla Briggs
Linda Chadwick
Cheri Champoux
Emily Christianson
Roger De Roo
Aron Dodger
Taylor Dodson
Patricia Egeler
Jason Gilbert
Alex Glocer
Lynne Gratz
Susan Griffin
Steve Gross
Shun Han
Eric Harding
Sandee Hicks
Channing Huntington
Julia Jackson
Chip Manchester
Tami McDunn
Kristen Mihalka
Adam Moncznik
Chuck Navarre
Faye Ogasawara
Dave Pawlowski
Aimee Reische
Jim Reische
Aaron Ridley
Erika Roesler
Perry Samson
Bret Squire
Allison Steiner
Gabor Toth
Matthew Trantham
Bart van der Holst
Line van Nieuwstadt
Bobbi Walunas
Dan Welling
Bertalan Zieger


Xia Cai, Investigation of Global Periodic Sawtooth Oscillations Observed in Energetic Particle Flux at Geosynchronous Orbit, Robert Clauer and Michael Liemohn, Co-chairs

Yi-Ching Chung, A Snow-Soil-Vegetation-Atmosphere Transfer/Radiobrightness Model For Wet Snow, Anthony (Tony) England, Chair

Alan Hogg Jr., Stomatal and Non-Stomatal Fluxes of Ozone, NO, and NO to a Northern Mixed Hardwood Forest, Mary Anne Carroll, Chair

Ying Dong Jia, The Magnetohydrodynamics of Cometary Plasma, Michael Combi, Chair
Your classmates would like to know where you are and what you are doing. Please send us information and a recent photo for Alumni Notes. Fill in the accompanying form, send a news article, press release – but send us the information. You can send the information via email to aossnews@umich.edu or by mail to the address below.

Please complete this page and fill in the circles if the information you are providing is a change of address or title, if you know of job openings for students, and/or if you are willing to be a resource person for AOSS students/alumni.

Return via mail to:
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Atmospheric, Oceanic & Space Sciences
University of Michigan
1521C Space Research Building
2455 Hayward Street
Ann Arbor, MI 48109-2143

Name
Employer
Title ☑ This is a new title
Professional Address (City, State, Zip) ☑ This is a new address
AOSS Degree(s)/Year(s)
Email address
☑ Here is information I would like to share with AOSS.
Class Note:

☑ Yes, I know of summer internships and/or regular job openings for AOSS students/alumni
☑ Yes, I am willing to be a resources person for AOSS/alumni interested in:
  ☑ Atmospheric Science ☑ Space Science ☑ Geographic Location

Internship/Job Information

Alumni Notes

Yuei-An Liou, ’94 MS, ’96 PhD (AOSS and EECS) – Professor and Director of the Center for Space and Remote Sensing Research (CSRSR), National Central University, Taiwan, has been elected to the Russian Academy of Engineering Sciences (AES) for his leadership of the radio-occultation space mission and contributions to radio occultation soundings of the atmosphere. The AES currently has 56 foreign members. Since joining the National Central University in 1996, Prof. Liou has pioneered research activities in GPS meteorology and the ionosphere, remote sensing of the atmosphere and land surface, land surface processes modeling, and application of neural networks and fuzzy systems in inversion problems.

Jeffery Masters, ’82 BS, ’83 MS, ’97 PhD – Director of Meteorology, Weather Underground, was part of a 3-hour documentary on severe weather and global warming produced by a Japanese film crew. Dr. Masters segment was recorded in the new AOSS Solar Terrestrial Atmospheric Resource Room. The documentary aired in Japan in July 2008.
Help provide opportunities for AOSS students and keep our programs strong. Send us your donation today.

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