StaffNotes

For and about the people of UCAR, NCAR and UCP

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Above: New research by NESL/CGD's Clara Deser and Yuko Okumura finds that, rather than being mirror images, El Niño and La Niña display significant differences in their spatial structures and seasonal evolution.

Cycles, dipoles, and oscillations

NCAR scientists probe atmospheric patterns

IT'S BEEN A noticeably dry and gusty fall and winter thus far along the Front Range, with wildfires, wind storms, and wave clouds filling the skies. Meanwhile, early-season snowpack in Colorado's mountains has measured well above average in many locations. The likely cause of this weather? La Niña, El Niño's sister.

La Niña occurs when cooler-than-normal sea surface temperatures form in the eastern and central Pacific Ocean off the coasts of Peru and Ecuador. The cooler water temperatures are caused by an increase in easterly sea surface winds that force cold water from below the ocean's surface to the top. The cooler water, in turn, chills the overlying air and helps reinforce the La Niña pattern.

If what goes around comes around, as the saying goes, nowhere is this more evident than with atmospheric patterns such as La Niña. A handful of major weather and climate patterns with names that range from the fanciful (Pineapple Express) to the more technical (Pacific Decadal Oscillation) stretch thousands of miles across the atmosphere and shape weather and climate in disparate places. These circulation patterns arise because of heating contrasts between the poles and equator, modulated by the

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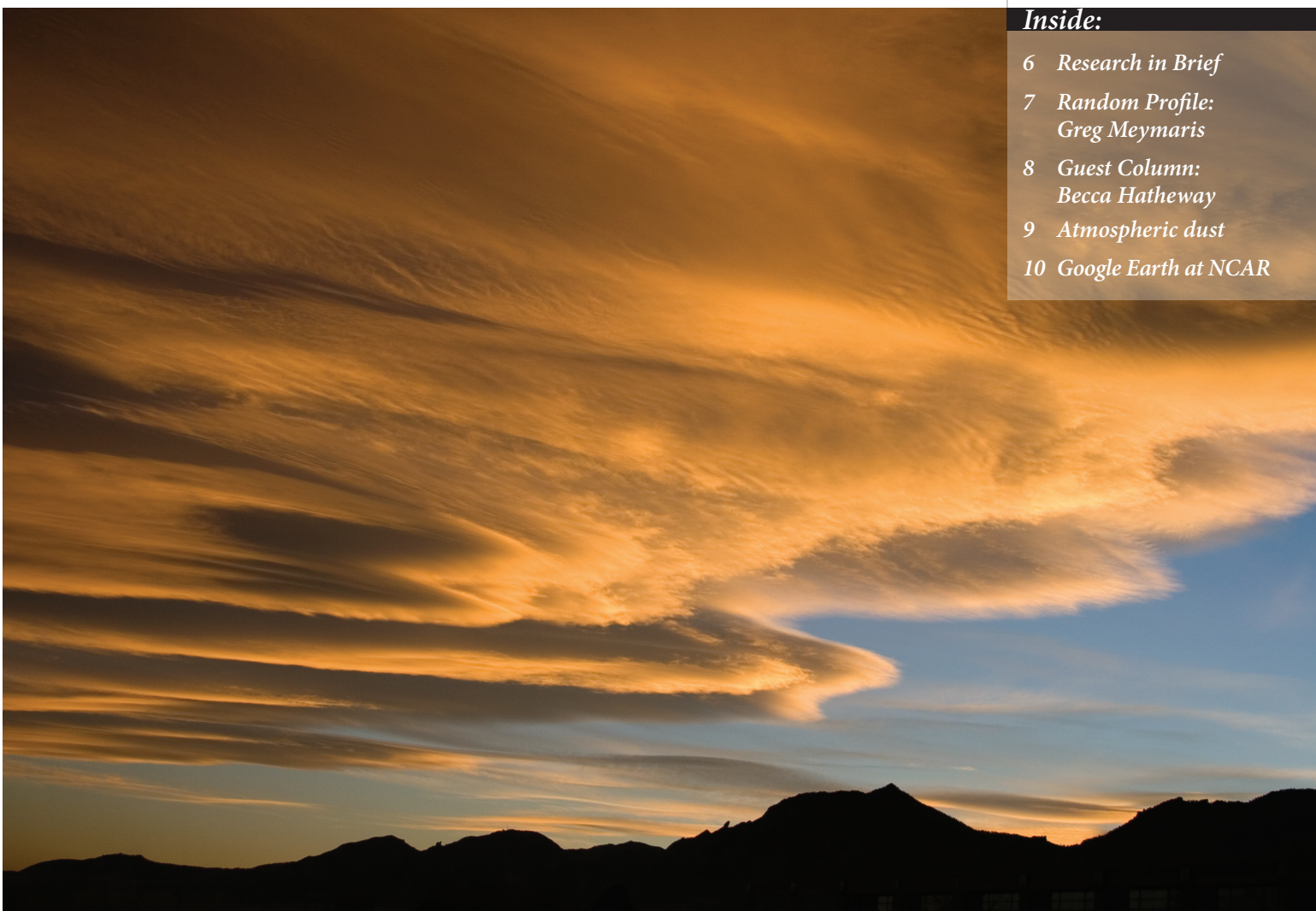

Below: Lenticular clouds at sunset along the Flatirons. Also called lee wave clouds, these clouds form downwind from an obstacle in the path of a strong air current—in this case, the Rocky Mountains. La Niña is known for bringing high winds to the Front Range, along with dramatic lenticular clouds.

Inside:

Remember 2010? Time Capsule for 2035 on display at Mesa Lab

AS PART OF UCAR/NCAR's 50th anniversary celebrations, a time capsule centered on the theme "What was life like in 2010 at UCAR/NCAR?" has been filled with more than 90 items that provide a snapshot of the organization. The items range from an all-staff photo taken at last year's fall party to a 32-bit communication board to a copy of NCAR's Twitter page.

Suggestions for what to include in the time capsule were sought from staff. (Visit the exhibit's webpage, below, for a complete list.) A selection committee determined the final contents, ensuring that as many aspects of life at UCAR/NCAR as possible were represented.

Rather than burying the capsule, organizers opted to keep it above ground for a better chance that it will make it to the 2030s intact. A selection of the capsule's contents are on display in the Mesa Lab exhibits area, and the majority of items are stored safely in the NCAR Archives to ensure their preservation. Burying a time capsule threatens its preservation for many reasons, including temperature extremes, humidity, insects, Earth movements, and leaks and rust, according to NCAR archivist Kate Legg. "Storing our time capsule in the Archives in preservation-quality boxes helps minimize deterioration and ensures that in 2035 there will be a successful unveiling of the contents," she says.

Many of the contents of the time capsule were "born digital" and exist on flash drives and DVDs, a reflection of life in 2010. Because the threat of technologically obsolete storage media is a concern, hardcopy printouts are being stored in the Archives with their digital counterparts.

"Preserving digital content is one of the largest issues facing archivists and other curators, with ever-changing storage media and software," Kate says. "Technology has allowed us to record even more about our lives than ever before, but the way we record it is less stable than traditional paper and thus may be inaccessible to historians and scholars in the future." Indeed, the flash drives and DVDs themselves may be viewed as relics of the past in 2035, offering a curiosity to future staff.

www.archives.ucar.edu/exhibits/50th

Open Skies agreement affects UCAR travelers

STAFF WHO FLY the friendly skies can also now fly the open skies. Due to a recent change in federal regulations, UCAR can take advantage of "Open Skies" agreements that allow for travel using government funds on some foreign air carriers.

Generally, federal travelers are required by the Fly America Act to use U.S. flag air carrier service for all air travel funded by the U.S. government. However, a new exception to this requirement is transportation provided under bilateral or multilateral air transportation agreements to which the United States and foreign countries are parties and which meet the requirements of the Fly America Act.

For UCAR/NCAR staff, this means that travelers can now use a foreign air carrier provided that the carrier is a member airline of the European Union, Australia, or Switzerland (currently there are no Asian airlines that fall under Open Skies); the travel is not funded by the Department of Defense; and a GSA (General Services Administration) city-pair contract does not exist.

The rules surrounding Open Skies are very complex and involve a number of factors, says Katy Schmoll, UCAR vice president for finance and administration. In order to minimize the risk to travelers and maximize efficiency in the UCAR Travel Office, flights using a foreign carrier under the Open Skies agreements can only be booked through Boulder Travel, UCAR's contracted travel agency. Boulder Travel will take full responsibility for assuring that flights are consistent with the regulations.

Katy cautions that travelers should be aware that the UCAR Travel Office will reject any voucher indicating foreign carrier use under Open Skies routing paid for with government funds that is not booked through Boulder Travel.

"Open Skies will likely offer attractive alternatives to some, but not all, travelers," Katy says. "It's worth exploring your options with Boulder Travel when flying to Open Skies participant countries."

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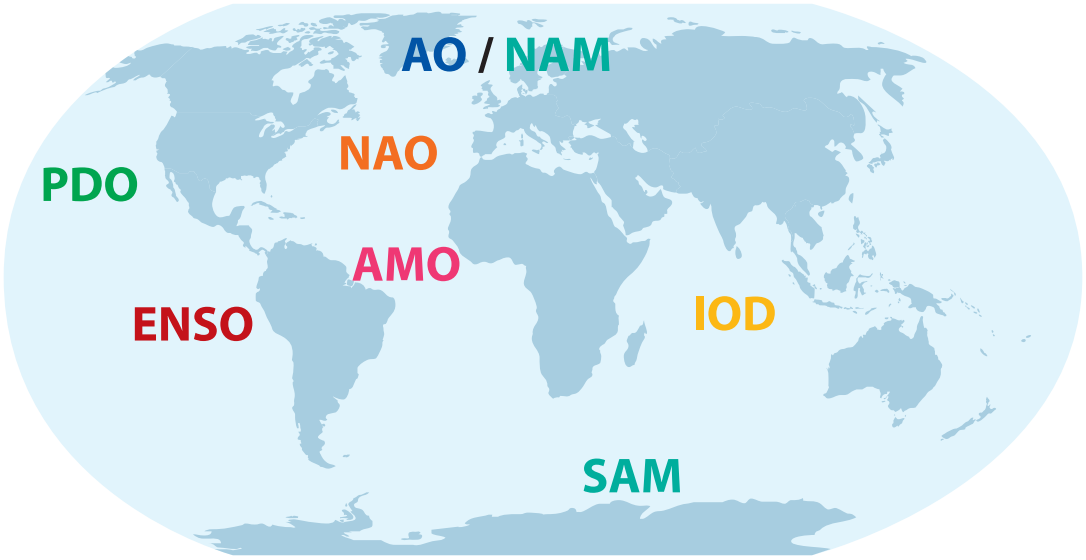

Left: A look at Earth's major atmospheric patterns in their regions of origin: ENSO (El Niño/Southern Oscillation), the Pacific Decadal Oscillation (PDO), the North Atlantic Oscillation (NAO), the Arctic Oscillation/Northern Annular Mode (AO/NAM), the Southern Annular Mode (SAM), the Indian Ocean Dipole (IOD), and the Atlantic Multi-Decadal Oscillation (AMO). For an interactive version of the map with more information about each pattern, visit www2.ucar.edu/news/backgrounders/arctic-oscillation-pineapple-express-weather-maker-glossary.

changing seasons, and the rates at which land and water absorb and release heat. The result is an ever-changing patchwork of warmer, cooler, wetter, and drier regions.

At NCAR, scientists in NESL/CGD and other divisions are working to better understand and predict these patterns, as they have considerable effects on regional temperature and precipitation. They're also looking at the interplay between atmospheric patterns and climate change.

Children of the tropics

Better known for the El Niño and La Niña patterns it produces, ENSO (El Niño–Southern Oscillation) can cause extreme weather around the world, including floods and droughts. It is characterized by variations in sea surface temperatures in the eastern tropical Pacific, with the warm phase called El Niño and the cool phase La Niña, along with a seesaw in atmospheric pressure in the tropical western Pacific known as the Southern Oscillation.

South American fishermen gave El Niño its name (Spanish for "The Boy") in reference to the Christ child, because the periodic warming of Pacific waters off Peru and Ecuador is often noticed around Christmastime. The neutral phase of ENSO, during which the atmosphere and ocean are neither unusually warm nor cold, is sometimes humorously referred to as La Nada ("The Nothing").

Rather than being mirror images, El Niño and La Niña display significant differences in their spatial

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More news from the UCAR Travel Office

STARTING IN 2011, the Travel Office will offer training to travelers and administrators to help make the auditing process go as smoothly as possible. The office will arrange the training sessions on a division-by-division basis.

"Because of the complexity of travel at this organization, especially international travel, we will be offering training to everyone who turns in travel expenses for themselves or others in order to facilitate speedier reimbursements," says Shelley Richards-Craig (F&A).

Shelley estimates that the Travel Office processes about 7,500–7,800 trips per year, totaling more than $12 million. Reimbursement forms that are filled out incorrectly can slow the process. In another move toward greater efficiency, the office expects to roll out an online travel application in the next year that automates authorization, approval, and reimbursement processes, she adds.

Atmospheric patterns *continued from page 3*

structures and seasonal evolution. New research in CGD has reproduced some of the key differences using climate models. The study, led by Yuko Okumura, has important implications for the prediction of ENSO and its global influences.

Yuko and Clara Deser analyzed two datasets of monthly sea surface temperatures spanning different periods: 1900–2008 and 1982–2008. They confirmed a robust asymmetry between El Niño and La Niña throughout the record, especially during strong ENSOs. Both phases typically begin in late spring or summer. Most El Niños terminate rapidly after peaking in December or January, but many La Niñas persist through the following spring and summer and re-intensify in winter, some even lasting through a third year. Modeling experiments suggest that this asymmetry can be explained by the different evolution of surface wind anomalies over the far western Pacific during El Niño and La Niña.

The surface wind anomalies associated with the current La Niña show a pattern consistent with Yuko and Clara's analysis, as NOAA's Climate Prediction Center reports that the present La Niña is expected to continue well into spring 2011 in the Northern Hemisphere.

The ability of climate models to capture ENSO got a boost in April 2010 with the release of CCSM4, which is being used for an ambitious set of climate experiments that will be featured in the IPCC's next report, due in 2014.

CCSM4 depicts ENSO better than previous versions of the model, according to CGD's Rich Neale. The model is more sensitive to tropospheric humidity, making it better able to represent deep convection in the tropics. It's also more sensitive to vertical wind shear. In addition, the model reproduces the observed asymmetry in the durations of El Niño and La Niña, which was not captured by the earlier versions of CCSM.

The north Pacific

Related to ENSO is the Pacific Decadal Oscillation (PDO) in the north Pacific. During the PDO's positive phase, sea surface temperatures tend to be above average along the west coast of North America and

Below, right: Rainfall accumulating along the west slopes of California's mountains appears in bright colors in this visualization of a winter storm produced by James Done (NESL/MMM), based on NOAA work using the Weather Research and Forecasting model. The simulation was in support of the ARkSTORM project.

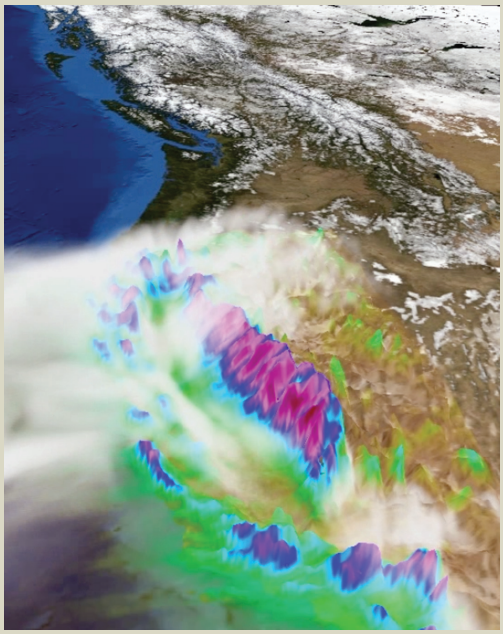
EVERYTHING YOU'VE EVER WANTED TO KNOW ABOUT ATMOSPHERIC PATTERNS

Among some audiences, "Pineapple Express" may be best known as the name of a 2008 comedy by director Judd Apatow. In scientific circles, however, the term is an informal name for the weather pattern that brings warm, moist air from the tropical Pacific Ocean near Hawaii to the Pacific Northwest and California, producing heavy rains. The Pineapple Express often forms when a dip in the jet stream coincides with atmospheric moisture associated with the Madden-Julian Oscillation.

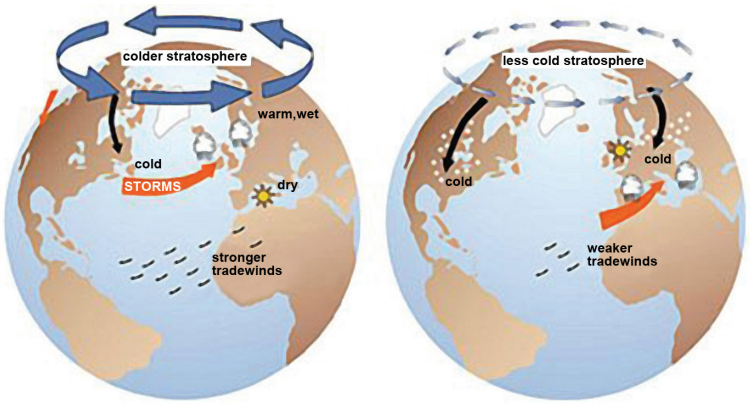
Because the moisture may originate far from Hawaii, scientists are increasingly referring to the phenomenon as atmospheric rivers (ARs). James Done (NESL/MMM) recently collaborated with NOAA to simulate and visualize two AR cases as part of a project called ARkSTORM. Led by the U.S. Geological Survey, ARkSTORM examined past atmospheric rivers and associated flooding to produce a scenario that will help planners in California prepare for the next "big one."

To learn more about these and many other atmospheric patterns, check out "From Arctic Oscillation to Pineapple Express: A Weather-Maker Patterns Glossary," at the link below.

www2.ucar.edu/news/backgrounders/arctic-oscillation-pineapple-express weather-maker-glossary



in the eastern tropical Pacific, while across the central north Pacific they are cooler than average. The opposite pattern occurs during the negative phase. Each phase typically persists for 10–30 years. A warm phase predominated from the late 1970s to around 2000, but the PDO has alternated between cold and warm phases since then (see graphic, page 11).



Left: A schematic of the major features of the positive (left) and negative (right) modes of the NAO/NAM. (Illustration by John Michael Wallace, University of Washington, courtesy NSIDC Education Center.)

Below: Haiyan Teng and Grant Brantstator.

In CGD, Haiyan Teng and Grant Branstator are using CCSM4 to study the predictability of the PDO, in support of decadal predictions for the next IPCC report. Even though the PDO has an oscillating period of 20–50 years, it may not be predictable for that long, Haiyan says. She and Grant are estimating the limit of PDO predictability by running large ensemble experiments in which they measure how quickly small errors spread from initial conditions in the model.

"Even if we have the fastest computers, we cannot predict weather after two weeks because the system is chaotic and a tiny error in the initial states will grow too big," she explains. "The same thing happens to the climate system—we're improving the models and have faster computers but we don't know if even the range of 10–30 years is actually predictable."

The two haven't yet looked at the influence of climate change on the PDO but plan to address this in future research.

Polar patterns

Swirling around the northern half of the globe—and grabbing attention during recent bouts of cold and snow in the United States and Europe—are the North Atlantic Oscillation (NAO) and the Northern Annular Mode (NAM), the latter sometimes known as the Arctic Oscillation.

The NAO affects weather in Europe and along the east coast of North America. In its positive phase, pressure over the Arctic drops lower than normal, while pressure rises more than average near the Azores; in the negative phase, this pattern is reversed. The NAM is closely related to the NAO. Its positive phase is associated with a stronger and more northerly vortex encircling the pole and fewer intrusions of cold Arctic air into midlatitudes, whereas the negative phase brings a weaker, more variable vortex and greater risk of Arctic outbreaks of cold air into eastern North America and Europe.

Starting in the 1960s, the NAO/NAM trended toward more positive values before tapering off in the mid-1990s. The last two winters have seen extreme negative values. Climate models have predicted that the build-up of greenhouse gases in the atmosphere will cause the NAO/NAM to trend positive, but Clara cautions that the modes vary naturally.

"Increasing carbon dioxide in most of the models does show a weak positive response, but that signal is quite small compared to natural ups and downs," she says. "It would be premature to say that a winter with a strong positive NAO/NAM would be entirely attributable to greenhouse gases."

One question that Clara and other scientists are studying is how the projected loss of Arctic sea ice due to climate change will affect the NAO/NAM. Modeling evidence suggests that the disappearance of sea ice would favor a negative NAO/NAM, the opposite effect of greenhouse gas forcing. Despite the negative NAO/NAM conditions, however, temperatures over northern Eurasia warm due to enhanced heat loss from the adjacent Arctic Ocean.

"The competition between the strength of the atmospheric circulation response which favors colder temperatures and the extent of Arctic sea ice loss which favors warmer conditions makes this an interesting problem and an open area of research," Clara says. (More on this topic will appear in the winter 2011 issue of *UCAR Magazine*.)

On the other side of the world is the Southern Annular Mode (SAM), also known as the Antarctic

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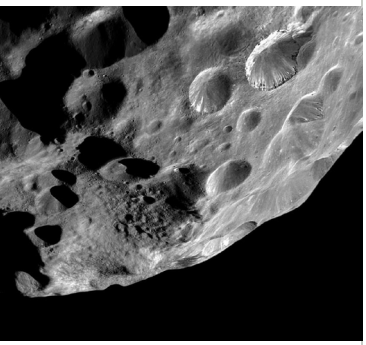


Above: Image courtesy NASA. **Above right:** Polar mesospheric clouds (also known as noctilucent clouds) are most often observed in the summer months at high latitudes (greater than 50 degrees) above both the Northern and Southern hemispheres. Illuminated by sunlight when the lower layers of the atmosphere are in the darkness of Earth's shadow, the clouds appear bright and cloudlike at twilight. (Image courtesy NASA Earth Observatory.)

>>>When asteroids strike

A TEAM OF SCIENTISTS is tackling a scenario that is the stuff of Hollywood thrillers: What happens if a medium-sized asteroid strikes Earth? In particular, what if it crashes into the ocean?

The question is not fanciful. Well over 100 asteroids about 1–2 kilometers in diameter are thought to be orbiting in paths that could bring them close to Earth, and many smaller asteroids are looming undiscovered in our planet's neighborhood. Although the odds of one of these objects striking Earth in the near future are very low, the atmospheric consequences of such an event have never been explored in detail until now.

Four NESL/ACD scientists, working with colleagues from Tucson's Planetary Science Institute and Germany's Max Planck Institute, ran computer simulations using a three-dimensional shock physics code (SOVA) and the Whole Atmosphere Community Climate Model (WACCM), which extends from Earth's surface up into the thermosphere.

The results, published in *Earth and Planetary Science Letters* in October, show that a 1-km asteroid striking the ocean would send vast amounts of water vapor and sea salt into the atmosphere, penetrating well beyond the stratosphere, to altitudes above 100 km. In the stratosphere itself, seawater chemicals such as chlorine and bromine would strip away significant amounts of Earth's protective ozone layer. This would lead to a huge spike in ultraviolet radiation reaching Earth's surface, with levels higher than any observed today. A smaller asteroid, measuring 500 meters across, would deplete global ozone to levels similar to the record ozone holes over Antarctica in the mid-1990s.

The effects of life on Earth would include increased rates of sunburn, skin cancer, and cataracts, as well as difficulty growing certain crops.

As noted in the study, past research suggests that an asteroid 500 meters wide or less strikes Earth about once every 200,000 years on average, with larger asteroid strikes occurring about once every 800,000 years. The study only analyzed asteroid strikes on the ocean; such a scenario is twice as likely as a land strike given that oceans cover about 70% of Earth's surface.

>>>Ozone hole and the upper atmosphere

THE IMPACTS OF the Antarctic ozone hole extend upward as well as downward, according to a new modeling study from a team of NCAR scientists. They found that the ozone hole appears to be affecting temperature and circulation patterns in the mesosphere, leading to differences in the qualities of polar mesospheric clouds.

The mesosphere is the layer of the atmosphere that begins around 50 kilometers (31 miles) above Earth's surface, just beyond the stratosphere. Observations have detected differences in altitude and brightness between polar mesospheric clouds (clouds made of ice crystals in the upper mesosphere) in the Northern Hemisphere and those in the Southern Hemisphere. Scientists have suggested various mechanisms for explaining this difference.

The new study, led by NESL/ACD's Anne Smith, points to the ozone hole in the stratosphere above Antarctica. By running simulations with the Whole Atmosphere Community Climate Model (WACCM), the team found that the ozone hole causes a decrease in temperature in the lower stratosphere that persists into the summer. This is accompanied by wind changes that modify the upward propagation of small-scale waves, which in turn alter the atmospheric circulation in the mesosphere above the Southern Hemisphere.

The team found that this hemispheric asymmetry was small before 1980 but increased at about the same time as the onset of the Antarctic ozone hole. A model run with no ozone loss showed no increases in the hemispheric asymmetry of mesospheric circulation and temperature, confirming that ozone loss is a likely cause of the hemispheric differences.

Anne cautions, however, that the decrease in stratospheric temperature due to the ozone hole shown by the model is larger than observed, so it is likely that the simulated response in the mesosphere is also too large.

"As the ozone hole recovers in upcoming decades, these trends in mesospheric temperature and circulation may reverse," she adds.

Each issue, Staff Notes spotlights a staff member selected at random from the phone directory. This month we profile Greg Meymaris.

Greg Meymaris

RAL

Greg came to RAL in 1999 as a graduate research assistant while working on his Ph.D. in mathematics at CU-Boulder. He's worn several hats in the division, starting out as a project scientist before becoming a software engineer.

Staff Notes: Tell us about your job in RAL.

Greg: I'm a mathematician working as a software engineer in a place that does atmospheric research. My area of expertise is turbulence and radar. The project I've been working on longest is an algorithm that goes onto commercial aircraft, senses turbulence, and radios down that information. I work on another project for NEXRAD [the Next-Generation Radar network], working on using signal processing to improve data quality. I also work on a project where you put the two together and try to detect turbulence using NEXRAD radars—the NEXRAD Turbulence Detection Algorithm (NTDA).

Staff Notes: What do you like best about your job?

Greg: I like that what I do has an impact for the greater good—working on turbulence detection algorithms so that people aren't flying into turbulence, and working on algorithms that go onto NEXRAD, which lots of people use. I like the variety that comes from having different projects; there are many good challenges and I get to think. I have engineering problems to work on and I also have science problems, and I get to help bridge that gap, which is what RAL is all about.

Staff Notes: What would you do if you weren't a software engineer or even working in this field?

Greg: I don't know if I'd really want to do it as a profession, but I love rafting. I've been down the Grand Canyon and have gone on a dozen or more rafting trips. I also really like geology—that interest came out of rafting. I like evolutionary biology and a lot of Earth sciences. Photography might be another thing I'd like to do.

Staff Notes: Where did you grow up?

Greg: I grew up in Massachusetts and came out here for grad school. At that point, I'd never been west of the Mississippi. When I came out here I drove, and the first part of the mountain west that I saw was an amazing sunset near Santa Fe. Later on that trip, I pulled an all-nighter driving from Phoenix to Boulder. I came up over the top of the hill on U.S. 36 at sunrise with the blue sky and the mountains tinged pink. That was my first view of Boulder and I was pretty hooked. A bit delirious, too, so it made a strong impression. I've never wanted to leave.

Staff Notes: Tell us about your life outside work.

Greg: My wife, Kirsten, and I have two kids. Klara is five and Calvin is three. Kirsten used to work in EO. We live in Gunbarrel.

Staff Notes: What does your family do for fun?

Greg: We've taken the kids rafting a few times. A nice place to take them is on the Colorado River near Fruita at the Ruby/Horsethief Canyons. We've also taken them on the San Juan in Utah and to Pumphouse, near Kremmling, on the Colorado. Otherwise, I like the Green River and Yampa through Dinosaur National Monument.

We love to go camping and have a little pop-up camper. The kids are learning to ski up at Eldora now. I'm not a downhill skier, so I'm learning as they learn. I swam in college at the University of Massachusetts and now I swim, along with my wife, with the Boulder Aquatic Masters. My wife and I did triathlons for a while, and we both did an Ironman in Lake Placid. She beat me by two and a half hours.

Staff Notes: What's the hardest section of a triathlon for you?

Greg: From a race standpoint, the biking. I don't have the right strength-to-weight ratio.

Staff Notes: Any exciting plans on the horizon?

Greg: Yes, we're about to leave for vacation in Hawaii.

New exhibits on the horizon

EO's plans for Sun-Earth connections and a weather gallery at the Mesa Lab

Becca Hatheway
Educational Designer & Exhibits Coordinator, EO

Editor's note: Becca became EO's exhibits coordinator in December 2010, succeeding Linda Carbone.

THE EXHIBITS at the Mesa Lab have a long history of drawing in visitors to learn more about atmospheric science and related topics. In recent years, several beautiful and informative exhibits have been installed, including "Climate Discovery" in 2003 and "Mesa Lab: Building a Masterpiece" in 2009. Every day, people enjoy the hands-on interactive components located throughout the public spaces in the building, including the tornado model and the Quiet Lightning and Chaotic Pendulum exhibits. The Public Visitors Program offers free noontime tours every weekday and also takes student groups and other visitors on tours, often scheduled many months in advance.

> *"I love working on creative projects and I think that the exhibits at NCAR provide a great venue for communicating science to the public."*

This year EO, working with others in the organization, is undertaking some exciting new exhibit development projects. We're collaborating with HAO to develop an exhibit called "Sun-Earth Connections," which will be installed in the mezzanine of the Mesa Lab opposite the Main Seminar Room. This exhibit will explore how activities on the Sun influence life on Earth; it will include a beautiful wall-sized mural that provides an overview of research related to Sun-Earth connections, images of the Sun and space weather, and touch screens allowing visitors to explore this fascinating topic.

We're also developing a new Weather Gallery that will be installed on the first floor of the Mesa Lab. This exhibit will include some of the hands-on features, video screens, and other components currently on display. We will add some new interactives, touch screens, and other multimedia components, as well as graphic panels with information and images about weather. We're working with a wonderful science advisory committee that includes UCAR/NCAR educators and scientists who are all excited about the outcome of this process.

I'm thrilled to be leading these projects. I've worked in EO for seven years but am new in my role as exhibits coordinator. Linda Carbone, who retired in December, has left a great legacy for me. In the last seven years at UCAR, I've developed curriculum and classroom activities for K-12 students; presented teacher workshops about weather, climate, and related topics at local and national conferences; facilitated online courses for teachers about climate science; written content for Windows to the Universe; and worked on education projects for GLOBE. Prior to working at UCAR, I managed classroom programs and teacher professional development programs at the Denver Museum of Nature & Science, taught natural history at the Keystone Science School, and taught kindergarten.

I love working on creative projects and I think that the exhibits at NCAR provide a great venue for communicating science to the public. Our exhibits appeal to different learning styles and interests, and in the future we'll have the opportunity to enhance them.

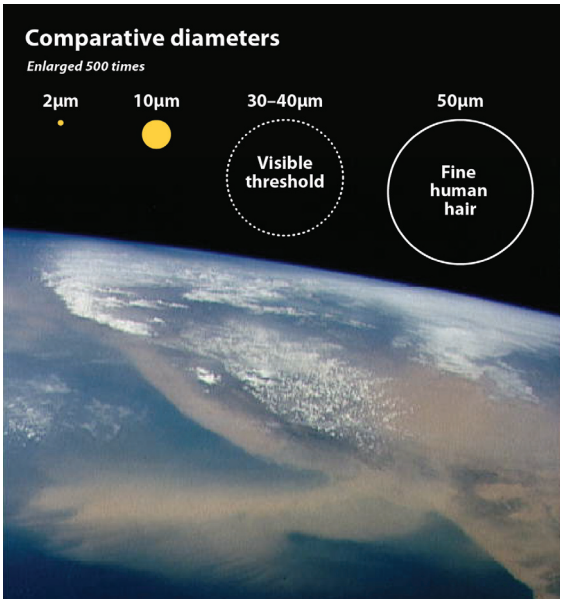
In the coming year, we'll be prototyping some of the new exhibit components at the Mesa Lab before permanent installation. I invite you to participate in providing feedback during those times.

Glass and dust: study finds clues to climate change

A NEW STUDY FROM NESL/CGD makes it hard to ever see a shattered drinking glass the same way. ASP postdoctoral researcher Jasper Kok has found clues to climate change in the way that glass and other brittle objects break.

Jasper's study, published in *Proceedings of the National Academy of Sciences* in December, finds that microscopic particles of dust, emitted into the atmosphere when dirt breaks apart, follow similar fragment patterns to broken glass. The research suggests there are several times more dust particles pumped into the atmosphere than previously thought, since shattered dirt appears to produce an unexpectedly high number of large dust fragments.

Because dust plays a significant role in controlling the amount of solar energy in the atmosphere, the research has implications for understanding future climate change. Some dust particles reflect solar energy and cool the planet, while others trap energy as heat, depending on their sizes and other characteristics.

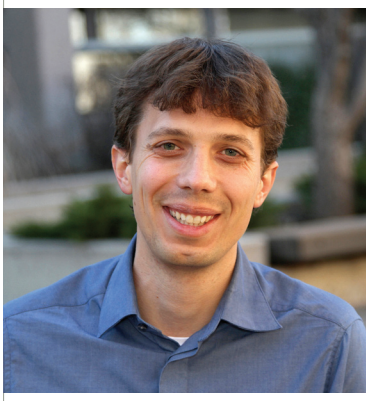


"As small as they are, conglomerates of dust particles in soils behave the same way on impact as a glass dropped on a kitchen floor," Kok says. "Knowing this pattern can help us put together a clearer picture of what our future climate will look like."

The study may also improve the accuracy of weather forecasting, especially in dust-prone regions. Dust particles affect clouds and precipitation, as well as temperatures.

On the Web

For more about the study, visit
www2.ucar.edu/news/3510/broken-glass-yields-clues-climate-change



Above: Jasper Kok.
Left: Dust particles in the atmosphere range from about 0.1 microns to 50 microns in diameter (microns are also known as micrometers; 1 micron = 0.025 inch). The size of dust particles determines how they affect climate and weather, influencing the amount of solar energy in the global atmosphere as well as the formation of clouds and precipitation in more dust-prone regions. The NASA satellite image in this illustration shows a 1992 dust storm over the Red Sea and Saudi Arabia.

Total lunar eclipse

Winter was marked by a very special welcome this year. On December 21, the date of the northern winter solstice, a total lunar eclipse occurred. The phenomenon began at about 10:30 p.m. MST on December 20, ending at about 4 a.m. on the first day of winter. It was the world's first winter solstice eclipse in 456 years. Marijke Unger (CISL) shot these images from Longmont as the eclipse progressed, capturing the reddish hue at totality when all of the sunlight reaching the Moon passes through the filter of Earth's atmosphere. "Sometimes it pays off to be a night owl, as this was a stunning spectacle to witness," says Marijke, who used a Canon EOS 5D Mark II with a 70–200mm f/2.8L IS USM lens. If you missed this eclipse, don't worry—two lunar eclipses are coming in 2011, on June 15 and December 10.

Maps on steroids: Google Earth at NCAR

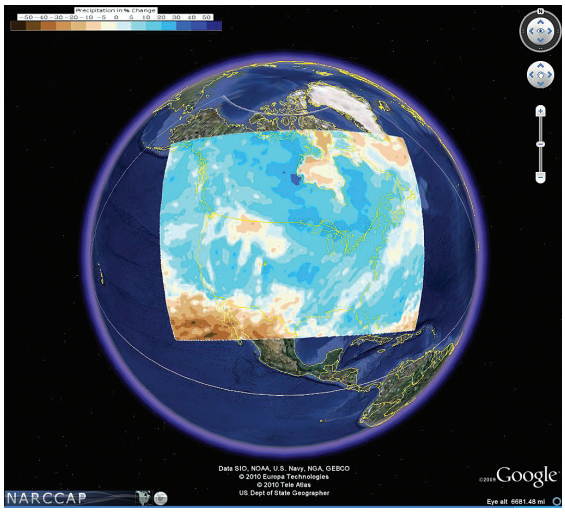
RESEARCHERS WHO USE Google Earth, the virtual globe, map, and geographical information program, just got a boost from the company, which has granted UCAR/NCAR a number of free Google Earth Pro licenses for use by staff. The licenses are part of Google Earth Outreach, which supports nonprofit organizations on issues affecting local regions or the entire globe.

Anyone can download the freely available Google Earth software that doesn't require a license key. For the additional features of Google Earth Pro, such as video recording, higher resolution printing, and advanced import/export, staff should contact CISL's Markus Stobbs (mstobbs@ucar.edu; ext. 1238) for a license key.

UCAR/NCAR scientists are using Google Earth in a variety of ways, from animating Antarctic driftsonde tracks to mapping wildfires and reconstructing the ancient Nile delta.

Josh Thompson (CISL/IMAGe) is a student assistant working on visualization and Web support for NARCCAP, a regional climate model project that provides high-resolution climate change scenario data for North America. One of his goals is to integrate the data into Google Earth (see visual).

"Using Google Earth, NARCCAP data can be projected in many different ways, which is beneficial to us as well as to our growing user community," Josh says. "The presentation tools have proven to be very useful for analysis and comparison."



Right: This screenshot shows an example of NARCCAP plots that have been overlaid into Google Earth. To create the image, Josh Thompson (CISL/IMAGe) generated a plot with NCL (NCAR Command Language) and edited it for usability in Google Earth. The result shows the pairing of a regional climate model and global climate model.

At the United Nations climate change meetings held in Cancun, Mexico, in December, Google unveiled a database that will help scientists and conservationists track and analyze changes in Earth's environment and hopefully slow deforestation. Called Google Earth Engine, the satellite imagery tool takes advantage of Google's large-scale cloud computing infrastructure to build a powerful database out of thousands of satellite photographs from the past 25 years, many of which have never been analyzed. The database is freely available for public use.

For more information about how researchers at UCAR/NCAR are using Google Earth, visit wiki.ucar.edu/display/googleearth/Home.

UCAR Visual Communications Group

If part of your job is using visuals to illustrate science, there's a new group that wants to hear from you. The Visual Communications Group was started in autumn 2010 by David Hosansky (Communications).

"We want to continue creating more and better visualizations of our science," David says. "There are lots of different people around the organization working to this end, so the idea is to get everyone in the same room."

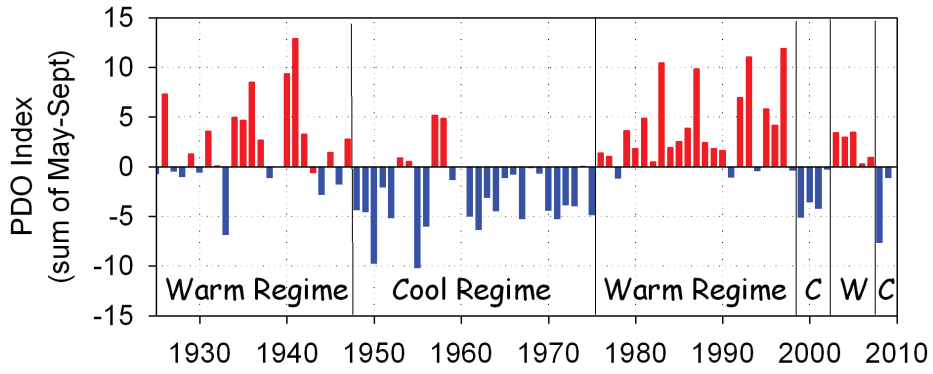
The group's first meeting was in early December. About ten staff from around the organization—mostly in outreach, graphic design, and administration—met to pick each other's brains, share ideas, and see where their needs overlap. The group plans to meet about every other month. For more info, contact David (hosansky@ucar.edu; ext. 8611).

Oscillation and analogous to the NAM. In the SAM's positive phase, when sea level pressure is low over Antarctica and high in the midlatitude region to the north, a stronger and more southerly vortex encircles the pole, leading to fewer intrusions of Antarctic air into the southern oceans. The negative phase features a weaker, more variable vortex and a greater risk of Antarctic outbreaks of cold air heading north.

The SAM has trended toward positive values since the 1960s, a development that scientists attribute to the effects of both ozone depletion above Antarctica and increases of greenhouse gas emissions. Scientists expect the ozone hole to recover over the coming century, raising the question of how this will affect the SAM. Some projections have shown that greenhouse gas forcing will dominate, with the positive trends that began in the 20th century continuing into the future. Other studies have found the opposite response, with the dominance of ozone recovery overwhelming the influence of greenhouse gases and leading to a reversal of positive summertime trends.

A recent study led by Julie Arblaster (CGD) examines simulations from two coupled climate models that incorporate greenhouse gases and ozone recovery. While both models suggest that recent positive summertime SAM trends will reverse sign over the coming decades as the ozone hole recovers, climate sensitivity in the models appears to play a large role in modifying the strength of how the mode responds.

"Future changes in the SAM could also have important impacts on Southern Ocean carbon uptake," Julie says. "Understanding the mechanisms behind the various model results is an important step toward narrowing the uncertainty in future climate projections."



Left: This graph shows shifts in the Pacific Decadal Oscillation from 1925 to 2009. Values are averaged over the months of May through September. Red bars indicate positive (warm) years; blue bars negative (cool) years. (Image courtesy Northwest Fisheries Science Center, NOAA.)

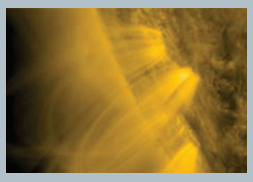
2010 Outstanding Accomplishments Awards

Did you miss the awards ceremony and holiday party held in December? For complete coverage, including video, go to www2.ucar.edu/staffnotes/news/3428/2010-ucar-awards-ceremony-and-holiday-party.

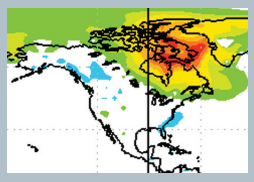
take a look

JOINING NCAR's HIAPER AIRCRAFT (right) on January 17 at RAF was a European counterpart in town for the first time. The German Aerospace Research Establishment (DLR) recently acquired HALO (left), a Gulfstream G550 jet. Nine DLR staff accompanied the plane on its Colorado visit, which gave them a chance to share notes with RAF on instrumentation and other aspects of high-altitude research. To see who's who in the group photo above, head to www2.ucar.edu/staffnotes/take_a_look.

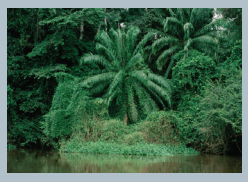
TAKE ANOTHER LOOK ONLINE: www.ucar.edu/staffnotes



One of the most enduring mysteries in solar physics is why the Sun's outer atmosphere, or corona, is millions of degrees hotter than its surface. To learn about new research from HAO that addresses this puzzle, visit **www2.ucar.edu/news/3548/plasma-jets-are-prime-suspect-solar-mystery**.



Some fascinating weather unfolded across the Northern Hemisphere in December and January, but you may have only heard about part of it. Get the whole story in *UCAR Magazine's* Currents at **www2.ucar.edu/currents**.



A new study led by RAL's Caspar Ammann finds that geoengineering schemes could disproportionately cool the tropics. Read more at **www2ucar.edu/staffnotes/research/3661/geoengineering-cooler-tropics**.

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