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Cooperative Institute for Research in Environmental Sciences
University of Colorado at Boulder

WeatherZine

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Subscribers to the WeatherZine receive a PDF version, as well as the text version. The PDF version can be read and printed using the freely available Adobe Acrobat Portable Document Format (PDF) Reader. The newsletter is also available online at http://sciencepolicy.colorado.edu/zine

Inside this issue:

Changes at WeatherZine

Along with the WeatherZine's move to the CIRES Center for Science and Technology Policy Research comes a new look, thanks to the efforts of our dedicated staff. The new WeatherZine home page is at http://sciencepolicy.colorado.edu/zine/. This page provides access to HTML, PDF, and text versions of the most recent edition of WeatherZine. It also provides access to past editions of WeatherZine, forms for subscribing and submitting information, contact information for the editors, and links to the Societal Aspects of Weather website and the weatherpolicy listserv. The WeatherZine may be contacted via email at weatherzine-admin@sciencepolicy.colorado.edu. Subscribers to the WeatherZine now receive both a text and PDF version via email.

The WeatherZine is a project under the Atmospheric Sciences Policy Education and Network (ASPEN) program. The ASPEN program also includes the Societal Aspects of Weather (SOCASP) web portal, the weather policy listserv, the Extreme Weather Sourcebook, and the Use and Value of Climate and Weather Forecasts Bibliography. Please visit the newly designed ASPEN program web site (http://sciencepolicy.colorado.edu/aspen/index.html) for more information about these and future ASPEN projects.

While you're in the neighborhood, be sure to visit the Center's new home page (http://sciencepolicy.colorado.edu/) for more information about the Center, its staff, research areas, and projects.

Editorial

Prediction Markets: The Best Possible Forecast?

Nobel Prize winner Nils Bohr once remarked, "Prediction is difficult, especially of the future." Recognizing the difficulties of prediction, what if there was a way to integrate all available information about the future into a single forecast that would instantaneously incorporate and make available new information? Sound too good to be true? Research in economics and recent developments in the private sector point to a novel way to think about forecasting in the earth and atmospheric sciences.

The basic premise of the approach lies in the *efficient market theory* from the field of economics and most closely associated with the work of Eugene Fama at the University of Chicago in the 1960s. The efficient market theory holds that the current price of a commodity in an exchange market reflects all available information. When you hear the phrase "you can't beat the market" it is referring to the perspective that the "market" (usually the stock market) is *efficient*; i.e., if information were available that would allow someone to gain a trading advantage, this information would be reflected instantaneously in the price of the commodity through the actions of buyers and sellers in the marketplace. Whatever advantage the trader thought may have existed is absorbed into the market.

Economists have sought for many decades

Editorial Continued

to prove or disprove the efficient market theory in the context of the stock market and other areas. In some cases research has shown that markets have inefficiencies (e.g., see the Research Highlight on p. 7 of this issue which shows an "inefficient" relationship between the daily weather and stock market performance). But in many cases research has shown that markets are efficient to varying degrees. Consider the following examples:

- Researchers at the University of Iowa's Tippie School of Business have created an "electronic exchange" where futures contracts are traded on political events like elections, but also phenomena such as box office returns for Harry Potter and Federal Reserve monetary policy. Although the Iowa Electronic Exchange (http://www.biz.uiowa.edu/iem/markets/) is a non-profit enterprise, real money is traded in its exchanges. The exchanges provide a wealth of experience for understanding markets and also have proven to be highly skilled (but not perfect) predictors. The Iowa Electronic Markets appear to predict elections and other outcomes better than polls or models (see further reading below).

- Researchers have long studied sports betting and the apparent efficiency of the "point spread" between teams. In sports betting markets a "point spread" is the expected difference between two teams' final scores. This spread moves in response to wagers placed by gamblers. Research suggests that the point spread is a more accurate predictor of sporting event outcomes than other methods such as statistics or power ratings (see further reading below).

What if a "prediction market" were created that would allow trading based on specific predicted outcomes such as the weather? Could such a market be created that operated efficiently and had sufficient participation to integrate all available information about the future? Here is a research hypothesis: An efficient "prediction market" generally will outperform all competing prediction methodologies in the earth and atmospheric sciences.

Recent developments in the private sector related to the securitization of risk suggest that "prediction markets" may not be so far off. In recent years a market has developed for "weather derivatives" (http://www.cme.com/products/index/weather/products_index_weather.cfm) to allow companies with weather-related risks to trade that risk in the marketplace, much like commodity futures such as gold and pork bellies are traded. Such markets typically focus on variables of direct relevance to particular industries such as heating degree days and cooling degree days, rather than the weather itself.

But this is changing. Recently a company called Aquila Energy announced a new weather derivative focused explicitly on the weather itself. Their "guaranteed forecast" (http://guaranteedweather.com/guaranteedweather/content/solutions/guar_forecast.html/) promises to allow traders to "hedge their commodity position from changes in the forecast or a 'busted' forecast." They are in effect creating a "point spread" for weather forecasts. One result of such a product, should it attract enough participation, is that Aquila (or perhaps its competitors) may wind up with more information than anyone else on the accuracy of weather forecasts, and this information itself may be of considerable value.

Several policy issues come to mind. First, there is an implication for the research community. It would appear to make sense to test the hypothesis about whether "prediction markets" can outperform other approaches to forecasting phenomena related to the earth and atmospheric sciences. Perhaps an equivalent to the Iowa Electronic Market could stimulate such research related to weather forecasting, climate forecasting, and, in principle, any area where predictions are made. Second, if the marketplace can provide skillful forecasts, then perhaps a mechanism might be created for this information to be provided systematically to consumers of forecasts through the public or private sectors, or through a partnership.

Make no mistake, prediction is difficult (especially about the future) and markets offer no silver bullet. But it is because prediction is difficult that innovative approaches to the integration and dissemination of knowledge should capture our attention. Perhaps four decades of experience in economics and its applications can contribute a fundamental innovation to forecasting applications in the earth and atmospheric sciences, maybe even leading us closer to the "best possible forecast."

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For further reading:

Forsythe, R., F. Nelson, G. Neumann and J. Wright, 1991. The Explanation and Prediction of Presidential Elections: A Market Alternative to Polls, pp. 69-112 in Laboratory Research in Political Economy, T. R. Palfrey, ed., University of Michigan Press

Stern, H. 1991. On the probability of winning a football game, *The American Statistician*, **45**:179-184.

L. Zeng, 2000. Weather derivatives and weather insurance: Concept, application and analysis, *Bulletin of the American Meteorological Society*, **81**:2075-82.

Guest Editorial

Industry-Academic Partnerships: The Oklahoma Experience

During the Reagan presidency, Eric Bloch, then director of the National Science Foundation, established the Science and Technology Centers (STC) Program in response to concern about an apparent weakening of the United States in science and technology development, as well as a desire to broaden university linkages with industry and develop more direct ties between university research and K-12 education. To be located exclusively at universities, the STCs were to attack especially challenging problems in basic research that required relatively large, interdisciplinary teams and stable funding for a significant period of time -- problems that eventually might yield technology for the benefit of society. Further, the STCs were to develop meaningful relationships with industry for effectuating knowledge and technology transfer; provide a framework for improving the representation of women and minorities in science; and develop programs for linking university research with K-12 education.

In 1987, Doug Lilly and I responded to the first STC solicitation to create the Center for Analysis and Prediction of Storms (CAPS) at the University of Oklahoma (OU). We proposed to study the practical predictability of high-impact, local weather, especially deep convective storms, using numerical models initialized principally with data from the NEXRAD Doppler radar network. At that time, no one knew if small-scale, highly energetic weather phenomena had any degree of practical predictability. However, we faced an even greater challenge – one that formed the core scientific problem upon which CAPS was founded: the estimation, from time series of the radial wind and reflectivity fields provided by a single Doppler radar, of the dozen or so quantities needed to initialize a computer forecast model.

To address this and many other issues, CAPS built its foundation around the following principles, some of which immediately were evident while others emerged over time: 1) in addition to conducting research, develop a tool or technology (in the case of CAPS, an end-to-end forecast system) that will provide sustainable R&D opportunity beyond the formal life of the center, particularly in the context of operational forecasting and commercial applications; 2) as a national center, undertake initiatives that have broad community involvement and impact; 3) work with end users, especially in government and private industry, in evolving the science and technology; 4) establish close working relationships with other disciplines and focus not only on the meteorology of the storms-scale prediction problem, but also on the computational science aspects; 5) make all results and software publicly available for use without restriction; and 6) ensure that the benefits of the research have a clear and effective path to practical utilization.

When CAPS began operation in the late 1980s, Doug and I saw the National Weather Service as its primary, and perhaps only (in addition to the military) beneficiary. However, by the mid 1990s, that simplistic view had changed dramatically to include broad elements of the private sector. Today, the provision of meteorological services is undergoing a profound change, with the private sector emerging as a dominant infrastructure for the *creation* as well as delivery of customized weather and climate information. This transformation is being driven by four developments: 1) the availability to private companies of extremely powerful computers that, until recently, were affordable only to major government facilities; 2) the general availability of sophisticated numerical weather and climate prediction software, like that developed at CAPS; 3) a growing recognition by industry that access to customized weather and climate information, appropriately applied, can lead to significant economic advantage; and 4) tremendous advances in communications and related technology. A related factor continues to be the slow and cumbersome process by which technology moves from the research to the government operational sector, and the inability of the government to respond rapidly to changes in technology -- a response that, in the private sector, often can be nearly instantaneous.

All of these factors are leading private meteorological companies, and even large weather-sensitive industries such as energy and transportation, to operate their own numerical forecasting systems (which, importantly, continue to depend upon data from the National Weather Service). The specific configuration of this technology -- in contrast to the National Weather Service – can be customized for particular decision making processes or tools. Thus, instead of simply repackaging NWS information, private companies now are generating independent forecast products on a schedule, and in a configuration, appropriate to their needs. Perhaps most importantly, however, is the fact that the user of the

To submit an item to the WeatherZine, use the on-line form at:

http://sciencepolicy.colorado.edu/cgi-bin/feedback.pl?site_id=1

Or send an email to:

weatherzine-admin@sciencepolicy.colorado.edu

and include your name, organization, and email address.

Guest Editorial Continued

information generated can change the configuration of the forecast system to respond to the particular "problem of the day or hour." No such feedback loop exists between information providers and users in government-operated systems.

In line with Congressional expectations placed upon the NSF (and especially the STCs), CAPS began to emphasize technology transfer in 1996. At that time, American Airlines funded a 3-year, $1M R&D grant to further develop and apply experimentally the CAPS technology to its domestic route system. Not surprisingly, this level of funding brought an expectation by American of owning the intellectual property. Prior to 1980, such ownership would have been unattractive, for any technology developed with federal funds was at that time "community property." Arguing that what belonged to everyone belonged to no one because a company would not attempt to commercialize something to which it could not gain exclusive access, in 1980 Congress passed the Bayh-Dole Act (P.L. 96-517) to provide universities the option of taking exclusive title to intellectual property developed with federal dollars for the purposes of commercialization. In the case of American Airlines, OU -- like most of its counterparts – chose to retain ownership of the intellectual property, but to grant American Airlines a license for its use.

Given that companies like American Airlines wish to use technology operationally, and given that universities are not private companies capable of providing guaranteed deliverables, services, or quality of service, CAPS led the establishment in Norman of a for-profit private company, Weather Decision Technologies (WDT), one goal of which is to commercialize intellectual property developed at OU. Like most other universities involved in spin-off companies, OU owns a small portion of WDT. Such linkages, though legal, raise legitimate issues regarding conflict of interest, which always will exist but which at OU are fully disclosed and carefully managed.

The successful partnership between CAPS and American Airlines, which formally ended in 1999 with the donation of $250,000 to establish at OU the American Airlines Professorship in Meteorology, set the stage for a $10.6M alliance between OU and Williams Energy Marketing and Trading headquartered in Tulsa, Oklahoma. As part of this alliance, which began in July 2001, CAPS is receiving $8.1M over 5 years for basic and applied research in numerical weather prediction, and for the purchase of a new supercomputer. The Williams project affords CAPS an opportunity to continue its work at a funding level equal to that provided by the NSF during its tenure as an STC, with additional grants and contracts nearly doubling that amount.

The intellectual property produced under the Williams funding also will be owned by OU but licensed in various ways to Williams. This protects Williams' investment without compromising academic freedom. No restrictions are placed on publications, including dissertations and theses, though of course CAPS will be careful to avoid disclosing within them information that is proprietary to Williams. Furthermore, all software developed can be used for non-commercial research and development, which of course yields benefit to the broader research community.

Developing meaningful relationships with private industry is a time-consuming and lengthy process, as are all relationships in life. Some worry that academic freedom is or soon will be compromised, and I too share this concern. However, based on my experiences to date, I believe that academic-industry partnerships and alliances indeed can work to the benefit of all, and moreover, I feel they are vital for economic development. The only way to know for certain is to try.

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Student Editorial

The Need for Probabilistic Forecasting

Now that autumn has given way to winter, the meteorological community is once again presented with the opportunity to both promote and practice probabilistic forecasting. I'm sure many meteorologists reading this article will think, "Probabilistic forecasting? Every other conference I go to has a talk on probabilistic forecasting! Why is the WeatherZine's Student Editorial Editor wasting a column talking about something that is already common knowledge in the meteorological community?"

Before I answer this question, let me first explain probabilistic forecasting for those not familiar with the term. As any forecaster knows, there are days when forecasters are rather sure of what will happen, and there are days when forecasters are rather uncertain. A probabilistic forecast includes not only information regarding the expected weather for the near future, but also the degree of certainty that the forecaster has in the forecast. Some broadcast meteorologists will note uncertainty in the timing of a frontal passage, or how far a swath of heavy

precipitation will stretch. Some, in an attempt to assure viewers that they are the best meteorologist in the market, will not make such statements for fear that uncertainty will be mistaken as incompetence. The forecasters that truly provide the greatest service to their viewers or clients frequently share information regarding uncertainty. Unfortunately, this information is shared too infrequently.

The need for probabilistic forecasting, and the consequences of not meeting this need, were quite evident in the aftermath of the Nor'easter of March 4-6, 2001. On March 3, based on forecasts of a record storm, the entire East Coast was gearing up for the event. Municipalities had workers stay overtime to handle problems that would arise from the storm. Factories were shut down for the first time in years. In a race to be the first with the story, broadcast meteorologists warned of a near-record blizzard and told viewers to stock up on supplies and stay tuned to their local news. What these broadcast meteorologists failed to tell their viewers was that the track of the storm, as well as the location of the rain-snow line, was quite uncertain, and that in an area as populous as the North Atlantic, a fifty-mile margin of error could make the difference between getting a foot of snow or an inch of rain. One could also argue that communication from the National Weather Service contributed to this misplaced sense of certainty in the forecast process.

While the model forecasts correctly predicted the intensity of the storm, they incorrectly predicted its location. The majority of snow in fact ended up in New England and avoided major populations. The New York metropolitan area lost millions of dollars, leading Byram Township, New Jersey, mayor Richard Bowe to threaten to take local broadcast meteorologists to court. Said Bowe, "People who give the wrong information should be held accountable for losses sustained by those who follow that information." National Weather Service meteorologist Bill Goodman responded, "We use our knowledge of the weather and computer models to make our best judgment. This is not a perfect world." That is certainly true, but while the meteorological community is aware of its limitations, it does not always communicate those limitations to the general public. This is where probabilistic forecasting can improve the meteorological community's ability to serve the public.

So back to the question posed earlier in this article. Why discuss a need for probabilistic forecasting when readers of this column likely already recognize this need? The answer is simple. The greater meteorological community recognized a need for probabilistic forecasting long before March 2001, but that hasn't led to a significant change in the forecasting process. To the degree that change has occurred, it has been relatively minor with respect to decision makers' needs for the best information that the forecasting community can provide. One must conclude that this is either the result of the greater forecasting community's failure to recognize the need for probabilistic forecasting, or forecasters simply ignoring this need for some reason. To provide such information to viewers and clients of professional forecasters, the meteorological community must facilitate a transition to probabilistic forecasting, whether through research, product development, or simply dialogue, as we await the first Nor'easter of 2002.

Those of us concerned with the societal impact of weather must do what we can to develop the knowledge and means necessary to issue forecasts that indicate the appropriate level of uncertainty. In the larger picture, we must continue to bridge the gap between our respective research areas and the situations in which our research can make a difference in people's lives.

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WeatherZine News

GuaranteedWeather.com Contest

Aquila Energy, a global leader in weather derivatives and energy, announces the launch of the world's first online weather risk management portal, GuaranteedWeather.com. Through this Web site, businesses with weather sensitive risk can learn about weather risk in their industry, quantify it and purchase financial derivatives to help manage it. Aquila Energy is offering academics and professionals the opportunity to publish weather risk management-related studies on the site in exchange for worldwide exposure, full authorship credit, a small gift and the opportunity to win a cash prize.

Aquila is seeking papers and studies on:

1. Uses of Weather Derivatives – Unique uses of weather derivatives to manage a specific weather risk. The articles should address the application of HDD, CDD and GDD puts, calls, collars or swaps – or precipitation caps or floors.
2. Effects of Weather on Specific Industries – Examples of how derivatives have been used to address a business' weather risk, for example: a profile of a particular business' weather risk, the decision process used in analyzing and choosing a derivative strategy, and the pricing methodology used in determining the final outcome of the weather hedge.
3. Pricing Methodologies – Theoretical and practical issues relating to pricing weather derivatives.

GuaranteedWeather.com Contest Continued

4. Climate Events – The impact of climate events such as El Nino, La Nina, Pacific Decadal Oscillations, and Sunspot Activity – and their influence on business and the economy.
5. Seasonal Forecast Methodologies – Different methods of producing seasonal forecasts.

For more information, visit GuaranteedWeather.com. (http://www.guaranteedweather.com/guaranteedweather/content/submitpaper/submit.pdf)

WeatherZine News

The Christine Mirzayan Internship Program of the National Academies

The Christine Mirzayan Internship Program of the National Academies is designed to engage graduate science, engineering, medical, veterinary, business, and law students in the analysis and creation of science and technology policy and to familiarize them with the interactions of science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to a professional.

During the program, interns work on studies and activities throughout the National Academies. Each intern is assigned to a senior staff member who acts as his or her mentor. The mentor provides guidance and ensures that the intern's time is focused on substantive work and activities. In addition, the interns select topics, plan, and organize sessions for a seminar series whose audience includes not only NRC interns but also other interns throughout the Washington area.

For the year 2002, applications are being accepted for the June 3 through August 9 session. To apply, candidates should submit the on-line application (http://www4.nas.edu/pd/pdsurvey.nsf/webapplication?openform) and reference letter forms meeting the requirements described at the web site (http://www4.nas.edu/pd/pdsurvey.nsf/reference?openform).

Materials must be received by March 1. Decisions will be made within two or three weeks of the application deadline. Applications for the internships are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine as well as business and law students.

WeatherZine News

Funding Opportunities
New Directions in the Earth Sciences and the Humanities
Interdisciplinary Team Projects

The New Directions Initiative (NDI) (http://www.mines.edu/newdirections/) will award up to six grants to support collaborative partnerships between scholars in the earth/environmental sciences and the humanities. Interdisciplinary teams made up of at least one earth/environmental scientist and one humanist can apply for up to $10,000 per team, contingent upon 1:1 matching support by the team's home (or other) institution, for a total of up to $20,000. The projects being proposed should be case-based, that is, tied to environmental issues of concern to local, state, regional, national or international governments, private corporations, and/or community groups. The outcomes of this collaboration will include a presentation at the New Directions national conference and an essay in the subsequent proceedings volume.

Proposals are welcome across a wide spectrum of disciplines within both the earth sciences and the humanities. To enhance learning and dialogue across the sponsored teams, we ask that all proposed interdisciplinary projects be organized around the theme of water. This theme will be interpreted quite broadly: representative topics include issues in environmental remediation, global climate change, pollution control and abatement, water quality and quantity, the long-term storage of nuclear waste, and the discovery of life on other planets. Examples of possible projects can be found at the NDI website.

Proposals are due by January 15, 2002. See the New Directions (http://www.mines.edu/newdirections/funding.htm) site for application instructions. Decisions will be made by January 30, 2002

For additional information contact: rfrodema@mines.edu

Correspondence

Dear WeatherZine,

Re: "Vulnerability and Risk Assessment: A contribution of the Weather Research Community in Developing an Effective Response to Terrorism" (http://sciencepolicy.colorado.edu/zine/archives/30/editorial.html)

Your editorial in the October 2001 issue of WeatherZine raises some very good points. However, it is important that we not invent another stove-piped capability but rather work toward a true all-source/all-hazard disaster information system. The Western Disaster Center (http://www.wdc.ndin.net/) is actively supporting this concept through the development of a US Disaster Information Network.

Building upon the 1997 Disaster Information Task Force Report and the 1998 NRC report Reducing Disaster Losses Through Better Information, Presidential Executive Order 13151 has already defined a workable federal policy to use information technology more effectively to coordinate the collection and dissemination of information to appropriate response agencies and state governments to better mitigate, prepare for, respond to, and recover from natural and man-made disasters.

NOAA is the federal coordinating agency for establishing the National Hazards Information Strategy (NHIS). NHIS is an interagency effort to support the application of information and data critical to reducing losses of property and lives from disasters.

Let's not reinvent the wheel as a result of the events of September 11 but rather let's get on with the development of a true all-source/all-hazard National Hazards Information Strategy.

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Dear WeatherZine,

Re: "Ka-ching!! Dealing with Financial Conflicts of Interest" (http://sciencepolicy.colorado.edu/zine/archives/1-29/29/editorial.html)

My prime competitor in state contracts here in the upper Midwest is a company owned by a university professor. The interesting thing about your article is that the professor uses university students and software and receives federal money. It is tough for me to say that the situation is completely wrong. However, I think there may be a tendency to have allegiance to the fatter wallet that could be either the grant money or the private client.

I think partnerships are useful. Private companies, even some pretty big ones, view R&D as a huge waste of money and focus on the user interface. On the other hand, the university community may not have the marketing skills and contact with potential users to realize some financial payback for the research dollars spent.

What is an appropriate balance? The answer is not clear to me. What is clear is that the private and public sectors do not work together enough. I think the greatest societal benefit would result from increased cooperation. Certainly cooperation cannot be legislated. I'd like to see the American Meteorological Society and National Weather Association take a gutsy ethical stand on private-public conflicts of interest, but professional ethics seems to be an issue on the back burner.

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Research Highlight

"Good Day Sunshine: Stock Returns and the Weather"

Researchers David Hirshleifer and Tyler Shumway have identified a novel societal impact of weather. "Good Day Sunshine: Stock Returns and the Weather" (http://www-personal.umich.edu/~shumway/papers.dir/weather.pdf) looked at the relationship between morning sunshine at a country's leading stock exchange and stock returns that day at 26 stock exchanges around the world. They found that sunny days were highly correlated with above-average returns. For example, annualized returns in New York on perfectly sunny days were 24.8%, compared to only 8.7% on perfectly cloudy days. Rain and snow, however, had no effect on share returns. The findings appear to be consistent with theories that sunshine positively impacts mood and mood positively impacts prices. While the authors' findings suggest that investors could have benefited somewhat modestly from weather-based trading strategies, the more important implication is that investors should become aware of their moods so they do not allow moods to cause errors in their judgments and trades. In

"Good Day Sunshine: Stock Returns and the Weather" Continued

other words, don't let "Good Day Sunshine" lead to a foolish day on Wall Street.

To find out more about climatic effects on behavior, see Philip M. Parker's **Climatic Effects on Individual, Social, and Economic Behavior: A physioeconomic review of research across disciplines** (Greenwood Press, 1995). Parker's work is an extensive bibliography that includes 3,307 references on the effects of weather on physiology, psychology, sociology, and economics.

Education Highlight

New Environmental Studies Graduate Program at the University of Colorado

In the fall of 2002 the University of Colorado will admit its first class of graduate students to its Environmental Studies Program. The graduate program is designed to educate students at the professional level to address complex environmental issues. The emergence of humans over the past few decades as major agents of change in nearly all aspects of earth systems from local to global scales (for example, water, nutrients, climate, land use, etc.) necessitates a new paradigm in graduate education in the environmental field. To be effective problem solvers in this field, physical scientists must understand human behavior (policy, law, economics, etc.). In turn, social scientists must understand how the physical earth systems function in order to make reasonable policy and achieve a sustainable and robust economy. In addition, all scientists need to be more effective at working in cross-disciplinary teams, as well as at communicating their ideas and findings to the public. To maintain focus and employability for the graduates, the Environmental Studies graduate degree program has a number of different tracks:

- Climate and Atmospheric Chemistry
- Water Sciences
- Environmental Policy and Sustainability
- Waste Management and Environmental Remediation
- Biogeochemical Cycles

Faculty in the program are drawn from the College of Engineering and Applied Sciences, the College of Arts and Sciences, and the Schools of Law and Journalism. Interdisciplinary research opportunities also exist with the Cooperative Institute for Research in Environmental Sciences (CIRES), the Institute for Arctic and Alpine Research (INSTAAR), the Natural Resources Law Center, the Institute for Behavioral Science, and the Laboratory for Atmospheric and Space Physics (LASP). The presence of leading laboratories in the environmental sciences in Boulder, including the National Center for Atmospheric Research and the NOAA Environmental Research Laboratories, provides additional opportunities for a rich educational experience.

For further information, please contact:
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Web: http://www.colorado.edu/envirostudies/

Jobs

International Research Institute for Climate Prediction (IRI)
Linking Science to Society
Postdoctoral Scientist Program

UCAR announces the continuation of a postdoctoral program in the application of seasonal to interannual climate forecasts. Fellows will be located at the International Research Institute for Climate Prediction (IRI), on the campus of Columbia University's Lamont-Doherty Earth Observatory in Palisades, NY. The IRI (http://iri.columbia.edu) combines a network of international research capabilities with a core of expertise in

- **Applications**, whose components include information dissemination, climate applications research and development, and training; and
- **Predictions**, where modeling research in support of forecast system development, and regular forecasting occurs.

The objective is the development of an integrated forecast decision support system. Toward this end, IRI engages local and global partnerships in program, project or product specific activities of mutual benefit. Fellows work in close collaboration with IRI researchers, partners at Columbia University's Earth Institute, and experts from the region of study. In this way, the IRI advances an "end-to-end" program that

- Develops global climate forecasts of temperature and rainfall variations,
- Assesses the regional consequences of those variations, and
- Applies this information to support practical decision

Jobs Continued

making in critical sectors impacted by climate fluctuations like emergency preparedness, public health and safety, energy, fisheries, agriculture, and water resources.
The postdoctoral program places fellows for two year visiting research appointments, to be renewed annually. Applicants to the program should propose a project and develop a project description, including a statement of project relevance to the IRI, as an integral part of their application. Advancement of applications research and development is a priority.

Interested and qualified persons are encouraged to contact Carolyn Mutter, Assistant Director for Science Management (czm@iri.columbia.edu) regarding the development of proposed research activities and the identification of appropriate mentors. Projects involving climate issues in global food security, health, hazard, and information management are particularly encouraged.
For application information visit the program's website. (http://www.vsp.ucar.edu/02IRI.html)

AMS/Industry/Government Graduate Fellowships

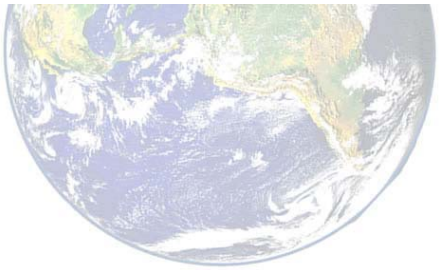
These fellowships are sponsored by major high-technology firms and government agencies and are designed to attract promising young scientists to prepare for careers in the atmospheric and related oceanic and hydrologic fields. Applicants must be entering their first year of graduate school in the fall of 2002 and provide evidence of acceptance as a full-time student at an accredited US institution at the time of the award. Applicants must pursue a related full-time course of study in the atmospheric or related oceanic or hydrologic sciences over a full academic year. Applicants must have a minimum grade point average of 3.0 on a 4.0-point scale. Applicants must be US citizens or hold permanent resident status. No age restrictions exist. The Society encourages applications from women, minorities, and disabled students, traditionally underrepresented in the atmospheric and related oceanic and hydrologic sciences. The evaluation of applicants will be based on the applicant's performance as an undergraduate student, including academic records, recommendations, and Graduate Record Examinations (GRE) scores. Selection will be made by the AMS Executive Committee. A $15,000 stipend will be presented to each fellowship recipient for a nine-month period in the 2002/2003 academic year. For more information and to download the application form, visit the fellowship application website (http://www.ametsoc.org/ams/amsedu/scholfeldocs/appfellow2002.pdf).
Completed applications with all attachments must be postmarked by: February 15, 2002.

AAAS and AGU Congressional Fellowships

Application deadlines are approaching for the 2002 AAAS and AGU congressional fellowship programs. Fellows in these programs spend one year working as special legislative assistants on the staffs of members of Congress or congressional committees, beginning in September 2002. Fellows perform as regular staff members. In the past they have performed every type of work normally asked of the permanent staff, whether they are in individual offices or with committees. The program includes an orientation on congressional and executive branch operations, and a year-long seminar program on issues involving science and public policy. The fellowships are designed to provide a unique public policy learning experience, to demonstrate the value of science-government interaction, and to bring technical backgrounds and external perspectives to the decision-making process in government.
The AAAS will select and sponsor two Congressional Fellows. Click here for application details (http://fellowships.aaas.org/application.html). The deadline is January 10, 2002.

The AGU will select and sponsor one Congressional Fellow. The fellowship stipend is $42,000 with allowances for travel and relocation. Click here for application details (http://www.agu.org/sci_soc/policy/congress_fellows03.html). The deadline is February 1, 2002.

Although AAAS coordinates the entire Congressional Science and Engineering Fellowship Program on behalf of the scientific, engineering and professional organizations participating in the program, each organization selects, sponsors and supports its own Fellow(s). Applicants may apply to the program from more than one society.



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Additions to Societal Aspects of Weather (http://sciencepolicy.colorado.edu/socasp)

Floods, General Resources

http://www.panda.org/news/press/news.cfm?id=2386
Dams and Floods

World Wildlife Fund (WWF) research warns that dams built with the promise of reducing flooding can often exacerbate the problem with catastrophic consequences, as some recent floods have shown. "Dams and Floods" shows that dams are often designed with a very poor knowledge of the potential for extreme flood events. Where data do exist they may fail to consider current risks such as increased rainfall due to climate change or increased run-off of water from land due to deforestation or the drainage of wetlands.

www.fema.gov/mit/tsd/dl_cgs.htm
FEMA's Draft Guidelines and Specifications for Flood Hazard Mapping Partners

FEMA has recently prepared these Draft Guidelines and Specifications that define the technical requirements, coordination and documentation activities, and product specifications for flood hazard maps and related National Flood Insurance Program (NFIP) products.

reports.eea.eu.int/Environmental_Issues_No_21/en/enviissue21.pdf
Sustainable Water Use in Europe - Part 3: Extreme Hydrological Events: Floods and Droughts

This report from the European Environment Agency (EEA) presents an overview of the main causes and impacts of floods and droughts in Europe and provides an overview of policy responses to prevent such disasters or reduce resultant damage.

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