

Opportunities for 21st Century Meteorology: New Markets for Weather, Water and Climate Information

Jack Kelly
National Weather Service, NOAA

This is a most timely and important topic, so before getting to the three specific questions posed to the panel, some background and perspective is in order. Simply stated, climate, water and weather events are important and create business opportunities as well as risks. William Daley, former Secretary of Commerce said, "Weather is big business. It can help or hurt a community. One-seventh of our economy, about \$1 trillion a year, is weather sensitive."

During the 21st century, unprecedented situations are likely to arise which could significantly challenge the way we live or cause dramatic changes in the economy. According to the National Climatic Data Center, the U.S. sustained 48 weather-related disasters over the past 21 years each of which has overall damages and costs of \$1 billion or more, with total damages and costs exceeding \$180 billion.ⁱ Seven occurred during 1988 alone – the most for any year on record. Ninety percent of all Presidentially-declared disasters were weather and flood related, and 1998 was most expensive year yet for natural disaster relief.

Innovative use of weather, water and climate information will increase our safety and productivity, improve the Nation's competitiveness, and enhance our standard of living. For example, one study found that the long-range predictions issued by the Climate Prediction Center for the 1997-98 El Nino led California to conduct major mitigation efforts leading to a reduction in losses of about \$1 billion.ⁱⁱ

Communication technologies are fostering an unprecedented growth in the use of weather, water and climate information, particularly by the broadcast industry and the emerging Internet and wireless industries. These technologies enable citizens and industries to get weather information when and where they want it. According to the Pew Research Center for the People and the Pressⁱⁱⁱ weather has become the number one form of news that people looked for on

line. Recent surveys have rated NOAA's weather-rich web site either the most popular (Media Metrix, Inc.) or second most popular (Nielson) U.S. government site. Weather, water and climate information is also the underpinning of an entire and growing industry of firms which gather, package and deliver this information and services to fit the specific needs of their clients. Estimates vary, but the yearly revenue of the commercial meteorology industry probably exceeds \$500 million.^{iv} Since users in a number of weather sensitive industries increasingly need expert support to interpret and apply meteorological data, this private sector market segment should experience further growth. Perhaps the best recent example of a business opportunity created by increased availability of weather and climate information is the weather derivatives industry, which, since the first public offering in mid-1998, has now mushroomed to a \$7 billion industry.^v

Beyond just weather, water and climate information, open and unrestricted access to taxpayer-funded government information – from corporate data from the Securities and Exchange Commission to patent data from the Commerce Department's Patent and Trademark office^{vi} -- is contributing to the spectacular growth in the information retrieval and database industries:

?? From a \$4 billion industry in 1994 to an expected \$10 billion industry in 2002.^{vii}

?? From 900 database vendors in 1991 to 2400 vendors in 1999.^{viii}

^{iv} Guth, "Japan's Weather Mogul to Storm U.S." *Wall Street Journal*, October 30, 2000.

^v Weather Risk Management Association, <http://www.wrma.org/>

^{vi} Both agencies faced initial opposition to placing their information on the Internet from database firms which already marketed this information to private sector clients. Fears that "government competition" would stifle their growth proved unfounded as the economic statistics demonstrate. See the specific discussion of the SEC's "EDGAR" system in Stiglitz, et al., "Role of Government in a Digital Age," footnote xvi below, at pp. 54-56.

^{vii} Department of Commerce, U.S. Industry and Trade Outlook, 1998.

ⁱ <http://www.ncdc.noaa.gov/ol/reports/billionz.htm>

ⁱⁱ Changnon, "Impacts of 1997-98 El Nino-generated weather in the United States." *BAMS*, 80,1819-1827 (1999).

ⁱⁱⁱ Seabrook, "Selling the Weather: The climate is becoming more extreme, and so is the way we watch it," *The New Yorker* (April 3, 2000).

Pundits predict the trend to continue, and European governments are beginning to look to the U.S. data policy and public/private partnership model for ideas to stimulate their own economies.^{ix} We are all justly proud of the United States' policy of open and unrestricted access to taxpayer-funded government information. Our success is clear: policies that provide a level playing field of basic government information available to all coupled with new technological innovations – particularly the Internet -- fuel new information industries and create jobs.

The challenge for the meteorological community is to balance governmental responsibilities to provide warnings and forecasts for everyone subject to weather-related hazards with the private sector's responsibility to tailor forecasts for use by specific entities, build markets, and mitigate risk by developing more effective means to integrate weather, water and climate information into commercial business plans, strategies and decisions. While the National Weather Service and private sector entities each have distinct roles in the weather information dissemination process, we must continue working strategically as partners for the public good and the economic benefit of our country as a whole.

What are the new opportunities for the public sector to cooperate with the private sector to provide weather, water and climate services?

Since the overall sensitivity of the economy to weather, water and climate is about \$1 trillion per year, potential economic gains from better information are also large. Weather-sensitive industries have several responses:

- ?? They can use weather information directly to improve efficiency. This is the strategy followed by the aviation, agriculture and utility industries, among others, and is one of the foundations of the **commercial meteorology** industry.
- ?? They can simply absorb weather-related risk as a "cost of doing business." This has historically been the case in the construction industry, but is rapidly changing.
- ?? They can use **insurance** to protect against weather-

related casualty losses.

- ?? And now they can buy and sell **weather derivatives** to hedge against weather impacts.
- ?? Weather derivatives is a new financial industry, and perhaps the best example of a new opportunity for public/private cooperation. Weather risk management contracts grew out of the deregulation of the power industry beginning in 1995. They were traded privately over the counter until mid-1999, when the Chicago Mercantile Exchange developed the first public market in degree-day contracts. The estimated value of outstanding contracts is over \$7 billion and growing. This new industry has three impacts on government roles:
 - ?? The weather derivatives industry – both the market makers and the derivatives purchasers -- needs reliable, rapid and standardized access to climate data archives to analyze historical risks and "price" initial contracts;
 - ?? The industry needs objective, unimpeachable "honest broker" sources of information to close each contract - an ideal application of government data;
 - ?? And as the weather risk management industry grows, official government data and "honest broker" forecasts become "market movers" as a baseline on which to price and trade contracts.

In sum, the weather risk management industry provides a "hedging tool" allowing energy companies, for example, to even out their weather sensitive costs. The general public benefits when we pay less for our electricity than we otherwise would, and the same principles potentially apply to every weather-sensitive industry in the country.

Scientific and technological advances will make public sector weather and climate information more accurate, more precise in time and space, more frequent, and longer range. We will be able to deliver general public information so our citizens can get the information they want, when and where they want it.

These trends in improved delivery of government information to the taxpayers are seen as a threat by some in the private sector. But we should see these as opportunities for private sector growth. For example, you can today buy a private paging service that will alert you when the wind surfing conditions you specify are expected at your favorite beach. This is but one example of an almost limitless desire for highly detailed and personalized information services – services delivered by the private sector, at intervals the user sets, and based on increasingly precise and readily available public sector information.

^{viii} Gale Directory of Databases, 1999.

^{ix} "Commercial Exploitation of Europe's Public Sector Information," European Commission, Directorate-General for the Information Society, September 20, 2000. For an overview of international data policy issues see, Weiss & Backlund, "International Information Policy in Conflict: Open and Unrestricted Access versus Government Commercialization," in "Borders in Cyberspace," Kahin and Nesson, eds. (MIT Press 1997).

The upcoming 2002 Winter Olympics in Salt Lake City is giving public/private cooperation an opportunity to flex some of its muscles:

- ?? We have drawn a clear boundary for delivery of weather information by the public and private sectors to support the games.
- ?? Specific forecasts for each Olympic sport venue will be produced and provided by private sector meteorologists hired by the Olympic Committee's contractor;
- ?? The NWS will provide our routine services, with a recognition of the importance of the public transportation infrastructure and heightened concerns for public safety;
- ?? Close cooperation between the National Weather Service and the private sector will assure that consistent, tailored and timely weather information is available to meet public safety and Olympic Committee needs.

The growth and new market opportunities for the private sector come from better assimilation and tailoring of weather and climate data for use in the economic decisions that affect the profitability of commercial enterprises. The challenge for the National Weather Service is to recognize our role as a strategic partner and continue to provide weather, water and climate data, forecasts, and warnings in an increasingly accessible, consistent, useful and timely manner.

What factors could enhance effective cooperation between the public and private sectors in providing weather, water and climate services to industry?

The single most important factor is for both the public and private sectors to better understand and harness the rapid development of new information technologies. The coming convergence of Internet and television – which includes cable, broadcast, and direct satellite TV – along with digital radio, pagers, phones, the Global Positioning System, and other media and technologies, are moving us into a seamless CyberSpace world with global reach.

This developing phenomenon of CyberSpace has profound implications for all of us. For the private sector, it challenges traditional notions of how to integrate information into business processes, and how to present content. For us in the government, it does precisely the same thing. At last year's American Meteorological Society meeting there was an appropriate acronym making the rounds – "ICE" – it stands for "Internet Changes Everything."

If anything, the pace of Internet change has accelerated in the past year. NWS delivery of radar information using Internet technologies is now a reality – we started this January to provide a more complete set of radar

products to a broader audience using multiple Internet technologies. We are proud to be able to use three different and complementary Internet-based technologies and approaches to provide real time access to NEXRAD radar data and products.

The NEXRAD system is a nationwide network of 154 advanced Doppler radars operated as a joint project of NOAA/NWS, the Federal Aviation Administration and the Defense Department. NOAA/NWS has recently completed implementing a central radar data repository from which it can access and use the NEXRAD radar data as inputs to its public forecasts, watches and warnings.

This central repository provides over two dozen radar data products as a "real time" data stream, or Internet "multicast," – which is a new "push" technology -- to anyone choosing to bear the cost of a connection and direct dissemination costs. This multicast now feeds a group of wholesale data users, including the original NEXRAD Information Dissemination System (NIDS) vendors who continue to retransmit these products and their own value-added products to their customers. Second, we let anyone select and download for free any particular product by Internet file transfer protocol (FTP) -- a traditional Internet "pull" technology. Finally, we make four basic radar imagery products available for viewing on the web. Web-viewable radar fulfills our part of the Federal government's responsibility to provide a reasonable subset of the taxpayers' radar data in a convenient form – an "information safety net." It also provides a common point of reference for real time coordination with emergency managers, and serves as a link to the other two dissemination channels for those who might be interested in direct access to a broader range of products.

In addition to using these Internet technologies to disseminate radar data products, NWS is also sending them out on its existing NOAAPORT satellite broadcasting link, which is available to anyone with the necessary equipment.

Beyond the NWS' own initiatives, Internet service providers are beginning to implement technologies that will "pop up" a weather warning during the customer's regular Internet session – the Internet equivalent of the "crawlers" already widely used by the broadcast industry to alert citizens of warnings while they watch TV.

This should be an exciting time for a broad range of private sector entities to use their creative skills to take public weather, water, climate and environmental data, including forecasts and warnings, and turn it into even better products for their customers. Indeed, that will be the ultimate test in how well we succeed in this element of our partnership. In sum, the Internet is changing everything – including the weather business and

weather sensitive industries -- by making information once available only to experts accessible to everyone.

What policy framework could facilitate successful cooperative public and private efforts to meet the information and service needs of U.S. economic sectors, industries and markets?

The basic policy framework is already in place, has proven itself over time, and is beginning to be understood and accepted internationally. The government-wide information policies contained in the Paperwork Reduction Act (PRA)^x -- passed unanimously by the Congress and signed by the President in 1995 -- along with the Electronic Freedom of Information Act Amendments of 1996 (E-FOIA)^{xi}, are based on the premise that taxpayer-funded government information is a valuable national resource, and that the overall economic benefits to society are maximized when government information originally generated or collected for governmental purposes is made available in a timely and equitable manner to all.

These Congressional policy enactments trace their roots to the so-called "Bromley Principles" enunciated by my co-panelist Dr. Bromley in 1991, which established an open and unrestricted data policy for the taxpayer-funded scientific data and information needed for global change research.^{xii} The PRA and EFOIA also serve to flesh out and expand the context of NWS' 1991 public-private partnership policy,^{xiii} but do not fundamentally change it.

?? Our radar data dissemination, discussed above, is a specific example of how these policies work in practice. The NEXRAD system is one of the major components of the Weather Services' approximately \$4.5 billion modernization. The data generated by NEXRAD are basic inputs to the NWS public forecasts, watches and warnings which are part of our inherent governmental responsibility to assist in the protection of life and property. Yet, we don't just keep the underlying radar data to ourselves. Indeed, the information policies contained in the PRA and EFOIA, and implicit in the NWS' public-private partnership policy, recognize that the return on the taxpayers investment in NEXRAD is maximized by the broadest possible dissemination of the radar data generated by the system. Hence, we are providing that taxpayer-funded information to anyone who

wants it -- industry, academia, emergency managers, and the general public -- using multiple Internet technologies intended to satisfy the needs of the broadest possible range of users.

Volume users can get all of it in a real time multicast "push;" others can get access to any of it through file transfer "pull;" and Web browsers will visually display a small subset to anyone interested in immediate viewing. To limit dissemination to multicast might serve the needs of volume users, but would disadvantage others, such as emergency managers. And to limit dissemination to the Web might satisfy some members of academia and the general public, but would disadvantage the volume users such as the broadcast and commercial meteorology community. So our responsibility under the applicable Congressional, OMB and NWS policies is to make cost effective use of all available technologies to make the widest possible cross section of taxpayer-funded information available to those who want it.

Even more specifically, OMB Circular No. A-130, "Management of Federal Information Resources,"^{xiv} which implements the PRA and E-FOIA, directs Federal agencies to make maximum use of the Internet and its World Wide Web to make taxpayer-funded information more easily accessible to the general public:

"Advances in information technology have changed government information dissemination. Agencies now have available new media and formats for dissemination... In addition, the development of public electronic information networks, such as the Internet, provides an additional way for agencies to increase the diversity of information sources available to the public. Emerging applications such as...the World-wide Web will be used increasingly to facilitate dissemination of government information such as environmental data, international trade information, and economic statistics in a networked environment. A basic purpose of the PRA is to "provide for the dissemination of public information on a timely basis, on equitable terms, and in a manner that promotes the utility of the information to the public and makes effective use of information technology." (44 U.S.C. 3501(7)) Agencies can frequently enhance the value, practical utility, and timeliness of government information as a national resource by disseminating information in electronic media...because electronic information is more easily manipulated by the user and can be tailored to a wide variety of needs, electronic

^x 44 U.S.C. Chapter 35.

^{xi} 5 U.S.C. 552 (as amended).

^{xii} "U.S. Policy Statements on Data Management for Global Change Research," Office of Science and Technology Policy (July 1991).

^{xiii} <http://www.nws.noaa.gov/im/a06toc.htm>

^{xiv} 61 Federal Register 6428 (February 20, 1996).
<http://www.whitehouse.gov/OMB/circulars/a130/a130.html>

information dissemination products are more useful to the recipients.”

Maximizing the benefits of government information to society depends, in turn, on fostering diversity among the entities involved in disseminating and using it. These include for-profit and not-for-profit entities, such as broadcasters, information vendors, academic and research institutions, as well as State and local governments and perhaps most important, the taxpayers who paid the government to produce this information. This policy of open and unrestricted dissemination of taxpayer-funded information is aimed at creating strategic information partnerships such as the National Weather Service enjoys with the commercial weather and broadcast industries, as well as with the emergency management community.

So the issue is not the creation of a policy framework, but rather the application of the nation’s proven government information policy to changing times and technologies in the context of the strategic partnership. It is helpful to discuss the strategic partnership concept in the context of “ICE”. The provision of weather data and information is like a three-legged stool made up of the .com’s (“dot-coms”) of the commercial sector, the .edu’s (“dot-edu’s”) of the research and academic sector, and the .gov’s (“dot-govs”), which includes not only the National Weather Service at the Federal level, but also the hazards and emergency response community at all levels of government. The nice thing about a three-legged stool is that if one leg is a bit longer or shorter, it will still stand. However, if any leg becomes either too long or too short, the stool falls.

That’s the essence of the strategic partnership: an understanding of respective roles and responsibilities and how they fit together in a complementary manner. This includes the government having a taxpayer-funded responsibility to provide a basic “information safety net,” while creating the conditions for the “dot-com’s” to maximize their ability to serve their constituencies and the “dot-edu’s” to conduct research and develop applications.

In July, 1999, the AMS adopted a policy on the public-private partnership in weather and climate services.^{xv} It clearly recognizes what we at the National Weather Service have long believed: “the economic position of U.S. industries impacted by weather and climate will be well served, the private weather/climate sector will experience unprecedented growth, and the general public will continue to benefit as a result of this public-private partnership.”

Most recently, the Computer and Communications Industry Association commissioned a former chair of the Council of Economic Advisors to perform a comprehensive analysis of “The Role of Government in

a Digital Age,” with particular emphasis on public-private issues.^{xvi} The report sets out a useful set of twelve principles for government action in light of private sector prerogatives, and applies them in a number of case studies. Here’s what the report says about the NWS partnership and the balance between public and private roles:

“The National Weather Service seems to strike this balance well...For example, specialized weather forecasts and analysis for industrial clients are reserved for private firms, with cooperative transmission efforts in the case of weather emergencies. Thus, NWS’s approach seems to balance the public sector’s role in providing basic information with an appropriate concern [about] displacing specialized, value-added private-sector services.”

So, the policy framework is in place. It was clearly articulated by the AMS and others, and it is working.

Conclusion

Working together as partners keeps hazards from becoming disasters. The NWS can’t do it without the private sector and the private sector can’t do it without the NWS. Our taxpayer-funded data and products form a national information data base and infrastructure used by other government agencies, private weather companies, broadcasters, the general public, and the global community.^{xvii}

Working together, we need to create opportunities to educate the public about the unique partnership and dependence between the National Weather Service, the commercial weather and broadcast industries and how the emerging weather and climate related financial industries and weather and climate sensitive sectors of the economy can grow through the effective use of the right type of weather and climate information in their business decisions and plans.

This country has the best weather services in the world. Working together we can make them even better.

^{xvi} Stiglitz, et al., “The Role of Government in a Digital Age,” Computer and Communications Industry Association (October 2000) <http://www.ccianet.org/digitalgovstudy/main.html> For a similar study which reaches much the same conclusions, but which does not explicitly examine the NWS, see, Atkinson & Ulevich, “Digital Government: The Next Step to Reengineering the Federal Government,” Progressive Policy Institute (March 2000) <http://www.ppionline.org/>

^{xvii} “Vision 2005: National Weather Service Strategic Plan for Weather, Water, and Climate Services,” (August 1999) at p. 2.

^{xv} BAMS, Vol. 80, 2099 (1999).