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Use of Non-NOAA Data Sets for Emergency Response and Forecast Operations: Implications on NOAA Policy

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1. Abstract

Historically, data collected and used by National Oceanic and Atmospheric Administration's (NOAA) research laboratories for research and development and daily operations of NOAA's National Weather Service (NWS) for forecasting and emergency response activity was primarily owned, operated, quality controlled, and archived by NOAA. This allowed NOAA to have complete and total control of the data collection and quality checking. As the science of meteorology matures, customer needs change and the need to address emerging hazards, impacted by weather with higher temporally and spatially resolution data are required. The cost of expanding data collections in the way it has been done historically to meet these requirements is prohibitive.

In an attempt to effectively meet these requirements, NOAA has begun to develop additional partnerships with other Federal, state, and local government agencies and the private sector. The NOAA Office of Oceanic and Atmospheric Research (OAR) Earth Systems Research Laboratory (ESRL) has been collecting data from multiple entities experimentally for a number of years and developed the Meteorological Assimilation Data Ingest System (MADIS) as a tool for ingest quality control, and for redistribution of this data. NOAA's OAR Air Resources Laboratory (ARL) and NWS have evaluated this data set to support its requirements for basic weather parameters in high spatial and temporal resolution, for operations, research, and development activities supporting emergency operations and hazard response, such as severe weather conditions, bio-chemical spills, nuclear accidents, or terrorist threats. NOAA found these data sets valuable, yet limited in use for some of their requirements.

A new program, UrbaNet, funded through an earmark in the 2006 budget and in cooperation with NOAA's ARL, uses private sector weather data from existing data networks. Initial review of these data by NOAA indicates that additional development will be required to make these data appropriate for operational application in order to address the variability in the collection methodology, sensor exposure, sensor types, quality control, and quality assurance. The long-term plan for this

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program is to expand the data collection to include other data networks and to increase the regions of the country where these types of additional data may be applied. Use of non-NOAA weather data poses a number of scientific and policy concerns for NOAA's operational and research components. This paper will explore some of these problems and solutions that are being proposed.

2. Introduction

The UrbaNet program funds were earmarked in the 2006 budget and instructed NOAA's ARL to cooperate with the private sector weather data companies to exploit information from the existing data networks. Several companies collect various types and qualities of weather data nationwide and had prior agreements with NOAA to use their data. The sensors are already collecting high temporal and spatial resolution data. Most of these data collected are typical standard meteorological, including air temperature, dew point, air pressure, precipitation, wind speed, and wind direction. The temporal resolution of the data is frequently dependent upon the frequency of retrieval; however, most systems do have data logger capability for easy retrieval of maximum and minimum values or time-series of data.

Initial review of these data by NOAA indicate that additional development will be required to make these data appropriate for operational application in order to address the variability in the collection methodology, sensor exposure, sensor types, quality control, and assurance. Details on these and other scientific issues will be forthcoming on other papers at this conference and in the future. A significant part of this initial phase of this program is to analyze these data and see exactly where it is most useful in the operational and research communities. The long term plan for this program is to expand the data collection locations to more geographic regions of the country. In doing this, we also hope to include data from additional weather data networks and organizations. The whole idea is to expand the availability of basic weather data to as many locations as possible to meet the needs of multiple users. In addition, it may be found that as this network grows, the uses of the data, number of users, and data elements collected may change.

NOAA ARL's interest in this data came with the realization after September 11, 2001, that it would be useful to model the atmospheric dispersion of a pollutant at the very fine scale where people live. The hope is that high spatial and temporal resolution data can be assimilated into existing air quality dispersion models to determine the meteorological conditions at the street level scale in a city or equivalent geographic area (Hicks 2004). The ability to establish portable mesonets in a day or so after some type of catastrophic event which requires better understanding of weather conditions has been a capability of NOAA's OAR ARL Special Operations and Research Division (SORD) for a number of years. But for short-fused emergency events that play out over a matter of minutes, something must be done immediately to support emergency mangers in the protection of life and property near some type of hazardous event. These events range from fires of various scales, hazardous biological or chemical spills of various origin, and terrorist attacks

and that come to the attention to the U.S. Department of Homeland Security. All of these events would require immediate meteorological information from sensors in place and providing data. Emergency managers first contact NOAA's National Weather Service or NOAA's National Ocean Service (NOS) for support to get the latest nearby weather data and use the NOS CAMEO/ALOHA models (Peyton 2004) and/or request support from the NWS who run the ARL Hybrid single-Particle Lagrangian Intergrated Trajectory Model (HYSPLIT) (Draxler 2006).

In addition to Homeland Security events, NOAA continues to need data support for its hazardous weather, water supply and flood programs, as well as those affecting the ecological environment. The high temporal and spatial resolution data network improves NOAA's ability to pinpoint wind events, high/low temperature extremes, heavy rainfall events and other meteorologically driven events impacting the environment in which we live.

As mentioned above, there are several difficulties posed in using this data set. NOAA's Earth Systems Laboratory (ESRL), Global Systems Division (GSD) has been working with a data ingest and quality control system called the Meteorological Assimilation and Data Ingest System (MADIS) for a number of years (MacDermaid 2005). This system is currently in transition from research mode to operational mode in the NWS. Once in place a number of problems with the data set will be minimized. NOAA's ARL, Atmospheric Turbulence and Diffusion Division (ATDD), under the terms of the earmark, is working to provide support and guidance in redeployment of weather stations, systems and equipment quality control, and overall evaluation of the data. Modeling research and development continues in ARL Headquarters and Atmospheric Sciences Modeling Divisions (ASMD) to further evaluate the usefulness of this data.

3. Policy Implications

Use of non-NOAA weather data poses a number of scientific and policy concerns for NOAA's operational and research components. The government does not own the data collection systems, and therefore does not own the data. Since this data are collected with other users in mind, other than for government use (in general) the owners and intended users may impose limitations on how the data can be used and otherwise distributed to the public. Many companies will allow the data to be used for warnings and forecasts without specific detailed information about the source and location. This is still valuable to the forecaster in operations in that the data can be used in near real-time and later archived for purposes of warning verification. All of the data limitations must be spelled out early on in the negotiation process. A successful process has been developed in the research and development process of MADIS, with ESRL's GSD working specifically one on one with each company. This process must continue as MADIS transitions to the NWS.

This lack of ownership by the government does create a number of liability concerns that must be described and addressed in various forms of official documentation. Agreements must be put in place and routinely updated between the government and

each individual data collection network. The use of Memorandum of Agreement (MOA), Letters of Agreement (LOA), and Memorandum of Understanding (MOU) tend to be the three most common instruments for negotiating these issues.

NOAA's policy on the use of data remains at the lower levels of the organization and ultimately relies on the scientist to decide on the validity of the data, its appropriate use, and of course proper attribution for the collection of the data. The current policy of data restrictions is defined at the MOU/MOA/LOA level and establishes restrictions in the distribution process. Once the data are collected and distributed, the use of the data is ultimately up to the scientist, be it operationally or in a research capacity. A major concern for the operational forecaster is the reliability of the data on a routine fashion, as much of the data are collected through non conformal communications methods that meet line office standards and security re-quirements. The research community is more concerned about quality and spatial resolution and less concerned about timeliness. Once MADIS is in place within the operational environment to assist with quality control, operational staff help with quality assurance, hardened communications systems, standard equipment and maintenance schedules are agreed upon by providers, a number of concerns by operational users will then be addressed.

4. Conclusions

Given the existing budget climate with little new funding for data collections expected, yet the with the expansion of programs requiring weather related data, this is likely one of many data collection activities within NOAA to change in the next few years. NOAA may have to explore ways to better formalize its use of data and also increase its flexibilities in gathering data and continue to expand its involvement with state, university, and private sector partners to meet mission requirements.

5. References

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Draxler, R.R., 2006, The Use of Global and Mesoscale Meteorological Model Data to Predict the Transport and Dispersion of Tracer Plumes over Washington, D.C., Weather and Forecasting, Vol. 21, No. 3, pages 383-394

Payton, Debbie, 2004: Proceedings, Atmospheric Transport and Dispersion Modeling Support for Homeland Security, Eighth Annual George Mason University Conference on Transport and Dispersion Modeling, July 14, 2004, Office of the Federal Coordinator for Meteorology.

MacDermaid, Christopher H, and R. C. Lipschutz, P. Hildreth, R. A. Ryan, A. B. Stanley, M. F. Barth, and P. A. Miller 2005: Architecture of MADIS data processing and distribution at Forecast Systems Laboratory (Now GSD), American Meteorological Annual Conference 2005, IIPS P2.39.

6. Links

NOAA's Ocean Service – CAMEO / ALOHA
http://archive.orr.noaa.gov/chemaids.html
NOAA's OAR Air Resources Laboratory (ARL)
http://www.arl.noaa.gov/
NOAA's OAR ARL Atmospheric Sciences Modeling Division
http://www.epa.gov/asmdnerl/
NOAA's OAR ARL Headquarters Division http://www.arl.noaa.gov/ss/
NOAA's OAR ARL Atmospheric Turbulence and Diffusion Division
http://www.atdd.noaa.gov/
NOAA's OAR ARL Special Operations and Research Division
http://www.sord.nv.doe.gov/arlsord-1.htm
Weatherbug WeatherBug
http://ww2.weatherbug.com