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21st Century Ushers in New Hydrologic Services

Weather brings challenges to the utility industry in many ways. Industry infrastructure (e.g. property including substations, etc.) is vulnerable to damage from storms and floods. Field crews are in danger when deployed during hazardous weather and floods. To effectively manage these risks , utility safety officials must depend on, and demand accurate and timely information from weather and flood experts.

Spring and Summer squall lines can produce powerful winds and intense rainfall, and sometimes flash floods, disrupting utility services. However, the impact from these high intensity events are usually short-lived and generally localized covering a small geographical area.

Winter storms are considered deceptive killers because most deaths are indirectly related to the storm such as traffic accidents on icy roads, hearts attacks while shoveling snow, and hypothermia from exposure to cold. Utility crews are at risk during winter storms as they attempt to restore power and service to their customers. Whether the winter storm is a classic Nor'easter, an ice storm across the southern U.S. or a Midwest blizzard, winter storms can paralyze large geographical areas by disrupting utilities and creating high demands for services.

Perhaps the Grand-daddy of all meteorological events is the hurricane. There are no storms like it on the earth. They have it all. Moving ashore with violent winds, they sweep the ocean inward causing coastal flooding while spawning deadly tornadoes, intense thunderstorms, and lightning. Still, a hurricanes worst element may be the inland flooding associated with the torrential rains. In the last 30 years, it has been inland flooding, not coastal flooding, that has been responsible for more than half the deaths associated with tropical cyclones in the United States.

When it comes to hurricanes, wind speeds do not tell the whole story. Often the most deadly element of a hurricane is the inland flooding. Inland flooding can be a major threat to communities hundreds of miles from the coast as intense rain falls. Hurricane Agnes (1972) produced floods in the Northeast United States resulting in 122 deaths and $6.4 billion in damages. Intense rainfall is not always directly related to the wind speed of a tropical cyclone. In fact, some of the greatest rainfall amounts occur from weaker tropical storms that drift slowly or stall over an area.. Tropical Storm Alberto (1994) drifted over the Southeast United States and produced torrential rainfall. More than 21 inches of rain fell at Americus, Georgia. Thirty-four people drowned. Damaged exceeded $750 million.

What would a utility manager do with river and flood information extending out to 7 days and beyond? What kind of decisions would she/he make knowing more precisely how high the flood water would be and how far it would spread into the community?

Armed with this kind of valuable information, imagine the supplies and equipment utility safety managers could pre-position before a flood or drought engulfed a region. And, imagine having the ability to strategically place utility crews at key locations before disaster strikes instead of reacting to it.

Had some of this information been available when Hurricane Floyd (Figure 1) assaulted the East Coast:

- utility companies could have been better prepared and taken steps to reduce impacts on utility services
- emergency response efforts including sheltering could have been pre-positioned with appropriate utility hook-ups

- alternative communications links could have been strategically designed and established
- back-up plans could have been implemented well in advance of the disaster
- the need for emergency response could have been better anticipated for such things as when flood waters swept through sewage plants, contaminating the water supply with dangerously high levels of fecal coliform bacteria.
- potable drinking water could have been delivered and stored ahead of time

Wishful thinking? Maybe not. The National Weather Service (NWS) is implementing improved products and services through an initiative called the Advanced Hydrologic Prediction Services (AHPS). AHPS is based on an enhanced and comprehensive forecasting infrastructure. The development of some new products (e.g. real-time flood mapping) will involve more sharing of data and resources with other government and private-sector agencies. AHPS provides more information than previously available, allowing decision makers to make better, and more timely decisions responding to floods and droughts and every hydrologic condition in between.

Current short-term hydrologic forecasts extend out to three days. That's changing. Implementation of AHPS in its inaugural stages is already occurring in the Midwest, North Central U.S. and the Ohio River Valley. Other parts of the country will begin using AHPS technology as resources become available. Thanks to new information and technology, hydrologic forecasts are being extended out to seven days and beyond. New graphical formats will also be used to depict these river forecasts.

Perhaps the biggest improvement to hydrologic forecasting is the new graphical and text-based forecast products depicting the probabilities of certain ranges of river height out into the future. At the click of a button, a person will be able to view an array of hydrologic information including the location of each forecast point, the present height of a river, and a multiple-day river forecast.

Our goal is to produce one stop shopping online. Visual displays will assist local managers in making their decisions better and faster. If you can click a button, you will have information at your fingertips.

Here are some comments we have received from parts of the country where AHPS has already been implemented:

"Sometimes it's a lot easier to look at a picture and get the data off it, rather than trying to sift through all of the text and acronyms." (Bob Goldhammer, Emergency Manager, Polk County, IA).

AHPS *"...reflects the uncertainty in flood forecasting and helps keep people from relying too heavily on one reassuring (or scary) number."* (Grand Forks Herald, Saturday February 17, 2001).

It's immediate data, it's on line, it's right there available for us to use...[Without AHPS] *the decision process becomes much longer in trying to figure out where we need to put resources, what is the river doing, what is it doing currently.* (Ellen Gordon, Administrator, Iowa Emergency Management)

Another AHPS product currently being demonstrated is realtime inundation mapping (Figure 6). A flood warning of 20 feet above flood stage may mean little to those in a community that don't live close to the river. The residents may live a lifetime thinking their property isn't vulnerable to flooding. But, during extreme events, like the disastrous, record-breaking floods produced by landfalling hurricanes, those areas that have been dry for decades, can, and often do become flooded and residents are caught unprepared.

Realtime flood inundation maps will provide a graphical display allowing the viewer the ability to see how extensive the flooding will be. This areal extent of flooding will help businesses, like the utility companies become better informed and have information that could help them take precautions to minimize flood damages, and ultimately minimize the loss of service to their customers. The amount of money saved could be significant.

While other forms of graphical depictions of forecasts are relatively inexpensive to produce, realtime flood inundation maps are very expensive. Actually, the high-resolution digital elevation data (DEM) that is used to produce the flood maps are what costs the most. The NWS will work with cooperating agencies and communities where DEM information is available to develop this capability for areas that have the most critical need.

"Flooding can disrupt and disorganize entire communities," said retired Air Force Brig Gen. Jack Kelly, Director of the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS). *"The new flood prediction tools should give forecasters an advantage in providing timely and accurate information about approaching and on-going floods."*

How is all of this possible? AHPS takes advantage of NOAA's other advanced technologies, including Doppler weather radar, satellites, historic data, long-range climate predictions, and a highly evolved weather observation processing and communication system to produce the most advanced river forecasts to date.

Who will benefit the most from AHPS? In a word, America. *"AHPS goes beyond addressing flood and drought issues. AHPS provides water prediction for life decisions. From irrigation and farming to river transportation, retaining and releasing water from reservoirs and even recreation. AHPS will provide the water information necessary to engage in these activities efficiently and safely."* (Brenda Brock, NWS)

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