Water Policy and the Role of Information Technology

H2Ology – Tapping into Technology to solve water demands
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Introduction

- We have to dedicate more emphasis toward understanding regional precipitation and hydrology. How is it changing? How will it change? Water needs are so important in regions where people live, where animals live, where natural biota have adopted to regional climates and to regional precipitation patterns and rivers. We can do a better job of predicting.

Bay delta region

The California Bay-Delta is at the heart of the state's water supply system. Here the Sacramento and the San Joaquin rivers meet with smaller tributaries that empty into San Francisco Bay. Efforts to protect native species, such as the Delta smelt, have led to restrictions on water flow out of the delta. Statewide water reserves were cut by about a third when a federal judge moved dramatically and pumping from the delta to protect the smelt last year.

Santa Ana watershed

Water from more than 2,200 square miles of land drains into the Santa Ana River, eventually to fill a huge basin behind Prado Dam. While the dam's main function is flood control, a portion of this water is held in reserve for the Orange County Water District.

Sources: Orange County Water District

The Sierra

The snow pack in the Sierra Nevada range is critical to the State Water Project, which supplies water to much of California. Snow melt runs down rivers to replenish reservoirs along the California Aqueduct. In May, the season-ending snow pack figures came in 67 percent of normal following record low precipitation the previous two months.

Colorado River

Next to the Bay-Delta, the Colorado River is California's most important water source, but California shares it with six other states and Mexico. When there is extra water available on the river, California is allowed to channel it into reservoirs. But because of the worst drought in a century on the Colorado, it could be as long as 10 years before lakes Mead and Powell are full again.

Central valley

The California Aqueduct running down the state's midsection supplies a large portion of the imported water for Los Angeles, Orange and San Diego counties.

Pat Brennan and Molly Zisk / The Register
Information technology and water policy

- *Climate variability is* an opportunity to understand role of information technology in water policy; i.e., predicting & assessing:
  - Changes in drought patterns.
  - Mountain glacier melting; decreases in snow and ice cover.
  - Flood risk.

- *Information technologies* are being developed by NOAA, others to: forecast drought, predict floods, protect fisheries, avert fire hazards.

- Use of these technologies limited by:
  - Range & complexity of water resource decisions.
  - Spatial/temporal frames for decisions.
  - Lack of appreciation for risks to water resources from climate variability.
Information technologies = tools + policies

- Information technologies embrace:
  
  - Climate, weather, water forecasting products.
  
  - *Translation* of *products* into forms useful for decision makers:
    - FROM: “What is maximum probable flood stage of a river during large rain events?”
    - TO: “How many homes and businesses in a community are threatened if a river crests at a certain height?”

  - *Processes* that “facilitate dissemination, communication, use of climate science products, information, and tools” (NRC, 2007).
Example of translating technology into policy tool: Advanced Hydrologic Prediction System (AHPS)*

*National Oceanic and Atmospheric Administration, 2008
Political impediments to information technology use

- **Myth**: information technologies are produced and delivered to decision-makers who automatically rely on them because they are useful ("loading dock" model).

- **Reality**: information technology use is constrained by political factors –
  - Innovation not always encouraged by decision-making climate.
  - Disciplines producing information technologies work in "stovepipes."
  - Lack of national-scale policy coordination of water policy decisions.
  - Geographic and time scale diversity of "target audiences" for technologies.

- **Examples**: response to regional drought in southeast, preparation for tropical storms (e.g., Katrina); flood preparations in Midwest.
Organizational Impediments to information use

- **Myth:** Good information is relevant to users & appropriate to all situations.

- **Reality:** Decision-makers’ inclination to use information technologies is conditioned by their “decision space” –
  - Law, regulations, training, peer expectations.
  - Available resources (time and money) to integrate information into decisions.
  - Practical ability to use information given pressures of daily decisions.
  - Varying perceptions of risk of “non-use” of information.

- **Example:** Regional Integrated Science Assessments (RISAs) – national effort to apply information technology in “problem focused” manner; interact with decision-makers on fisheries, fire hazard, agriculture, public supply.
Information technology and policy vulnerability

• Decision-makers can lose stature, reputation if rely on wrong forecasts, or if undesired consequences come about from decisions based on correct forecasts (e.g., storms, floods).

• Culture clashes between decision-makers and scientists common:
  
  • To decision-makers forecast credibility hinges on certainty – more exact a forecast, more trusted it – and the developers of information – will be.

  • To scientists, even the best forecasts rarely approach absolute certainty – uncertainty is not a hallmark of bad science, but of honest science.
NRCS spatial summer runoff (April-September stream flow) volume forecast summary, showing median runoff forecasts as an anomaly (percent of average).
Correspondence of climate and hydrologic forecast lead time to user sectors in which forecast benefits are realized (from National Weather Service Hydrology Research Laboratory). The focus of this Product is on climate and hydrologic forecasts with lead times greater than two weeks and up to approximately one year.
Information technology as process
HOW THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT USES CLIMATE INFORMATION

In an attempt to restore the Everglades ecosystem of South Florida, a team of state and federal agencies is engaged in the world’s largest restoration program. A cornerstone of this effort is the understanding that seasonal and year-to-year climate variability (as well as climate change) could have significant impacts on the region’s hydrology over the program’s 50-year lifetime. The South Florida Water Management District (SFWMD) is actively involved in conducting and supporting climate research to improve the management of South Florida’s complex water system.

Research relating climate variability to Lake Okeechobee inflow started at SFWMD more than a decade ago. Since that time, SFWMD has been able to apply climate forecasts to its understanding of climate-water resources relationships in order to assess and communicate risks associated with seasonal and multi-seasonal operations of the water management system to agency partners, decision makers, and other stakeholders. The SFWMD has since established a regulation schedule for Lake Okeechobee that formally uses seasonal and multi-seasonal climate outlooks as guidance for regulatory release decisions.

The district has also learned that, given the decades needed to restore the South Florida ecosystem, adaptive management is an effective way to incorporate seasonal and multi-seasonal climate variation into its modeling and operations decision-making processes, especially since longer term climate change is likely to exacerbate operational challenges.
Conclusions – how integrate information technology into policy?

- *Information technology* development must engage many participants; those who create *and* use tools, to ensure products are *problem-focused*.

- *Information technology* should aim to generate *accessible* findings; those viewed by decision-makers & public as accurate, trustworthy, relevant.

- *Tool development* must be inclusive, interdisciplinary & provide dialogue among researchers and users – including public – to be *responsive*.

- *Policy makers* must understand tradeoffs between long-term predictions at local/regional scales and potential decreases in accuracy. *Uncertainty* should not be *feared*, but incorporated into *prudent planning*. 