

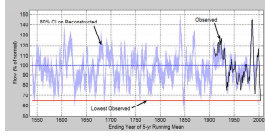


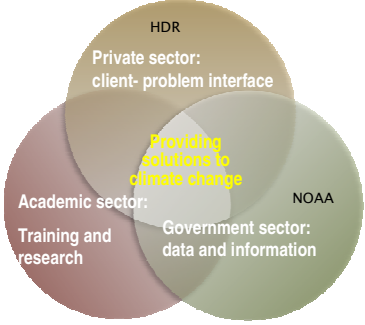


A WEBINAR ON CLIMATE SERVICES TO THE WATER SECTOR, JOINTLY BETWEEN THE AMS COMMITTEE ON CLIMATE SERVICES (CCS), AND THE AMS CERTIFIED CONSULTING METEOROLOGISTS (CCM), September 16, 2009

<h3>Climate Information and the Water Sector</h3> <p><b>Kristen Averyt</b> University of Colorado at Boulder, NOAA, Western Water Assessment <a href="mailto:kristen.averyt@noaa.gov">kristen.averyt@noaa.gov</a></p> <p>AMS Webinar September 16, 2009</p>   <p>1</p>	<h3>Cognitive Challenges</h3> <p>Within the water resources engineering community, the <b>stationarity assumption</b> is a fundamental element of professional training</p> <p><b>CLIMATE CHANGE</b> <b>Stationarity Is Dead: Whither Water Management?</b> P. C. MALLAPATI, John R. Brown, Mark Anderson, Robert W. Kinoshita, Thomas W. Anderson, David J. Schwab, David L. Swales</p>  <p><b>Time scales of climate change</b> exceed typical planning and infrastructure design horizons and are remote from human experience</p> <p><b>Confusion in conceptually melding the burgeoning climate change impacts literature</b></p> <p>CCSP SAP 5.1, Chapter 5. "Decision Support for Water Resources Management"</p> <p>2</p>
<h3>Integrated Frameworks</h3> <p><b>Develop an ongoing, iterative process between developers and users</b></p> <ul style="list-style-type: none"> <li>Identify <i>Current AND Potential</i> Users of Water Information</li> <li>Know the User: Climate Literacy</li> <li>Assess User Needs: What and Why?</li> <li>Informational Gaps</li> <li>Sources of Uncertainty</li> <li>Decision-Making Context: Exacerbating Factors</li> </ul> <p><b>EXAMPLES</b></p> <p><b>Dealing with Drought in Colorado</b>, Informing the Governor's Climate Action Plan, Governor's Drought Plan, and the Colorado Impacts and Adaptation Report <b>NOAA NWS River Forecast Centers</b>, Engaging Current and New Users in Developing Online Climate Tools for CBRFC; Developing a framework for engaging water resource users <b>Department of Interior Climate Training</b>, Scoping a Process for Engaging Federal Resource Managers and Technical Users of Climate Information with Climate Scientists</p> <p>3</p>	<h3>Climate Information Needs</h3> <ul style="list-style-type: none"> <li>Manage for climate <b>variability</b> and climate <b>change</b></li> <li>Need <b>seasonal</b> and <b>short-term</b> climate forecasts: 2-mos, 12-mos, 24-mos</li> <li><b>Downscaled</b> data</li> <li>Information tailored to <b>regions</b></li> <li>Streamflow volume forecasts conditioned on climate forecasts</li> <li>Water is managed for <b>extremes</b>: Worst-case, Best-case, Median and Mean; percentiles and terciles don't mean as much</li> <li><b>Demand</b> projections</li> </ul> <p><b>CAUTION: User needs change as climate literacy evolves; and different users need different things</b></p> <p>Lowrey et al., In Press, JAWRA</p> <p>4</p>

**Kristen Averyt's** presentation, entitled "Climate Information and the Water Sector" addressed 1) cognitive challenges, 2) integrated frameworks, and 3) climate information needs. She noted that climate variability and change have disrupted the notion of stationarity of the precipitation record, which is one of the staple assumptions of the water community in making predictions. She noted that it is important to bring together tool developers and users in an iterative process. This takes time, because trust is also essential to the relationship, and that takes time to build.


 <p>Climate Services for Water Clients: User Needs and Data Availability</p> <h2>Existing Climate Services in the Engineering Sector</h2> <p>Sep 16, 2009 John Henz, C.C.M., SPA Atmospheric Science Practice Leader HDR Engineering, Inc Denver Colorado</p> 	<h3>HDR, Inc</h3> <ul style="list-style-type: none"> <li>▶ Full service engineering Top 15 firm</li> <li>▶ &gt; \$1B dollars in revenue</li> <li>▶ Approaching 7,800 employee owners</li> <li>▶ Offices in 42 states and several foreign countries - increasing daily</li> <li>▶ Three primary engineering business classes: Transportation, Water and Federal, Energy &amp; Resource Management</li> <li>▶ Full Architecture, Design-Build Services</li> </ul>
<h3>HDR Climate Change Projects</h3> <ul style="list-style-type: none"> <li>▶ Bay Delta CCP EIS/EIR: Climate Change Task Leader</li> <li>▶ Salina River Climate Change/Water Supply</li> <li>▶ CWCB Colorado River Basin Climate Study</li> <li>▶ North Carolina Hurricane/drought Climate Study</li> <li>▶ Flathead Reservoir Drought Management Plan and EIS</li> <li>▶ South Boulder Creek Floodplain Delineation Project - Climate task</li> </ul>	<h3>The "weather enterprise solution" ?</h3> 

**John Henz's** presentation, entitled "Existing Climate Services in the Engineering Sector", provided insight into the climate services provided by the engineering company employing him. These services ranged from the development of drought management plans for reservoirs, predictions of climate impact on river water supplies, to assessing the climate change impacts on EIS/EIR studies. He offered ways the weather enterprise members can work together rather than compete in climate services. Eileen Shea of NOAA agreed and provided examples.

## Climate Services for Water Clients: User Needs and Data Availability

**Eileen Shea**  
NOAA National Climatic Data Center

**AMS CCS & CCM Webinar**  
September 16, 2009

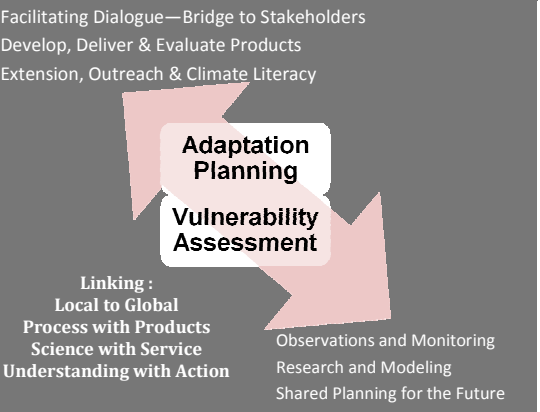


Provide authoritative climate information and services to assist the nation's citizens in making climate-related decisions that enhance their lives and livelihoods



### Climate Services Case Study: Water

- Problem and People focused:
  - Drought and Floods
  - Changes in snowpack (quantity and timing)
  - River stream flow
  - Fire outlooks
  - Physical Infrastructure (i.e., dams, reservoirs, water delivery systems)
  - Planning (e.g., urban, agriculture, health)
- CCMs and Other Service Partners
  - Core climate services customers
  - \*Feedback on products, services and tools
  - Targeted support for individual users
  - Trusted information brokers
  - Insights into user needs
  - Partners on the ground in service and science

**Eileen Shea** discussed “Climate Services for Water Clients: User Needs and Data Availability”. Eileen described how the various government members of the climate community (PRODUCERS of climate information in the form of observations, monitoring, research, modeling, and assessments) might, through the National Climate Service, address the needs to the USER community, including resource risk management and adaption and mitigation. She narrowed her focus even more to discuss services to the water community, noting that CCMs and other service partners address key user needs, and are in a position to develop trusting relationships with users.

## Climate Services for Water Clients: User Needs and Data Availability

Joint CCM-CCS Webinar  
1:00–2:00 P.M., 16 September 2009

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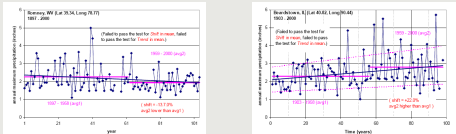
## Climate and Water Forecasting



Upper Brays Bayou, Houston, TX  
Wastewater Treatment Plant inundation  
during Tropical Storm Allison, June 9 2001

- Climate change and variability affects precipitation and streamflow climatology
- Civil infrastructure is designed to convey runoff for a specific return periods (2, 5, or 100-yr) to manage risk of flooding
- Understanding low flow streamflow statistics can be as important as high flow when water quality becomes an issue
- Flooding that exceeds design capacity can occur because:
  - Upstream urban development increases runoff due to changing watershed conditions and affects streamflow statistics and contains significant trends
  - Urban heat island are known or suspected to affect the frequency and severity of extreme storm events
  - The majority of the stations in the Ohio River Valley (NOAA Atlas 14) exhibited no trend in precipitation over a 50 year period. Some are increasing while others decrease, but with no discernible spatial pattern.

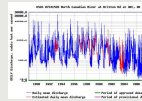
## Reliability of Precipitation Statistics



- Climate and human-induced effects
  - Urban heat island and climate change can increase the precipitation depth, shorten recurrence interval, and affect inter-arrival time of storms
  - Several 100-yr events could occur, but at different locations without altering the frequency of occurrence because rainfall probabilities are point statistics.
  - Changes in location and measurement equipment poses difficult in understanding long-term statistics
- The majority of the stations in the Ohio River Valley (NOAA Atlas 14) exhibited no trend in precipitation over a 50 year period.
- Forecasting water availability, flooding, and low flow characteristics is confounded by anthropogenic effects and in some locales, the lack of long-term measurements with consistent quality

## Summary

- Understanding changes in precipitation and streamflow climatology is important in assessing future conditions, design of urban infrastructure, managing water quality, or forecasting the impacts of climate change.
- Usefulness in climate and water services could be improved through
  - Access to data from multiple agencies with documented accuracy and metadata
  - Sufficient period of record to detect trends
  - Adequate geographic distribution of homogeneous sensor data
  - Continuity in sensor type (discontinued sensors or changes)
  - Lack of or inconsistent metadata that describes sensor conditions
- Forecasting water availability, flooding, or low flow characteristics relies on understanding the data quality of long-term measurements, its accuracy, and trends.



**Baxter Vieux's** presentation discussed some of the challenges of producing forecasts for the water community. This is because water availability is profoundly affected by many different factors at the same time, e.g., human activities, trends, lack of observations, lack of metadata, etc...

### AMS COMMITTEE ON CLIMATE SERVICES (CCS)

The goal of the Committee on Climate Services (CCS) is to promote the climate services enterprise through a partnership among government, private sector and academic sectors with a community focus on improving climate services to the nation. Created as a committee under the Board on Enterprise Communication (BEC), the scope of the CCS is envisioned as an ongoing process to gather the recommendations of the private and academic sectors for the direction of government climate services activities, to review those recommendations, and to present them to the government.

**CURRENT MEMBERS:** R. Boyles, R. Cohen, J. Dutton, C. Hakkarinen, H. Hartmann, K. Hubbard, P. Llanso, E. O'Lenic (Chair), K. Redmond, E. Shea, C. Simpson