American Water Resources Association
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Climate Change Adaptation
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New Orleans, LA

Tuesday, June 16
3:30 PM – 5:00 PM
SESSION 12: Drought Preparedness and Adaptation

The Lifecycles of Drought: Science, Preparedness and Adaptation Across Timescales - Roger Pulwarty, NOAA, Boulder, CO (co-authors: V. Deheza, M. Hayes, M. Svoboda, C. Nierenberg, W. Higgins, R. Webb)

Drought is a slow-onset hazard. Drought onset and demise are difficult to determine. Impacts are mostly nonstructural, spread over large geographical areas, and can persist long after precipitation deficits end. These factors hinder development of accurate, timely estimates of severity and responses. Drivers range from SST anomalies and global scale atmospheric response, through regional forcing and local land-surface feedbacks. Key climatological questions related to drought risk assessment, perception and management include how might precipitation patterns and strategies on which management systems rely, change in the future. The National Integrated Drought Information System ((NIDIS) and others have shown that effective early warning systems inform strategic responses that anticipate crises and crisis evolution across climate timescales. While such "early information" is critical for defining event onset, it is even more critical for identifying the potential for increases in severity. From an adaptation standpoint many social and economic systems have buffers in place to respond to onset (storage, transfers and purchase of grain) but lack response capabilities as drought intensifies, as buffers are depleted. Throughout the drought lifecycle (and between events), monitoring, research and risk assessments are required to: * Map decision-making processes and resource capabilities * Place multiple climate and land surface indicators within a consistent triggering framework * Identify policies and practices that impede or enable the flow of information The presentation will outline the capabilities and framework needed to ensure improved scientific inputs to preparedness and adaptation. Lessons will be drawn from recent and ongoing events in the United States and globally to guide adaptation practices.

California Drought Activities and the Sierra Drought of 2011-2015- Kelly Redmond, WRCC / DRI, Reno, NV

A set of four pilot activities in California, in support of the National Integrated Drought Information System (NIDIS), was recently initiated. By coincidence these began at approximately the start of the ongoing 2011-2015 California-Nevada drought. These pilot efforts span different physical water supply settings and mechanisms, the entire latitudinal

extent of the state, and quite different economic sectors, reflecting the tremendous diversity within the state. The intent was to address a major portion of the range and breadth of issues and audiences pertaining to drought in this area. The four areas include 1) the heavily engineered and import-reliant water districts of Southern California, 2) the rain-dominated coastal watershed of the Russian River north of San Francisco, 3) the Central Valley where more land remains fallow during drought, and 4) the Klamath River with interstate jurisdictions, endangered species, tribal concerns, dam restoration, a major federal water project, and multiple parties and cultures. A number of other activities, initiated or supported by NIDIS, in conjunction with NOAA programs and projects, and other federal and state agencies, have been under way as well. The question of how to portray western drought for the US Drought Monitor (USDM) has been an active topic of discussion since the USDM inception in 1999, and is of special interest to the NOAA-administered Western Regional Climate Center (WRCC) in Reno (host, Desert Research Institute) as the home institution of one of its ten authors. During 2014-15 a bi-weekly call among all National Weather Service (NWS) Weather Forecast Offices in CA, NV, s OR and w AZ took place to provide advice to USDM on adjustments to the map, with participation from state climatologists, WRCC, USDA, NWSRiver Forecast Centers . These conversations, and those among the drought listserv (about 350 potential participants), often touch on important but not-always-resolved questions for the USDM about the best way(s) to depict western drought for the public and for decision makers and managers. During 2014-2015 the Western Governors Association began a "Drought Forum" that featured well-attended and useful meetings on different drought topics in cities around the West. Representatives from WRCC and from the California-Nevada Applications Project (CNAP), have attended numerous drought meetings around California during the drought. CNAP involves Scripps/UCSD and UC-Merced in California and WRCC in Nevada under the NOAA Regional Integrated Sciences and Assessments Program (RISA). Many efforts are closely coordinated with the California Department of Water Resources (CDWR). Media contact is frequent and often intensive; fact sheets are routinely produced by federal and state governments, research projects, and non-governmental organizations (NGOs). Drought issues straddle the Sierra Nevada, and have strongly affected Nevada as well. For several years WRCC has hosted the well-attended and popular Great Basin Climate Forum, working closely with the US Department of Interior Great Basin Landscape Conservation Cooperative and the Southwest Climate Science Center, to describe and discuss recent, current, and near-future climate conditions. WRCC is also developing a web tool to provide information on likely precipitation accumulation outcomes for a current period of interest.

The Invitational Drought Tournament Recent Advances and Implications for Applications - Harvey Hill, U.S. Army Corps of Engineers, Alexandria, VA (co-authors: R.Olsen, J. Smith, C. Hackett, Andrea, C. Greenley, G. Mendoza, H. Cardwell, Langsdale)

The Invitational Drought Tournament concept was developed in Canada under the Agriculture and Agri-Food Canada Climate Adaptation and Resilience in Agriculture Project (CARA) between 2010 and 2014. This competitive scientifically based simulation exercise has since been independently applied in Colorado, Oklahoma, and Nepal. It has also been explored by NOAA's National Integrated Drought Information System (NIDIS) World Meteorological Organization's

(WMO) initiative to develop National Drought Programs as a tool to support improved drought preparation and proactive risk reduction. In addition, work is currently underway at the U.S. Army Corps of Engineers' Institute for Water Resources (IWR) in partnership with U.S. Army Corps district staff to explore how to expand the concept to a multi-water hazard tournament framework (drought, flood, and water quality). The expansion of concept is to be tested in Iowa and Texas. This presentation describes the original framework. It then will describe how additional hazards will be included. It also will discuss how the U.S. Army Corps experience is helping develop tools to support the efficient implementation of the concept. Case studies will be discussed in terms of lessons learned. Upcoming tests of the new multi-hazard methodology will also be described in terms of modifications to the framework. How uncertainty is more explicitly integrated into the simulation process will be described. A discussion how scientific information is linked to decision making will be discussed in terms of models, budgets, constraints, and limitations. It will then discuss progress made to linking it integrate water resource management, transition to operational settings, and anticipated next steps.

Water Resources Management Considering Climate Changes: Case Study of El Minia Governorate, Egypt - Hazem ElDeeb, University of Louisiana at LafayetteLafayette, LA (co-authors: M. El-Rawy, E. Habib)

Population in Egypt is characterized by a high rate of growth, and an uneven geographical distribution. In fact, 98 percent of the population lives on 5 percent of the area (that is the area of the Nile delta and its narrow valley), whereas 2% occupy the vast desert which represents 95 percent of Egypt. To relieve the pressure on the Nile Valley and Delta, ministry of water resources and irrigation in Egypt is currently implementing projects that expand new cultivated area, as a consequence the supplies of Nile River to existing lands will be affected. Because Egypt is an arid country with hardly any rainfall, water shortage is a major problem facing any development in Egypt, so water management is of paramount importance. Without a proper management, water will become a constraining factor for the development of the country. The present paper aims to investigate the various options for the water resources management in El Minia governorate, one of the major provinces in Egypt. A complete map of the water resources has been prepared including irrigation and drainage processes. In addition, the political needs for distribution, management and control of the water resources have been taken into consideration. The main features of one of the famous commercially available unsteady simulation software package, the Operational Planning Distribution Model (OPDM), has been described and used to simulate water distribution system and crop yield. It has been also implemented to the selected case study to develop appropriate water plan. Furthermore, the impact for allocation of the irrigation water has been investigated. The different options have been compared from technical and economical points of view. Moreover, the gross revenue of all crops is correlated to surface and ground water discharges, surface water salinity and ground water salinity. As the weather condition is an important factor that affects crops consumptive use of water, the monthly rate of sunlight hours, rainfall, wind speed, evaporation and relative humidity have been considered during the study period. Finally, effect of variation in both surface and groundwater quantities and qualities on the gross revenue has been presented.