

Water Management in a Changing Climate: Challenges in the application of Hydroclimatological forecasting for decision making

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The need for more efficient use and effective management of water resources is a critical global issue facing the 21st century. At least three factors place special stresses and additional uncertainties on water resources planning, development and system operation strategies. First, rapid population growth is occurring in many regions of the developing world. Second, growth in economic prosperity and access to modern amenities over the last few decades has impacted per capita water consumption rates and shifted demands in most regions, especially in countries that have experienced rapid population growth and urbanization. Third, complication arises from the additional regional uncertainty resulting from global climate change and the resulting intensification of the hydrologic cycle and occurrence of more hydrologic extremes (severe floods and droughts).

To be responsive to the need for more effective tools to address hydrologic hazards and manage water resources systems, engineers and scientists have become more reliant on the use of predictive models and stochastic methods. Depending on the problem, the hydrometeorological information needed may range from hourly forecasts (i.e., in the case of flash floods) to seasonal to inter-annual (i.e., in the case of reservoirs and other water resources system operations), and to decadal to century (i.e., in the case of long range water supply planning and structural designs). Responding to the desired timescale, varieties of mathematical models have been developed and are continuously being refined. Regional climate models are used with longer time scales, ranging from seasons to decades while information from Numerical Weather Prediction (NWP) models are often employed to help with shorter time scale forecasts (days to weeks). The outputs of such models are then used as input to hydrologic models for a variety of applications, including flood forecasting. While there is a rich body of literature reporting on progress related to both, "weather-scale" and "climate-scale" hydrologic predictions, many challenges face the research community attempting to extend the lead-time and accuracy of both types of predictions.

More specifically, despite the progress in each of the three pillars (models, observations and parameterization) of hydrometeorological prediction system over the past several decades, the improvements in the overall forecast quality is yet to reach the users expectations.

This presentation will provide a summary of both the progress and the related challenges. Among the issues discussed will be the strength and limitations of remote-sensing observations, downscaled modeling products, assimilated and re-analysis information. Personal reflections based on over 3 decades of research and experience from a number of international research initiatives such as WCRP'S GEWEX and UNESCO's G-WADI programs will be shared with the goal of encouraging further discussion about the recent proposed strategies to advance the development and application of hydroclimatological models for water management in a changing climate.