Geophysical Research Abstracts
Vol. 18, EGU2016-10887, 2016
EGU General Assembly 2016

Revealing, Reducing, and Representing Uncertainties in New Hydrologic Projections for Climate-changed Futures

Jeffrey Arnold (1), Martyn Clark (2), Ethan Gutmann (2), Andy Wood (2), Bart Nijssen (3), and Roy Rasmussen (2)

(1) United States Army Engineers | Climate Preparedness and Resilience Programs | United States (jeffrey.r.arnold@usace.army.mil), (2) National Center for Atmospheric Research | Research Applications Lab | Hydrometeorology Applications Program | United States, (3) University of Washington | Department of Civil and Environmental Engineering | Computational Hydrology Lab | United States

The United States Army Corps of Engineers (USACE) has had primary responsibility for multi-purpose water resource operations on most of the major river systems in the U.S. for more than 200 years. In that time, the USACE projects and programs making up those operations have proved mostly robust against the range of natural climate variability encountered over their operating life spans. However, in some watersheds and for some variables, climate change now is known to be shifting the hydroclimatic baseline around which that natural variability occurs and changing the range of that variability as well. This makes historical stationarity an inappropriate basis for assessing continued project operations under climate-changed futures. That means new hydroclimatic projections are required at multiple scales to inform decisions about specific threats and impacts, and for possible adaptation responses to limit water-resource vulnerabilities and enhance operational resilience.

However, projections of possible future hydroclimatologies have myriad complex uncertainties that require explicit guidance for interpreting and using them to inform those decisions about climate vulnerabilities and resilience. Moreover, many of these uncertainties overlap and interact. Recent work, for example, has shown the importance of assessing the uncertainties from multiple sources including: global model structure [Meehl et al., 2005; Knutti and Sedlacek, 2013]; internal climate variability [Deser et al., 2012; Kay et al., 2014]; climate downscaling methods [Gutmann et al., 2012; Mearns et al., 2013]; and hydrologic models [Addor et al., 2014; Vano et al., 2014; Mendoza et al., 2015]. Revealing, reducing, and representing these uncertainties is essential for defining the plausible quantitative climate change narratives required to inform water-resource decision-making. And to be useful, such quantitative narratives, or storylines, of climate change threats and hydrologic impacts must sample from the full range of uncertainties associated with all parts of the simulation chain, from global climate models with simulations of natural climate variability, through regional climate downscaling, and on to modeling of affected hydrologic processes and downstream water resources impacts.

This talk will present part of the work underway now both to reveal and reduce some important uncertainties and to develop explicit guidance for future generation of quantitative hydroclimatic storylines. Topics will include: 1- model structural and parameter-set limitations of some methods widely used to quantify climate impacts to hydrologic processes [Gutmann et al., 2014; Newman et al., 2015]; 2- development and evaluation of new, spatially consistent, U.S. national-scale climate downscaling and hydrologic simulation capabilities directly relevant at the multiple scales of water-resource decision-making [Newman et al., 2015; Mizukami et al., 2015; Gutmann et al., 2016]; and 3- development and evaluation of advanced streamflow forecasting methods to reduce and represent integrated uncertainties in a tractable way [Wood et al., 2014; Wood et al., 2015]. A key focus will be areas where climatologic and hydrologic science is currently under-developed to inform decisions – or is perhaps wrongly scaled or misapplied in practice – indicating the need for additional fundamental science and interpretation.