Geophysical Research Abstracts
Vol. 21, EGU2019-10454, 2019
EGU General Assembly 2019

Assessing the impact of climate extremes on watersheds dynamics¬

Fadji Zaouna Maina (1), Erica Siirila-Woodburn (1), Michelle Newcomer (2), Zexuan Xu (2), and Carl Steefel (1)
(1) Lawrence Berkeley National Laboratory, Energy Geosciences Division, Berkeley, United States (fadjimaina@lbl.gov), (2) Lawrence Berkeley National Laboratory, Climate and Ecosystem Sciences Division, Berkeley, United States (fadjimaina@lbl.gov)

Climate change scenarios predict fluctuations between periods of severe droughts and extreme precipitation mainly caused by atmospheric rivers. Some regions (such as California during water years 2015-2017) have already been subject to the transition between such end-member conditions. Impacts of these extremes on watershed hydrology are largely unknown, and are of great importance for resilient community planning for future water reserves. Due to the complexities of hydrological phenomena occurring at watershed scale, assessing these dynamics requires physically based models, which are extremely expensive in terms of computational time. We used High Performance Computing and a high-resolution integrated hydrologic model to investigate the complex nonlinear dynamics in response to climate change. We constructed and validated a model of the Cosumnes Watershed located in Northern California, a unique region given the un-dammed nature of one of the last freely flowing major rivers in California. The integrated hydrologic model serves to provide a complete picture of the hydrological components occurring at the regional watershed to basin scale, including snow accumulation and melting, surface runoff, groundwater infiltration, and also the exchange between surface water, vadose zone and groundwater. As a method of model validation, we performed several comparisons between model outputs and remote-sensing data. Comparisons include simulated SWE (snow water equivalent) versus SNODAS (Snow Data Assimilation System) and an alternative SWE map reconstruction method (Bair et al., 2016), soil moisture was with SMAP (Soil Moisture Active Passive), and actual evapotranspiration was compared with METRIC (Mapping Evapotranspiration at high Resolution with Internalized Calibration). Our results show that groundwater storage is decreasing despite the extreme precipitation due to groundwater pumping. With these simulations we are able to highlight regions of watershed most sensitive to climate extreme and anthropogenic activities. These analyses provide a better understanding of the physical phenomena occurring in the watershed, strengthening our knowledge of how the system may respond to these extreme conditions which might become the “new normal.”