ICRW7 Special Sessions

Bedrock Flow and Reactions: Implications for Ecohydrology and Watershed Exports; Bhavana Arora and Ben Gilbert Chairs

Description: Bedrock weathering and erosion are fundamental critical zone processes that shape Earth's surface, modulate water and soil resources, regulate Earth's climate, and transport solids and solutes from continents into the oceans. Plants play a significant role in altering the chemical and physical properties of bedrock and soil. We encourage abstracts that employ new observational, experimental, analytical and modeling approaches and theoretical frameworks to provide insights into the mechanisms and controls of weathering and erosion, interactions with plants, as well as their roles in global biogeochemical cycles. Contributions across all scales ranging from the pore scale, rhizosphere, single root, plant scale to the landscape scale are welcome. Specific topics include, but are not limited to: (1) type of hydrobiogeochemical conditions that promote nutrient export from weathered bedrock, (2) the role of plant-soil interactions on mineral weathering and nutrient retention, and (3) reactive transport and biogeochemical cycling of C, N and P in the coupled plant-soil-bedrock system.

Advancing Watershed Science using Machine Learning, Diverse Data, and Mechanistic Modeling; Dipankar Dwivedi and Kimberly Kaufeld, Chairs

Description: With the increasing availability of diverse data and the use of advanced machine learning and artificial intelligence (ML/AI), we now see growing opportunities for scientific discovery and predictive capability in watershed science. Here we invite theoretical and data-driven contributions that can advance the predictive understanding of watershed function. In particular (1) approaches aggregating a gamut of data sources to enhance process understanding, (2) algorithms quantifying and ideally minimizing the uncertainty in predictions, and (3) ML/AI techniques tackling inherent data challenges in watershed-scale modeling.

Nutrients in Freshwater Ecosystems; Laurie Alexander, Heather Golden, and Sarah Stackpoole Chairs

Description: One of the most intractable problems facing freshwater ecosystems today is excess nutrients (nitrogen and phosphorus). For several decades, management has targeted reductions in both point (e.g. sewage treatment plant) and non-point (e.g. agricultural fields) nutrient sources, but these efforts have not consistently resulted in significant water quality improvement. This session focuses on source, transport, and processing of nutrients across a range of land-use types and spatial scales. Studies that highlight novel datasets (high frequency data, remote sensing), models (WRTDS, SWAT, SPARROW), or other approaches (mass balance, hydrograph separation, isotope tracers) to address these focus areas are welcome. We also encourage a discussion of nutrient issues in the southeastern United States, including areas close to the meeting's location in Tifton, Georgia. The goal of this session is to provide a forum for federal and state agencies, non-profits, and academic researchers to integrate current research on freshwater nutrients, identify gaps in our current understanding, and define future research objectives, with the goal of informing improved nutrient management.

Watershed Response to Intensifying Precipitation Extremes and Adaptation Strategies: Science and Management Challenges; Anna Jalowska and Devendra Amatya, Chairs

Description: Extreme precipitation events are increasing in both frequency and intensity, and further intensification is projected in a warmer climate. In the United States, extreme precipitation is typically associated with hurricanes, atmospheric rivers that transport moisture from the deep tropics, and intense thunderstorms. Depending on their location, duration and extent, extreme precipitation events trigger pluvial and fluvial flooding which threatens human health, infrastructure, and the environment. In this session, we invite contributions that highlight science and management challenges related to intensifying precipitation extremes and their implications, which will enhance collaboration among researchers from various disciplines, planners, and decision makers. The session encourages studies that focus on observed and projected changes to extreme precipitation, the impacts of historical and future changes, and watershed and landscape adaptation and mitigation strategies.

Watershed Evapotranspiration in a Changing Environment; Ge Sun and Devendra Amatya, Chairs

Description: In the United States, about 70% of the annual precipitation is returned to the atmosphere as evapotranspiration (ET). Although ET is a major component of the watershed hydrological cycle, it is difficult to quantify at the watershed level due to complex biological (i.e., CO2 rise) and physical processes involved. The hydrological impacts of natural or anthropogenic disturbances such as global climate change, extreme climate (drought, hurricanes), land use change, irrigation, insect and disease outbreak, biological invasion, wildland fires on watershed hydrology are reflected in changes in ET to some extent. The ET process is tightly coupled with the carbon and nutrient cycles, plant growth and productivity, and other ecological processes (i.e., biodiversity). The session will focus on ET studies across landscape types (i.e., wetlands, forests, urban) and climatic regimes. We invite researchers to present their recent work on ET measurements and modeling at multiple scales from leaf to regional level. We aim at sharing recent ET-related scientific and technological advances in environmental remote sensing, micrometeorology (i.e., eddy covariance, Bowen Ratio), bioclimatology, and ecohydrological modeling research.

Tightening the hydrologic budget: New approaches to reconcile differences between observed and simulated fluxes and storage of water and constituents from field to regional scales; Samuel Saxe and Richard Webb, Chairs

Description: Climate change and population growth have increased competition for a finite supply of clean water for human health, agriculture, industry, and ecosystems. Water managers need to balance supply and demand, a daunting task given the broad spectrum of spatial and temporal scales of fluxes of water between the atmosphere, canopy, snowpack, unsaturated zone, groundwater, wetlands, streams, and lakes. This session will highlight observations of water and constituents that constrain estimates of the hydrologic budget at temporal scales from seconds to centuries and compare those observations with numerical simulations at field to regional scales. Presentations will identify data gaps and propose methods and studies to close those gaps with the goal of better understanding the impact of changing weather, climate, population, land use, and management practices on the hydrologic budget.