

2018 LaMoreaux Lecture (international Birdsall-Dreiss Lecture)

Groundwater as a Buffer to Climatic Change: Dynamic Subsurface Storage of Glaciated Landscapes

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The northeastern United States is experiencing rapid changes in its hydrology due to intense land-use change, urbanization, and climate change. It also possesses some of the highest density, longest term observations of hydrologic variables (streamflow, groundwater levels) in the US and world. The focus of this presentation is how small unconfined aquifer systems, and the streams to which they are connected, respond to hydroclimatic and land use changes. The research is data-driven. Physical and geochemical information is used to understand how different subsurface environments and surface-water groundwater interactions impact the sensitivity of groundwater storage to climate variability. Analysis of groundwater levels and streamflows reveal a heterogeneous response of aquifers to climate variability. This highlights the role of subsurface hydrogeologic heterogeneity to aquifer response. A long-term rise in water levels can be observed from analysis of water level trends. This is associated with an increase in precipitation and land-use change which has ultimately led to an increase in nuisance flooding. Integrating isotopic tracers into this work has improved our understanding of the role of extreme precipitation events on groundwater storage. Isotope data have also shed light on the fundamental importance of groundwater discharge to streamflow in the region. This work highlights the importance of understanding groundwater processes in generating in streamflow, with implications for water supply, baseflow generation, climate refugia, and assessing flood risk in a changing world.

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