Click here to view the Spring 2016 lecture tour schedule

Shemin Ge is Professor of hydrogeology in the Department of Geological Sciences at the University of Colorado-Boulder. She received her Ph.D. from The Johns Hopkins University in 1990, subsequently worked at S.S. Papadopulos and Associates, and then joined the University of Colorado in 1993. At the confluence of subsurface fluid flow physics and rock mechanics, Ge's early research examined the effects of tectonic deformation on paleo-fluid flow dynamics in sedimentary basins. She has since moved on to explore interactions between groundwater and earthquakes. She and her students and colleagues study earthquake-induced groundwater flow as natural experiments to reveal the hydrologic properties of geologic systems. They also explore the mechanisms of seismicity induced by reservoir operation and wastewater injection. Another thread of Ge's research relates to groundwater resources and surface-groundwater interactions under a changing climate with a focus on headwater regions. She has also ventured into fracture flow and fault zone hydrology, as well as subsurface thermal energy transport and storage. A list of her publications can be found at http://www.colorado.edu/GeolSci/faculty/ge.htm. Ge has served the hydrogeologic and broader geoscience communities in various capacities. She was Chair of the Hydrogeology Program Planning Group for the Ocean Drilling Program from 1999 to 2002. She was Editor for Hydrogeology Journal and Associate Editor for Geofluids and Journal of Ground Water. She recently served a two-year term as Program Director for the Hydrologic Sciences Program at the US National Science Foundation.

To schedule a visit, please use our online request form. You can also contact Shemin Ge at shemin.ge@colorado.edu. She will present a lecture on one or both of the topics described below. The Hydrogeology Division is particularly interested in including liberal arts colleges in the itinerary. The Division pays transportation expenses, and the host institution is expected to provide local accommodations.

1. Fluid Induced Earthquakes: Insights from Hydrogeology and Poro-mechanics.

Beginning in the 1960s, pore fluid pressure was identified as the primary culprit for inducing earthquakes reported near deep fluid-injection wells and newly built surface reservoirs worldwide. As these human activities continue and grow, induced seismicity has surged in recent decades at some but not all sites. This increase in seismicity raises the question of what fundamental hydrogeologic and poro-mechanics processes and parameters make some sites more prone to induced seismicity. This lecture will offer an overview and physical insights of fluid induced seismicity from hydrologic and poro-mechanics perspectives. Two contrasting case studies are used to illustrate how pore fluid pressure could have played a role in observed seismicity, one near a deep well fluid injection in the geologically quiescent region in the central US, and the other near a surface reservoir in a tectonically active region. High rate of fluid input emerges as an important player in contributing to induced seismicity. The first few years of fluid injection or reservoir impoundment is typically a critical period when seismic hazard is elevated. While pre-existing faults dictate earthquake locations, the spatial extent of pore pressure influence could reach tens of kilometres from fluid injection or reservoir impoundment sites. Continued research in this direction will not only offer a better understanding of the hydrogeologic and seismologic processes but also help to guide best practices in the quest for water and energy resources in coming decades.

2. Groundwater Dynamics in Headwater Regions under a Changing Climate.

Groundwater systems receive significant recharge in high-altitude headwater regions. Seasonal and longer term variations in surface temperature and precipitation are expected under a changing climate, which could substantially impact groundwater recharge and subsequently groundwater storage and discharge to surface waters downstream. These headwater regions are hydrologically sensitive to surface temperature changes due to the presence of frozen grounds that freeze and thaw seasonally and degrading permafrost. The freeze and thaw processes lead to changes in subsurface hydrologic properties and dynamically impede or invigorate groundwater flow. A key question is how seasonal and long-term surface temperature variations impact recharge to groundwater and its interaction with surface water. This presentation addresses this question as it relates to groundwater flow in headwater regions. Coupled heat transfer and groundwater flow processes are modeled for two headwater catchments, one in the Colorado Rocky Mountains and the other on the Tibet Plateau. These studies illustrate that shallow groundwater flow in summer and early fall is most energetic as thawed ground promotes snowmelt infiltration, invigorating the exchange between groundwater and surface water. Under increasing temperature scenarios, groundwater discharge to surface may experience a several-fold increase in magnitude over the decadal scale. While projected warming leads to increased groundwater discharge to surface waters, in the long run, insufficient recharge upstream will make it challenge to sustain the discharge.