

RAL SEMINAR SERIES

Ancient Rocks, Modern Sensors, & Future Models: A Scientific Journey in Water Resource Applications

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Water is one of the most fundamental drivers of Earth's landscapes, ecosystems, and human societies. Understanding its past, present, and future requires insights from diverse scientific approaches—spanning deep geological time, cutting-edge remote sensing, and predictive modeling. In this talk, I will share a scientific journey that began with the study of billion-year-old sedimentary rocks, moved into modern remote sensing and observing system development, and most importantly developed new ways to support water resource applications, including climate change impacts, and mountain snowpack measurement and modeling.

A key theme throughout this work has been the development and application of novel models and environmental sensors to enhance our understanding of water-related processes. These range from simplified atmospheric models and numerically scalable snow modeling to terrestrial scanning lidars, tree-sway imaging, and use of the noise in GPS reflections. In addition, I will highlight how advances in airborne and satellite-based remote sensing have opened new frontiers in monitoring surface water dynamics and snowpack evolution, while the next steps combine new sensing approaches and modeling techniques to realize their potential for applications. These emerging technologies provide unprecedented spatial and temporal insights into hydrologic systems, helping to bridge observational gaps and improve the accuracy of climate and water resource models.

This seminar will explore how different disciplines intersect to improve our understanding of water availability, and future applications in support of water resource management, hazard mitigation, and societal decisions. Looking towards the future, new opportunities continue to appear including innovative hyperspectral imaging and tomographic retrieval techniques for atmospheric sensing, machine-learning based modeling, and many more. By connecting the past, present, and future, this talk highlights the evolving role of earth and environmental sciences in addressing water challenges in an era of constant change when more demands are placed on limited resources.