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Ph.D. DISSERTATION DEFENSE

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Degree:	**Doctor of Philosophy in Civil Engineering**
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Date:	**07/29/2024**
Time/Location:	**10:00 a.m./Online (https://stevens.zoom.us/j/99573903779)**
Title:	**Data- and Process-Based Methods to Enhance Streamflow Estimation Across Scales**
Chairperson:	**Dr. Marouane Temimi, Department of Civil, Environmental & Ocean Engineering, Charles V. Schaefer, Jr. School of Engineering & Science**
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ABSTRACT

This dissertation addresses the enhancement of streamflow estimation through the integration of large-scale models, remote sensing data, in-situ measurements, and citizen science contributions. The initial phase evaluates the National Water Model (NWM) across the Contiguous United States using a multi-decade retrospective dataset. Analysis indicated superior agreement for natural flow conditions, especially in humid regions, while highlighting the need for performance enhancements in regulated flow. The study also assesses the Soil Moisture Active Passive (SMAP) Mission's soil moisture data in a deciduous forest region. In-situ observations were used to evaluate SMAP retrievals across seasons, employing four upscaling methods. Results show SMAP retrievals are systematically higher than in-situ observations with notable degradation during March-April and May-June, underscoring the need for improved retrievals over forest sites. Innovative monitoring and modeling techniques for river ice conditions are introduced, combining multi-satellite approaches and citizen science data. An automated system based on Google Earth Engine effectively captures the spatial and temporal evolution of ice conditions, particularly during freeze-up and breakup periods, marking significant advancements in river ice monitoring. The dissertation further explores river ice phenology in the Northeast United States, utilizing in-situ measurements and satellite imagery to assess the spatial and temporal patterns of ice formation, breakup, and concentration. Time series analyses reveal warming trends, leading to later freeze-up and earlier breakup dates, reflecting the impact of global and regional climate variations on river ice phenology. Lastly, the dissertation investigates river ice phenology through water temperature simulation using the 1D River Basin Model (RBM) and the NWM. This work contributes to improving flood ice-induced flood forecasting and operational responses in regions influenced by snowmelt and ice dynamics.