PROJECT SUMMARY

Overview:

Mechanisms responsible for observed and projected hydrologic change in high-elevation catchments are poorly understood, especially with respect to snowpack dynamics, surface-water/groundwater linkages, and interactions with vegetation. Idaho, Nevada, and New Mexico envision a Western Consortium for Watershed Analysis, Visualization, and Exploration (WC-WAVE) whose overarching goal is to advance watershed science, workforce development, and education with cyberinfrastructure (CI)-enabled discovery and innovation. WC-WAVE has three integrated components, with associated goals and approaches:

1. Watershed Science: Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework. Watershed scientists and students will parameterize, run, validate, and integrate watershed models; specify VW user requirements; and provide feedback on the evolving CI platform.
2. Visualization and Data CI: Accelerate collaborative, interdisciplinary watershed research and discovery through innovative visualization environments and through streamlined data management, discovery, and access. The CI team will develop, test, deploy and integrate the VW data and service platform components. CI advancements will provide a user-friendly VW platform that supports advanced analysis, modeling, and visualization activities and is based on robust CI that enables data preservation, data assimilation, and data and model interoperability.
3. Workforce Development and Education: Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization. The Consortium will support: graduate workforce development through a series of institutes and research activities that provide interdisciplinary training and workforce preparation; and two cohorts of diverse undergraduates and their faculty mentors that will acquire and use skills in modeling and visualization to create education modules that can be incorporated into curricula.

WC-WAVE collaborations and impacts will be sustained beyond the award via collaborative research projects; incorporation of data and models in open-community-based data centers and code repositories; and CI adoption by State programs.

Intellectual Merit :

Mountain watersheds provide a large proportion of water and ecosystem services to communities in the intermountain west. Climate change impacts affect the ability of watersheds to provide hydrological services such as water storage, flow moderation, and water quality improvement. Interactions among precipitation, vegetation growth, fire regime, soil moisture, runoff, and other landscape properties create systems in which even subtle changes in climate may lead to complex responses and cascading impacts. Integration of creative observation and analytical strategies using advanced modeling approaches and CI made possible in a virtual watershed framework is critical to understanding and predicting complex responses to climate and hydrologic change. WC-WAVE CI will enable increased understanding of watershed dynamics in the western US by allowing researchers to: easily acquire and integrate data, use an integrated suite of models to discover processes linking components of the hydrologic cycle, to identify environmental consequences of hydrologic changes, and to visualize and interpret data and model results. The VW framework capabilities will simulate watershed drivers and dynamics and lead to new discoveries.

Broader Impacts :

Immersive virtual reality environments provide platforms that foster interdisciplinary discussion and creative insight into complex scientific questions and enable innovations that result in groundbreaking discoveries. Further, developing three-dimensional thinking skills is an important goal for science education. The Workforce Development and Education program focuses on: (1) implementing an IGERT-like program that prepares graduate students to work in collaborative, interdisciplinary teams to effectively address complex scientific issues, (2) promoting undergraduate faculty professional development and preparing diverse undergraduates for future STEM education and/or employment, and (3) developing education modules that can be incorporated in undergraduate curricula. These activities will lead to a workforce that is prepared to tackle STEM challenges requiring interdisciplinary collaboration and computational thinking skills.

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