SPLASH

Providing new perspectives on mountain weather and water

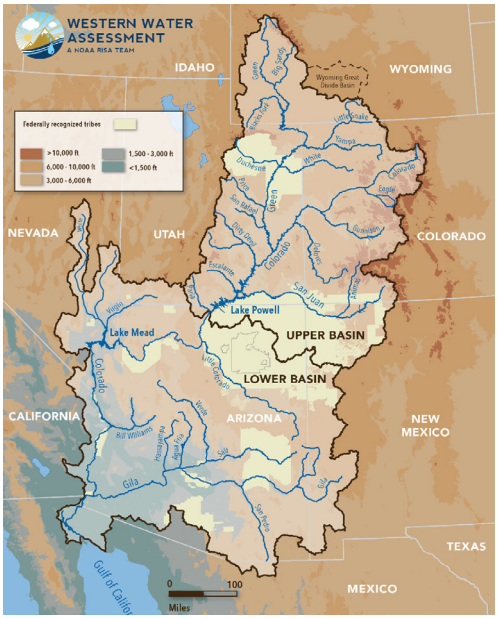
From fall 2021 to summer 2022, NOAA and research partners will participate in the **Study of Precipitation, the Lower Atmosphere and Surface for Hydrometeorology (SPLASH)**. This field study will install a comprehensive, state-of-the-art observing network in the East River watershed of the Colorado mountains with a goal of advancing weather and water prediction capabilities in areas with complex terrain.

Motivation

In many parts of the world, water resources come from mountainous areas. Predicting the weather and water supply in these regions is especially challenging, and anticipated changes to the climates of these areas are expected to significantly impact water availability, potentially affecting millions of lives. Improved observation-based understanding and prediction of water availability and extremes is needed for NOAA to deliver to the nation better access to water information to address water-related risks and manage water resources more efficiently and effectively.

The Colorado River Basin, a primary source of water for much of the southwestern United States, is estimated to see reductions in runoff ranging between 10% to nearly 50% by mid-century. Persistent dry conditions over the basin combined with warming, have resulted in uncertainty about long-term reliability of the Colorado River Basin as a crucial water source. These stresses, along with growing regional population, enhance the need for careful water resource management, elevating the importance of reliable prediction of river flow and its drivers mirroring important decision making that is required for many river basins across the western United States.

Colorado River Basin



Due to the rugged and remote nature of mountainous regions, surface observing systems are generally limited, and existing systems do not capture important land and atmospheric variables at fine-enough scales. Improved observing in these locales supports advanced understanding of processes critical to weather forecasting and water management, and other societally-relevant topics. This includes prediction of lightning and wind conditions for fire weather forecasting, understanding how terrain impacts the movement of storms, and prediction of atmospheric properties important for aviation safety and route planning (e.g. turbulence, convection). Such observations also support improved evaluation of whether these areas can serve as a reliable source of renewable energy.

Approach

Snowmelt in mountainous headwater regions is the primary contributor of annual basin natural streamflow and water reservoir storage. Given this dependence, some central drivers of Colorado River Basin hydrology and the ability to accurately predict this streamflow include near-surface temperature, precipitation amount, soil moisture, and snowpack properties. Also important are the complex

interactions between the surface and lower atmosphere, which help to regulate evaporation of surface moisture and snow, and winds in the lowest portions of the atmosphere. Measuring, evaluating, and understanding the contributions and relative uncertainties of these meteorological and hydrologic processes is critical to advancing NOAA's weather and water prediction capabilities.

For these reasons, SPLASH will deploy a variety of sensing systems to observe surface–atmosphere exchange processes, remote and surface sensors to improve understanding of clouds and precipitation, and a collection of observing systems to make detailed measurements of the atmospheric boundary layer. Leveraging ongoing NOAA research, development and operations, and in conjunction with concurrent efforts supported by other agencies, including the U.S. Department of Energy SAIL (Surface-Atmosphere Integrated field Laboratory) campaign and Watershed Function Science Focus Area, SPLASH will provide unprecedented perspectives on some of these critical components to support improved prediction of weather and water over complex terrain.

Anticipated Benefits

In combination with scientific analysis of the resulting datasets, research will apply SPLASH observations and the resulting enhanced process-understanding to evaluate and improve NOAA's latest suite of modeling tools, including the Unified Forecast System, Rapid Refresh Forecast System, and National Water Model. The ultimate goal of this project will be improved prediction of weather and water in the Colorado mountains and beyond to inform societal preparedness and response.

> *"Expanded observations and improved understanding of the complex atmospheric and hydrologic processes in mountainous terrain will likely lead to advancements in the ability to simulate and forecast snowpack accumulation, ablation and runoff for incorporation in NOAA's next generation of the National Water Model."*
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> – Edward Clark, Director, NOAA National Water Center

Partners

NOAA Physical Sciences Laboratory • NOAA National Severe Storms Laboratory • NOAA Global Systems Laboratory • NOAA Global Monitoring Laboratory • NOAA Air Resources Laboratory • Cooperative Institute for Research in Environmental Sciences and the Integrated Remote and the In-Situ Sensing program, University of Colorado Boulder - Boulder, CO • Cooperative Institute for Research in Atmospheric Science and the Electrical and Computer Engineering Dept., Colorado State University - Ft. Collins, CO • NOAA NWS Office of Water Prediction, National Water Center • NOAA Atmospheric Science for Renewable Energy Program g, University of Colorado - Boulder, CO • Black Swift Technologies - Boulder, CO • National Center for Atmospheric Research - Boulder, CO • US Department of Energy, Lawrence Berkeley National Laboratory - Berkeley, CA • Rocky Mountain Biological Laboratory - Gothic, CO

Examples of instruments to be deployed for SPLASH include (top to bottom) an atmospheric surface flux station, snow level radar, and disdrometer. Other planned NOAA observing systems include the Cooperative Lower Atmosphere Mobile Profiling System (CLAMPS), the Airborne Gamma Radiation Snow Survey, RADSYS instrumentation, eddy covariance towers, and reference precipitation systems.

Cover Photo Credit: Lawrence Berkeley National Laboratory

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