



# HYDROMETEOROLOGY APPLICATIONS WATER RESOURCE RESEARCH

## Water Cycle Support

We deliver relevant and timely information about the world's complex water system, assisting water-resource planners and managers to address issues such as water supply, flooding, droughts, reservoir operations, and emergency response. At the NSF NCAR Research Applications Laboratory (RAL), our directed research and development, including decision-support tools in hydrology, short-term precipitation forecasting, cloud microphysical modeling, winter weather, and observational networks, are being implemented and deployed in countless arenas by researchers, water-resource utility managers, and decision makers worldwide.

### CLIMATE AND MANAGED WATER SYSTEMS

A number of our projects focus on assisting decision and policy-makers to better understand the impact of climate change and extreme weather events on water resources. Using the Water Evaluation and Planning (WEAP) model we are helping to address the growing need around the globe for new tools and methods to assess the impact of future climate-predicted precipitation on water availability and quality. Our work with the Weather Research and Forecasting model (WRF) and the Intermediate Complexity Atmospheric Research model (ICAR) has built world-class datasets for the evaluation of regional climate change on the basin scale.

### HYDROMETEOROLOGY COMMUNITY MODELS

We have developed and support a number of hydrometeorology-related models that are available to the community, including: land surface (NOAH-MP, HRLDAS), hydrological (WRF-Hydro,

## Benefits & Impacts

- Relevant & timely information about the world's complex water system
- Robust decision-support tools assisting water-resource managers
- Understanding water supply, flooding, droughts, & reservoir operations



[ral.ucar.edu](http://ral.ucar.edu)



@NCAR\_RAL



[info@ral.ucar.edu](mailto:info@ral.ucar.edu)

SUMMA), water-resources management (WEAP), downscaling (ICAR), and models linking urban and crop characteristics and behaviors to the Weather Research and Forecast model (WRF-Urban and WRF-Crop).

## COMPUTATIONAL HYDROLOGY

Scientists and engineers in RAL are collaborating to build new community hydrologic research and applications datasets, models, and methods that will advance our nation's capability to monitor, predict, and project hydrology and to inform water management and planning.

## HYDROMET OBSERVATIONS

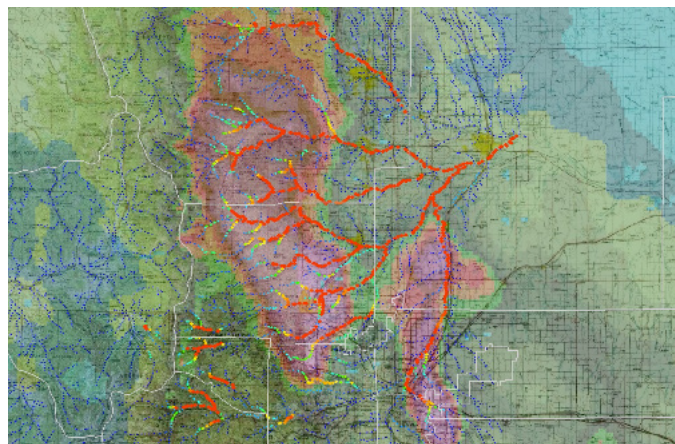
Observations of hydrometeorological processes provide the foundational understanding of how weather and hydrologic phenomena interact to create both societal risks and key societal resources. RAL has developed and deployed innovative observations in field programs around the world to create new knowledge.

## LAND-ATMOSPHERE INTERACTIONS

The research in this area is designed to help understand, through theoretical and observational studies, the complex interactions (including biophysical, hydrological, and biogeochemical interactions) between the land-surface and the atmosphere at micro- and meso-scales. The goal is to integrate such knowledge into numerical mesoscale weather prediction and regional climate models in order to improve prediction of regional weather, climate, and hydrology.

## STEP PROGRAM

The Short Term Explicit Prediction (STEP) program is tackling the challenging of improving the accuracy of high impact weather at short time scales (less than a day) via a cross-lab collaborative effort. The focus has been to improve the prediction of heavy precipitation and flash flooding by developing an integrated hydrometeorological system that includes data assimilation of radar data and is able to produce quantitative streamflow forecasts with improved rainfall and streamflow estimates. This work builds on cutting edge advances in cloud physics, machine learning, hyper-resolution hydrologic models, and data assimilation.



WRF-Hydro Community model

## STREAMFLOW PREDICTION

We are undertaking research to facilitate the transition of streamflow prediction advances into operational streamflow forecasting practice.

## WATER SYSTEM PROGRAM

The NSF NCAR Water System Program (WSP) is a cross-Laboratory program that aims to improve understanding of the current water cycle and its likely evolution in a future climate.

## WEATHER OBS AND IMPROVEMENTS

RAL scientists have conducted a wide variety of observations at locations around the world. Naturally, this has entailed the development of a local observational field site to test and evaluate new and existing instruments. The test site was developed at the NSF NCAR Marshall field site in 1991 to fulfill this need.

## WINTER WEATHER

Many western states have sought to augment water supplies using operational cloud seeding programs. These programs are based on glaciogenic cloud seeding with either silver iodide (AgI) or liquid propane. RAL scientists have been involved with conducting research and development related to weather modification in several western U.S. states, as well as internationally.

Hydrometeorology  
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