



NCAR
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Research Applications
Laboratory

From Science to Solutions

Science Serving Society: Research in Action

NSF NCAR RAL is a world leader in community-driven, end-to-end research.

Regardless of the meteorological challenge, our goal is to advance our understanding of the atmosphere and translate that knowledge into actionable information and tools that enhance the safety, health, security, and well-being of society. From airline pilots, to truck drivers, energy and water-resource managers, healthcare workers, emergency managers, and troops protecting the nation, experts at NSF NCAR's Research Applications Laboratory (RAL) are committed to help all community sectors meet their meteorological challenges with tailored, practical solutions.

Transportation Safety & Resilience

Aviation safety has improved dramatically since the discovery of low-level wind shear, once responsible for hundreds of airplane fatalities. Our research led to the development of technologies that detect and warn pilots of this hazardous phenomenon, helping them avoid dangerous conditions and improve flight safety. Further research led to methods for discerning and avoiding other hazards faced by aviation, marine, rail, space, and surface transportation. Diagnosing and predicting turbulence, icing, visibility, and thunderstorms give air-traffic controllers and airline staff valuable planning windows, while assessing and deriving road conditions provides state Departments of Transportation with advanced warning to help treat roads and warn motorists of hazardous conditions.

Benefits & Impacts

- Innovating solutions for building societal resilience to environmental hazards
- Science that protects and improves lives, property, and well-being
- Research that protects water and energy resources
- Collaborative research and technology transfer that benefit communities

Contact Us!

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Extreme Weather

Improving our observing and prediction capabilities for impactful events such as hurricanes, storm surge, hail, and flash flooding is at the core of our science. However even the best forecasting fails if the public doesn't understand the consequences. Our scientists also team with partners and local communities to improve risk messaging through animated graphics and mapping tools, and using clearer wording from the media for alerts and public education.

Wildfires

From assessing the wildfire risk, especially in the Wildland Urban Interface (WUI) where the most devastating fires have become more frequent, to monitoring fuel conditions and modeling fire behavior, we work with utilities, insurers, emergency management agencies, and critical infrastructure organizations to make confident decisions when they matter most.

Human Health

Heavy air pollution causes lasting health damage, sometimes proving as dangerous as heavy smoking, and excessive heat and smoke from wildfires poses health risks to vulnerable populations. Our scientists developed an air-quality forecasting system that helps warn residents when to stay indoors, reschedule activities, and protect their health.

National Security

Weather and environmental conditions can directly affect military operations, personnel safety, infrastructure, and national security. RAL develops advanced forecasting, artificial intelligence,



Expanding the reach of actionable Earth system sciences

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decision-support, and atmospheric modeling capabilities that help defense partners anticipate environmental hazards and make better-informed operational decisions. Our work also includes modeling and visualizing accidental or intentional releases of hazardous materials to support emergency planning, real-time response, and forensic analysis.

Energy & Power Grids

Broadening the options for alternative energy sources is essential for the global community to maintain robust, cost-effective, and reliable power grids. We work with public and private electric utility managers to develop tailored forecasting tools to efficiently and economically incorporate solar and wind power into their energy portfolios. By predicting favorable solar and wind conditions, power generated from these sources is now more reliable, which moves the world's communities closer to achieving their renewable energy goals.

"I have a very strong feeling that science exists to serve human betterment & improve human welfare." WALTER ORR ROBERTS

Water Resources

We develop technologies used for delivering 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, emergency response, to name just a few.

Outsmarting the Weather

Our research, development, and applications deliver value to the atmospheric-science research community, and the capabilities we continue to innovate support the global weather, water, and Earth system enterprise. There is more work ahead, but with rapidly emerging tools and faster, more powerful computers and models, we will meet these societal challenges persevering in our mission to solve problems and improve lives. This is the essence of science serving society.



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