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**70%**
Portion of insurance claims for severe weather damage attributed to hail in the U.S. each year (Insurance Institute for Business & Home Safety)

**$11.4 Billion**
Amount of fire insurance claims in California in 2018 (California State Insurance Commission)

**49%**
Percent of U.S. employment and GDP in coastal counties at risk of rising seas and severe storms (National Ocean Economics Program)

**3.7 Million**
Worldwide deaths each year due to outdoor air pollution (UN Environment Programme)

**20-40 Million**
People who would lose power for as long as two weeks to two years in a massive solar storm, on the scale of the 1859 Carrington Event (Lloyd's)

**$8 Billion**
Damage caused by flooding each year in the U.S. (NOAA)

*The University Corporation for Atmospheric Research is a nonprofit consortium of more than 115 colleges and universities focused on research and training in the Earth system sciences.*

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**Scott Rayder**
**Senior Advisor to the UCAR President**
rayder@ucar.edu
engagement@ucar.edu
303-497-1673

# Five

## Earth System Science Priorities:

### Weather • Climate • Water • Air Quality • Sun & Space Weather

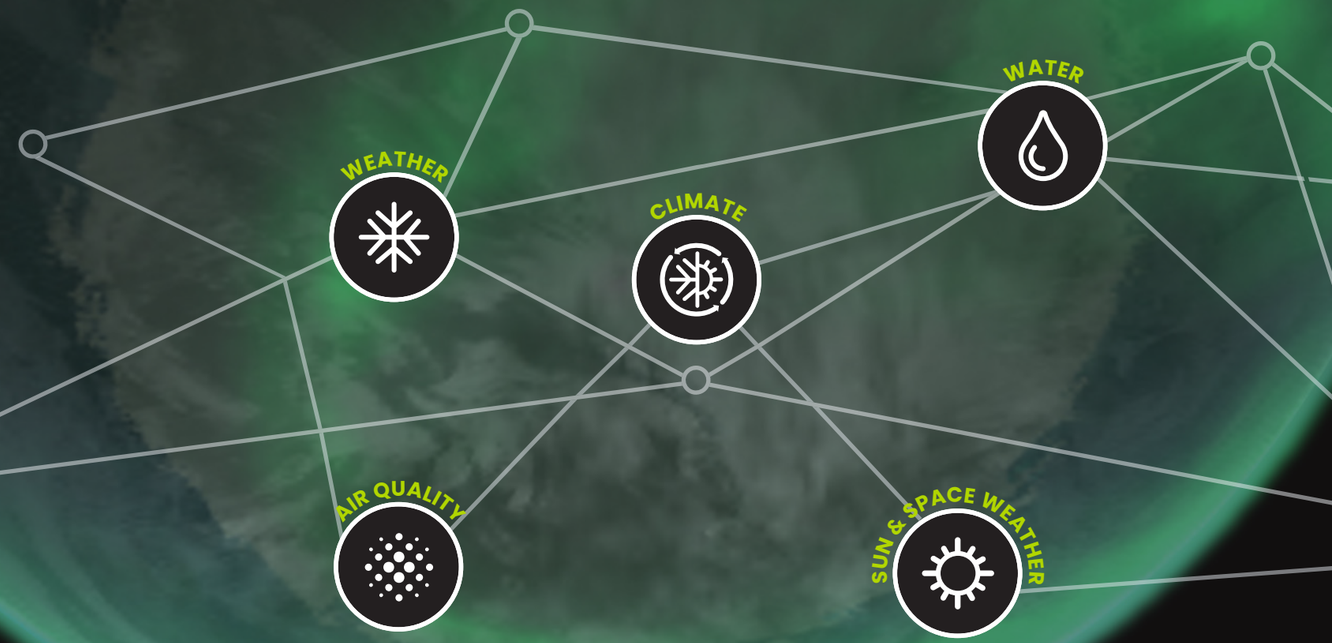
Earth system scientists at universities and national labs have been instrumental in advancing research, forecasting, and technology to save lives and property, foster economic competitiveness, and strengthen our national security.

Improved prediction of flash floods, droughts, smoke plumes, hurricanes, winter storms, and other hazards yields many societal benefits. Scientists are also working on subseasonal to centennial climate projections to better understand how warming air and oceans amplify storms, alter precipitation patterns, and contribute to sea level rise.

Advancements in Earth system science research and technology result in better information not only for severe weather warnings but also for water supply planning, renewable energy production, air quality alerts, supply chain management, and military and infrastructure planning.

Investments in basic and applied research, and partnerships across the academic, public, and private sectors, have helped cement the U.S. as a global leader in Earth system science. But the nation risks losing its edge to countries that are investing more in supercomputers, satellites, on-the-ground observations, and scientific research.

Continued, robust financial support of these five science priorities is essential to our nation's health, security, and economic prosperity.

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*Harnessing the power of NCAR & 115+ universities*

New

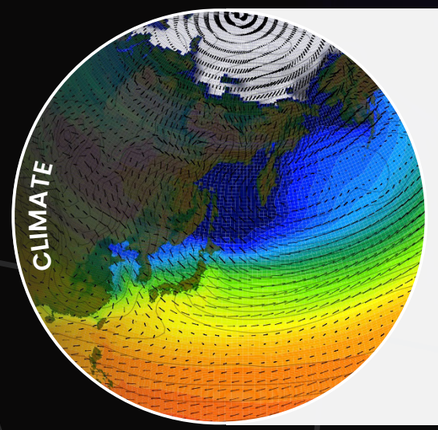
# Research Frontiers


### A radar that peers deeper into storms

- Mounted on a research aircraft, APAR (Airborne Phased Array Radar) will operate like many weather radars in one, revealing severe storms, hurricanes, and other hazardous weather conditions in far greater detail.

### Improved prediction of extreme weather

- A powerful computer model, MPAS (Model for Prediction Across Scales), is improving prediction of dangerous storms days in advance by simulating the local forecast area within its global-scale environment.




### Extending the forecast from seasons to years

- Using large sets of climate model simulations, scientists are developing long-term predictions, from cold winters to multi-year droughts, on timescales of a season to a decade out.

### Localizing the impact of rising seas

- Combining storm surge and flood prediction with local rates of sea level rise, scientists are homing in on coastal communities that will face the biggest threat.

### Studying the future's supercharged storms

- Using high-resolution computer models, scientists are creating a detailed picture of how the changing climate will also change storms, supercharging them with moisture.


### Pinpointing the flow

- Scientists are continuing to improve the new National Water Model, which delivers timely flood warnings as well as continuous forecasts for millions of points along rivers and streams.

### Detailing the future of snowpack

- Sophisticated, high-resolution weather models used to simulate today's weather in a warmer, wetter future are providing a detailed view of snowpack decline.

### Better seasonal drought forecasts

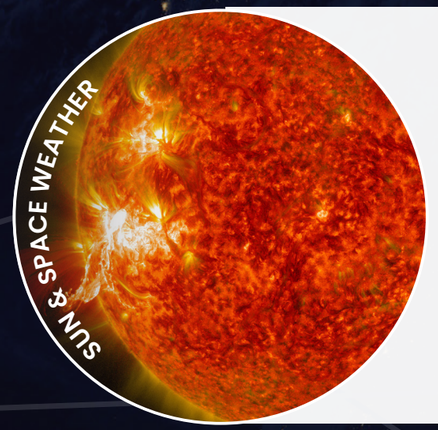
- Scientists are developing techniques to improve the streamflow forecasts water managers rely on in major basins across the West, including the Colorado River and the Rio Grande.


### Collecting critical data with unmanned aerial vehicles

- A prototype instrument mounted on a UAV is allowing scientists to sample the atmosphere above the surface and below the reach of traditional aircraft, gathering measurements of volatile organic compounds — major ingredients of air pollution.

### Following the smoke from fires

- Data gathered by advanced research aircraft will allow scientists to better understand how wildfire smoke can alter local weather patterns and produce profound effects on air quality, even far downwind of its origin.




### A tiny satellite to reveal big mysteries

- Scientists are designing a CubeSat, dubbed SolarCube, that will take simultaneous snapshots across the entire solar spectrum to provide an unprecedented look at the Sun's magnetic fields.

### Next-generation observing systems

- A new generation of coronagraphs and other ground-based instruments will enable unprecedented observations of the solar corona, enabling better predictions of its impacts that can disrupt satellite communications and knock out power grids.