

CLIMATE SCIENCE ACROSS THE GREATER MISSISSIPPI RIVER BASIN

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CLIMATE ADAPTATION SCIENCE CENTERS

National and Regional Climate Adaptation Science Centers (CASCs) are part of Ecosystems Mission Area of U.S. Geological Survey (**USGS**)



Primarily serve **U.S. Department of the Interior, its partners, Tribes & Indigenous Peoples, and natural & cultural resource-related non-governmental organizations**

Regional CASCs are **federal-university partnerships that deliver science to help fish, wildlife, water, land, & people adapt to a changing climate**



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Climate Adaptation Science Center (CASC) Regions

The CASCs collaborate across boundaries to address shared ecosystems, watersheds, and landscapes

- ★ University of Alaska Fairbanks
- University of Alaska Anchorage
- University of Alaska Southeast

ALASKA



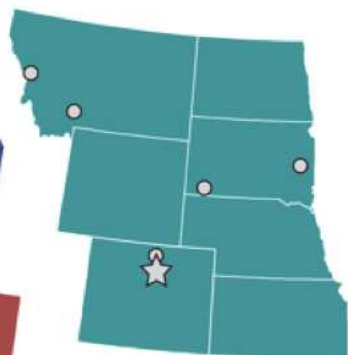
- ★ University of Washington
- Boise State University
- Oregon State University
- University of Montana
- Washington State University
- Western Washington University

NORTHWEST



- ★ University of Colorado at Boulder
- Conservation Science Partners
- Great Plains Tribal Water Alliance
- South Dakota State University
- University of Montana
- Wildlife Conservation Society

NORTH CENTRAL



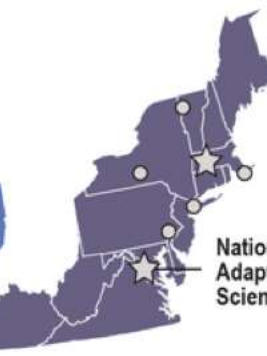
- ★ University of Minnesota Twin Cities
- College of Menominee Nation
- Great Lakes Indian Fish and Wildlife Commission
- Indiana University
- Michigan State University
- The Nature Conservancy
- University of Illinois at Urbana-Champaign
- University of Minnesota Duluth
- University of Wisconsin-Madison

MIDWEST



- ★ University of Massachusetts Amherst
- College of Menominee Nation
- Columbia University
- Cornell University
- Michigan State University
- Woodwell Climate Research Center
- University of Missouri
- University of Wisconsin
- University of Vermont
- USFS Northern Research Station

NORTHEAST



National Climate Adaptation Science Center

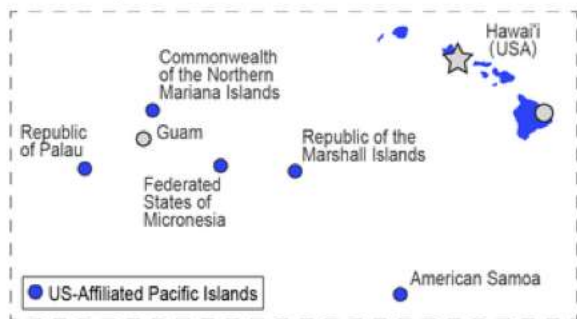
SOUTHWEST

- ★ University of Arizona
- Colorado State University
- Desert Research Institute (Nevada)
- Scripps Institution of Oceanography at UC San Diego
- University of California - Davis
- University of California - Los Angeles
- Utah State University



PACIFIC ISLANDS

- ★ University of Hawai'i at Mānoa
- University of Hawai'i at Hilo
- University of Guam



SOUTH CENTRAL

- ★ University of Oklahoma
- Chickasaw Nation
- Choctaw Nation of Oklahoma
- Louisiana State University
- Oklahoma State University
- Texas Tech University
- University of New Mexico



SOUTHEAST

- ★ North Carolina State University
- Auburn University
- Duke University
- University of Florida
- University of South Carolina
- University of Tennessee

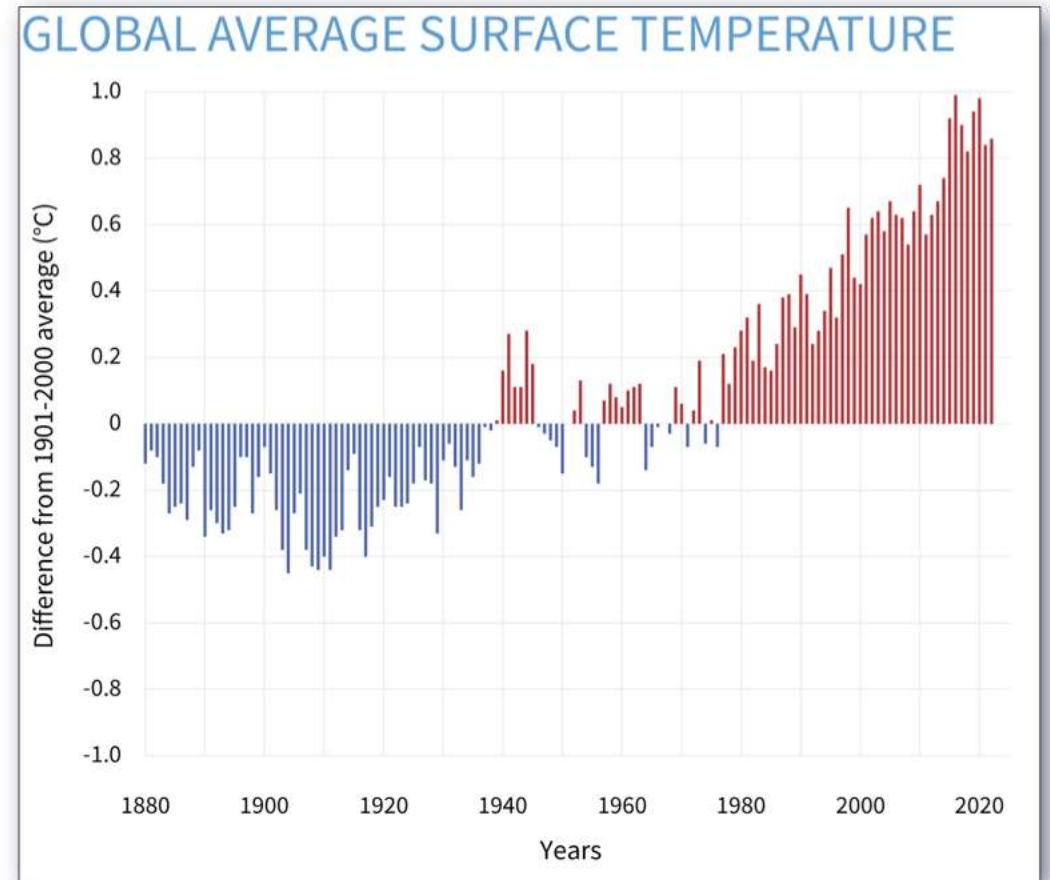


EXPLANATION

- ★ CASC Host Institution
- CASC Consortium Member

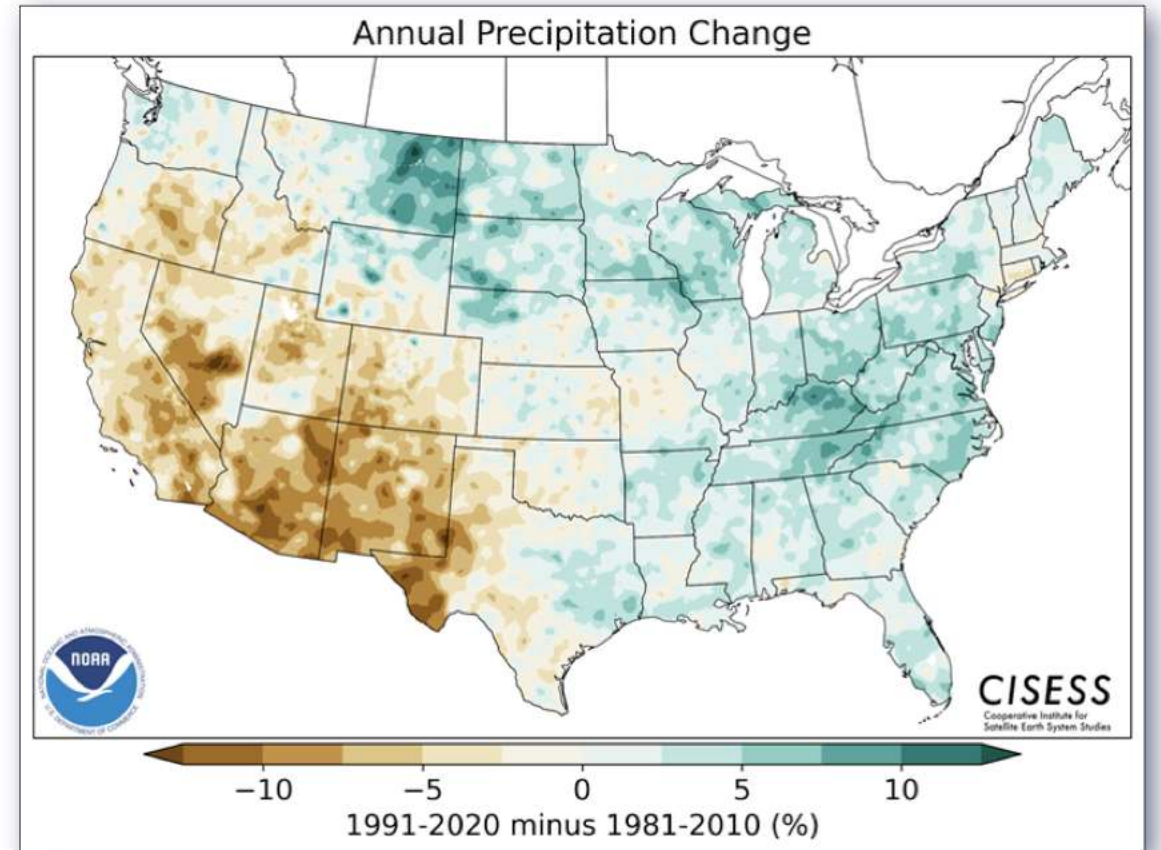
STATE OF THE SCIENCE

- Climate change **adds energy & moisture** to climate system
- More **frequent** or more **intense precipitation extremes & warm-temperature extremes**
- Climate-system **feedbacks** can result in large regional changes in the climate system



STATE OF THE SCIENCE

- Regional precipitation changes related to increased atmospheric **water vapor**, changes in atmospheric **circulations**, and remote changes in **atmosphere-ocean interactions**



NOAA



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STATE OF THE SCIENCE

- Precipitation changes affect **drought** intensity, frequency, timing, & duration; seasonal timing changes in **rain, ice, & snow**; **extreme** events; frequency of “**rain on snow**” occurrence; rate of **erosion**; and **leaching** of chemicals



USDA Photo by Lance Cheung



STATE OF THE SCIENCE

- More frequent **extreme heat** events expected to increase frequency of **harmful algal blooms**, stress **terrestrial & aquatic** species, and threaten **water available** for human & natural landscapes



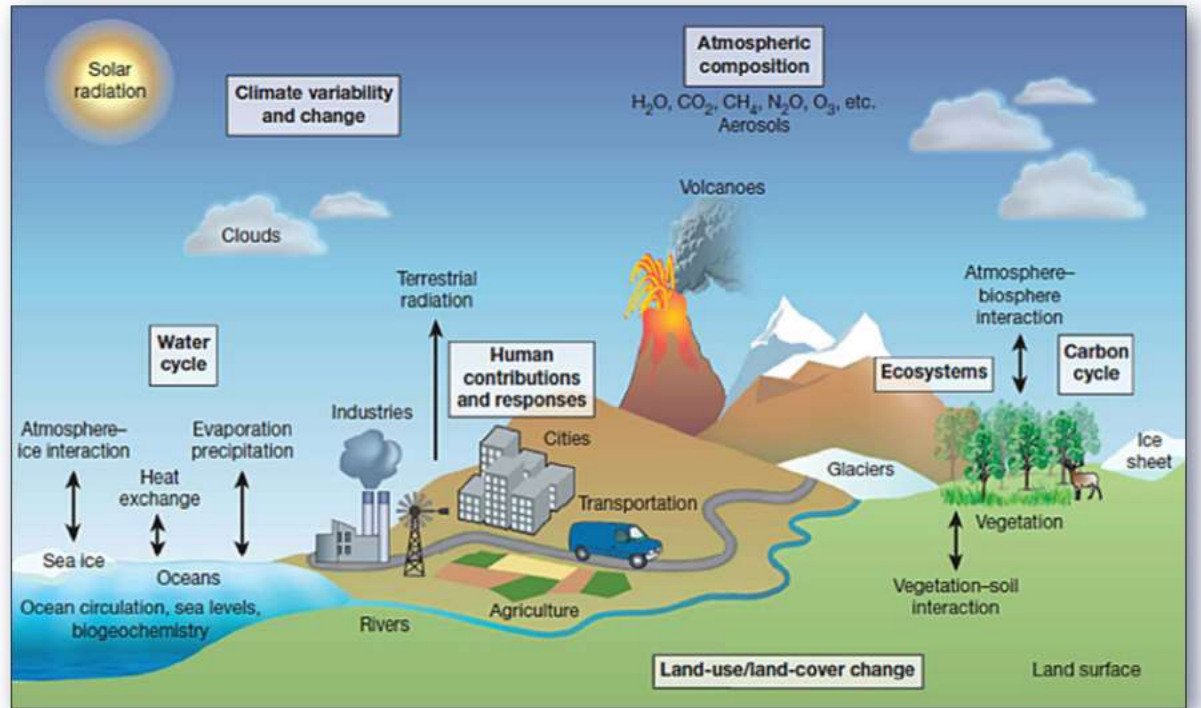
Courtney Celley/USFWS



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STATE OF THE SCIENCE

- When appropriately selected for the problem under study, a combination of **multiple global climate models & multiple downscaling techniques** provides adequate range of future changes for **local risk assessments**

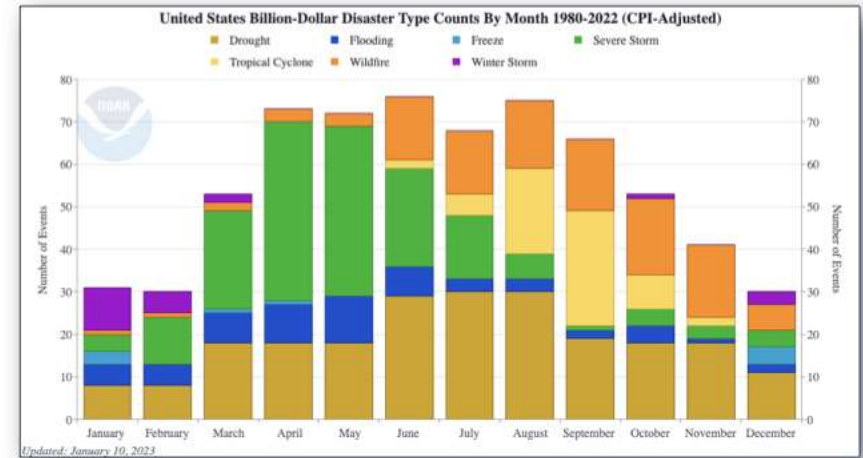


NOAA GFDL

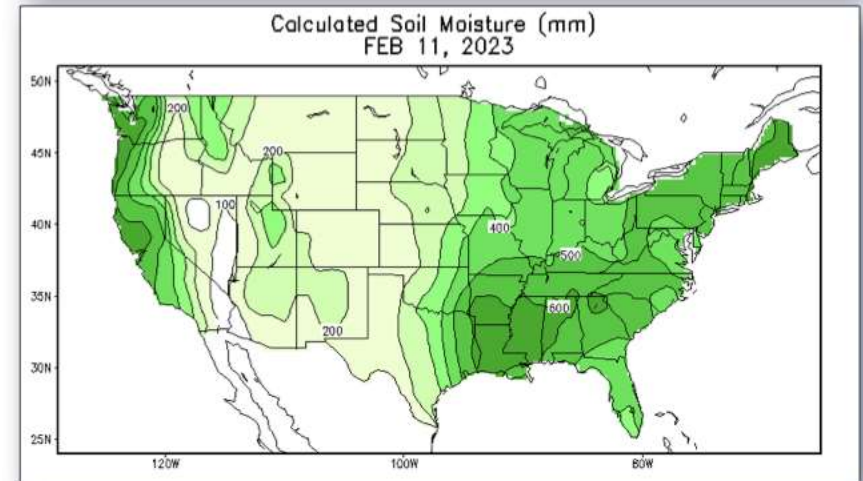


IDENTIFIED GAPS

- Spatially abundant, temporally consistent, and standardized **observations of environmental & socio-ecological impacts of climate change are insufficient**
- Measurements of **soil moisture, snowpack, evapotranspiration, runoff, and groundwater recharge** also are **relatively scarce**



NOAA

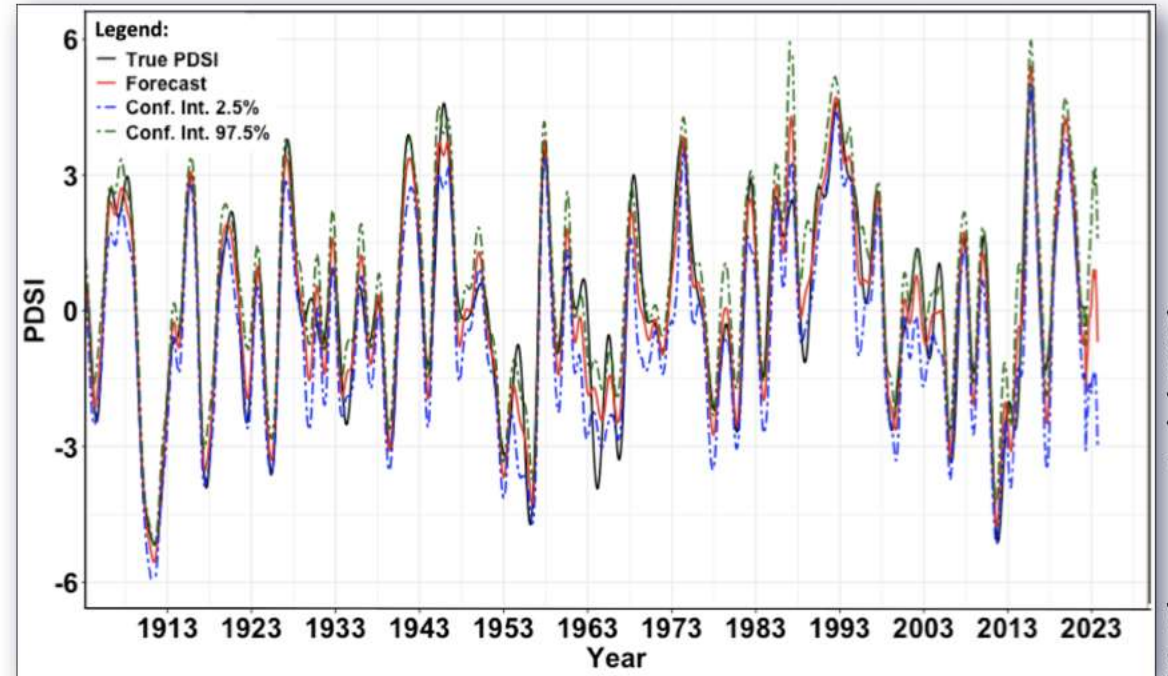


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IDENTIFIED GAPS

- Atmospheric **phenomena occurring from 2 weeks to 10 years** (i.e., subseasonal, seasonal, interannual, decadal) are understudied & forecast skill remains low
- These time scales critical to help decision makers **prepare for high-impact events**



McPherson et al. (2022)



IDENTIFIED GAPS

- Typically, an extreme climate event in one part of Basin is related to weather in other parts of Basin; yet rarely is there **whole-Basin approach** to analyzing system



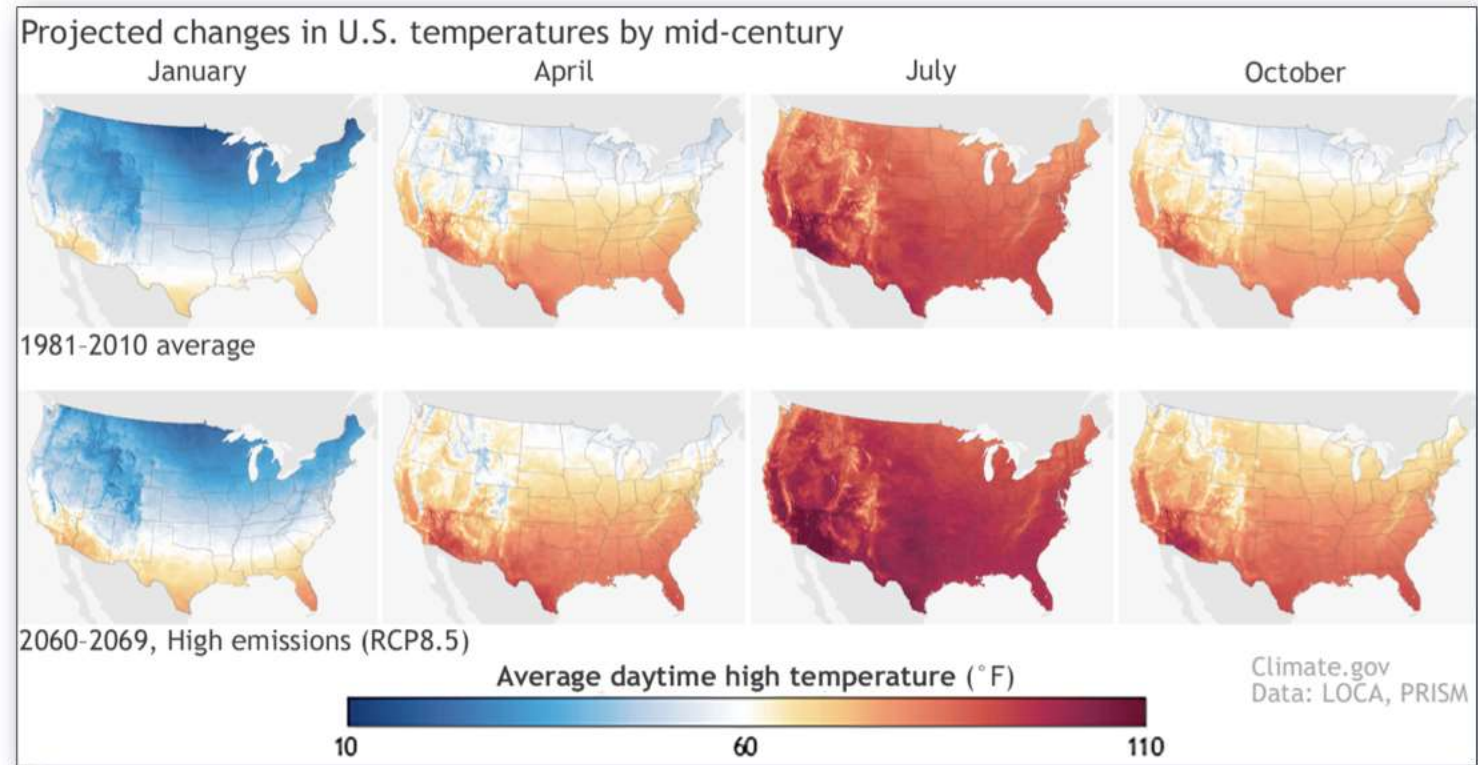
Wikipedia



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NEXT STEPS

- **Engage atmospheric scientists** with expertise in climate change within high-priority or big-budget projects to aid with risk assessment



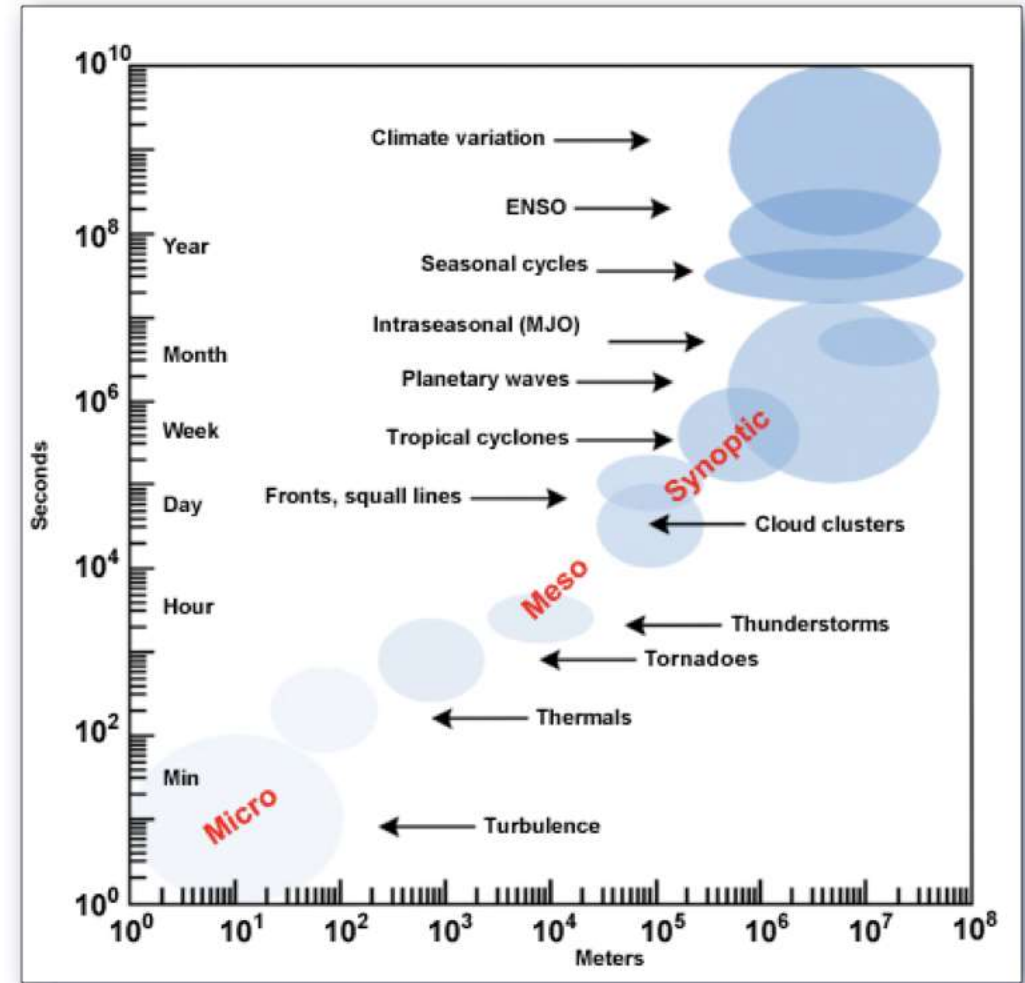
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NEXT STEPS

- Multi-scale atmospheric responses to climate change requires scientific community to **focus on regional scales** to connect global-scale climate drivers with local-scale weather impacts



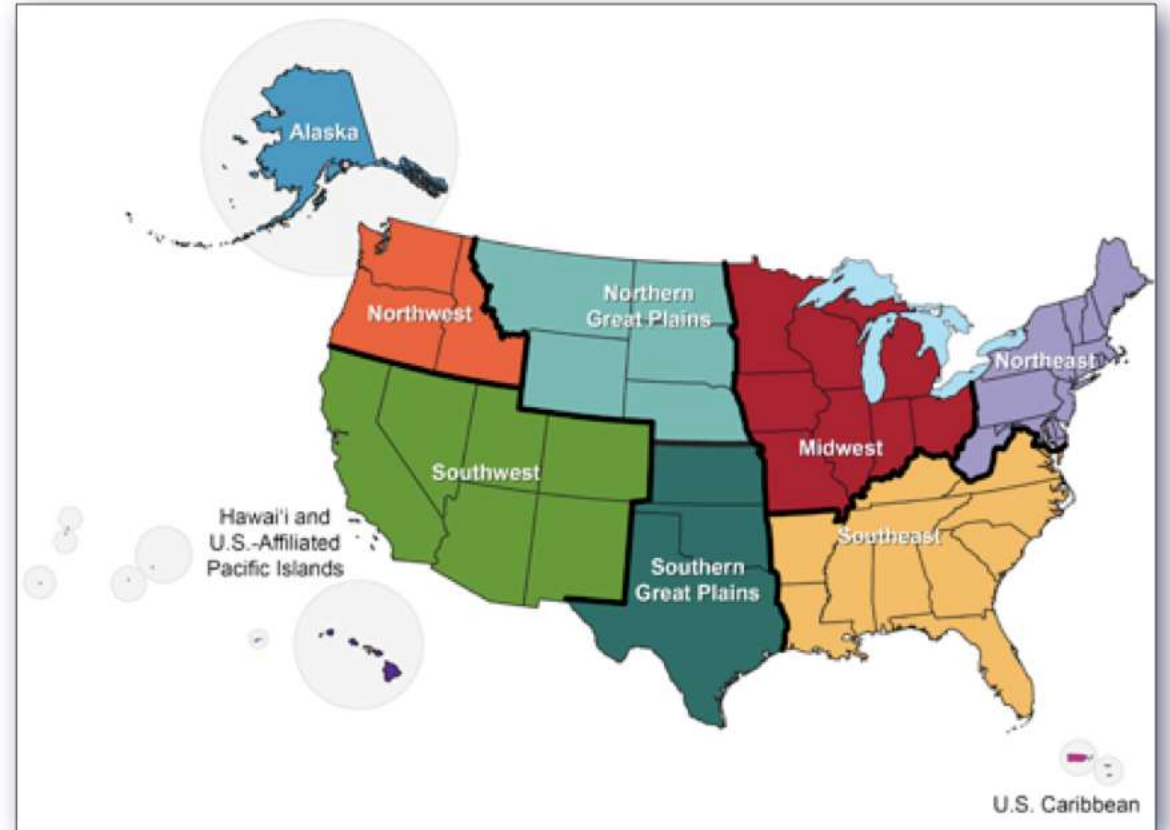
NEXT STEPS

- Support innovative **data science tools & integrated modeling of socio-ecological systems** (that connect with climate-change projections) to link physical, biological, social, and economic systems on variety of scales



NEXT STEPS

- Examine science summary & gaps of upcoming **Fifth U.S. National Climate Assessment** (publicly available in late 2023) as well as its options for policymakers



QUESTIONS?

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