Deploying Uncrewed Aircraft Systems for Atmospheric and Earth-System Research

University of Colorado Boulder

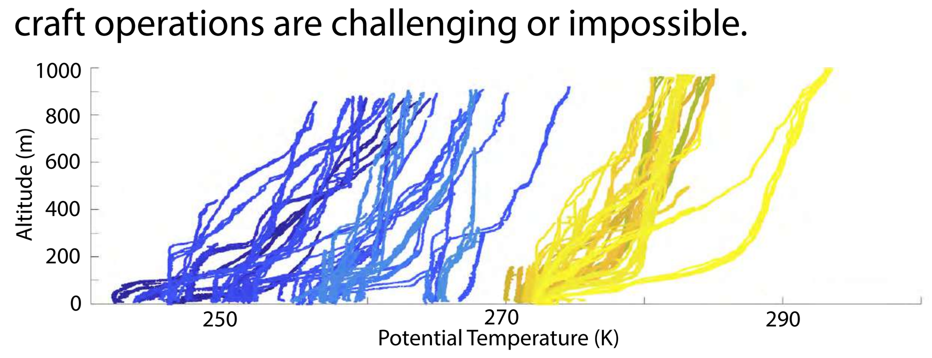
IRISS INTEGRATED REMOTE & IN SITU SENSING

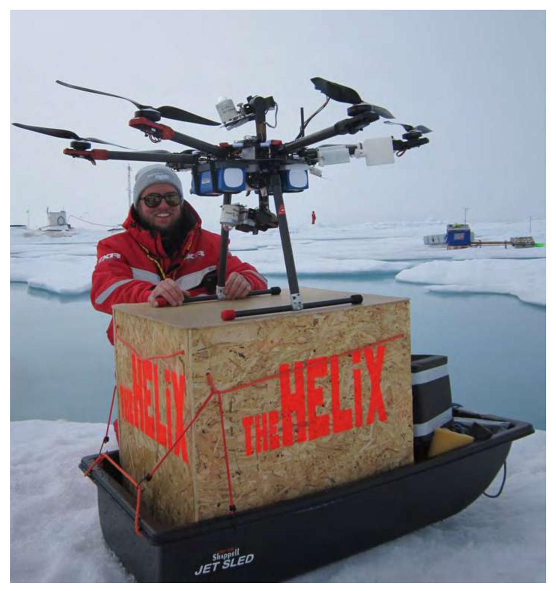
RECUV

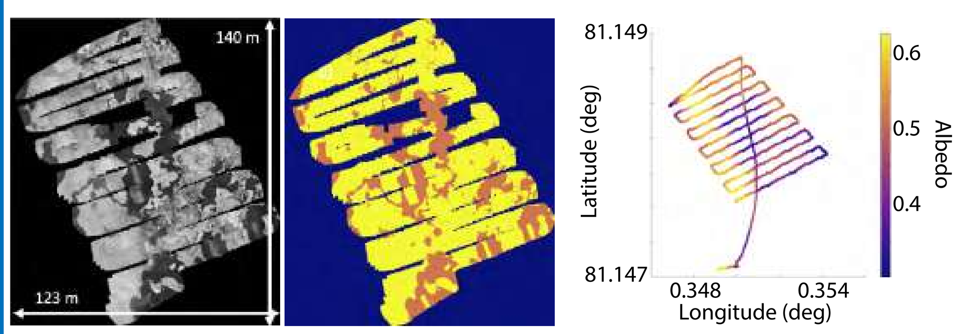
CIRES

Exploring the Earth's Polar Regions

Earth's polar regions are among the most vulnerable to climatic change. Using innovative observing technologies, IRISS, RECUV and CIRES have supported various field programs, including six months of observations in connection with the pan-Arctic Multidisciplinary drifting Observatory for the Study of Arctic Change (MOSAiC) and NSF and DOE-supported research in Antarctica and Alaska, to provide revolutionary perspectives on the atmosphere and underlying surface. UAS collect high-resolution information in remote regions where crewed aircraft operations are challenging or impossible.

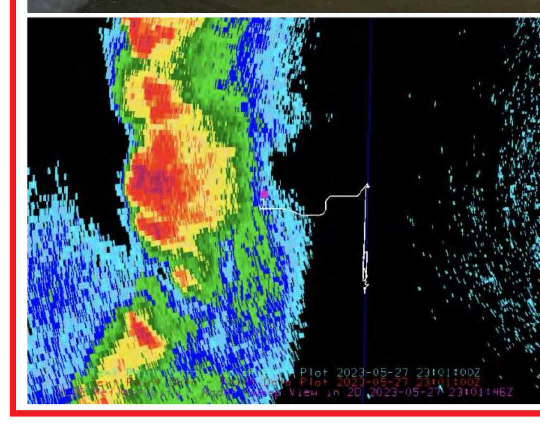


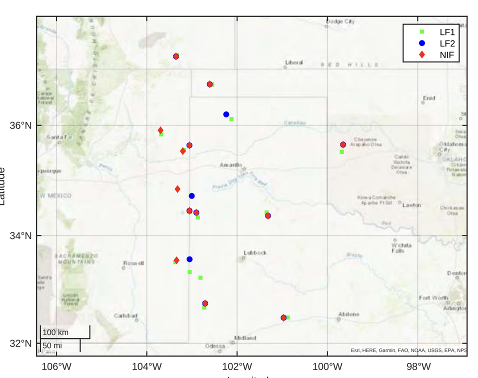


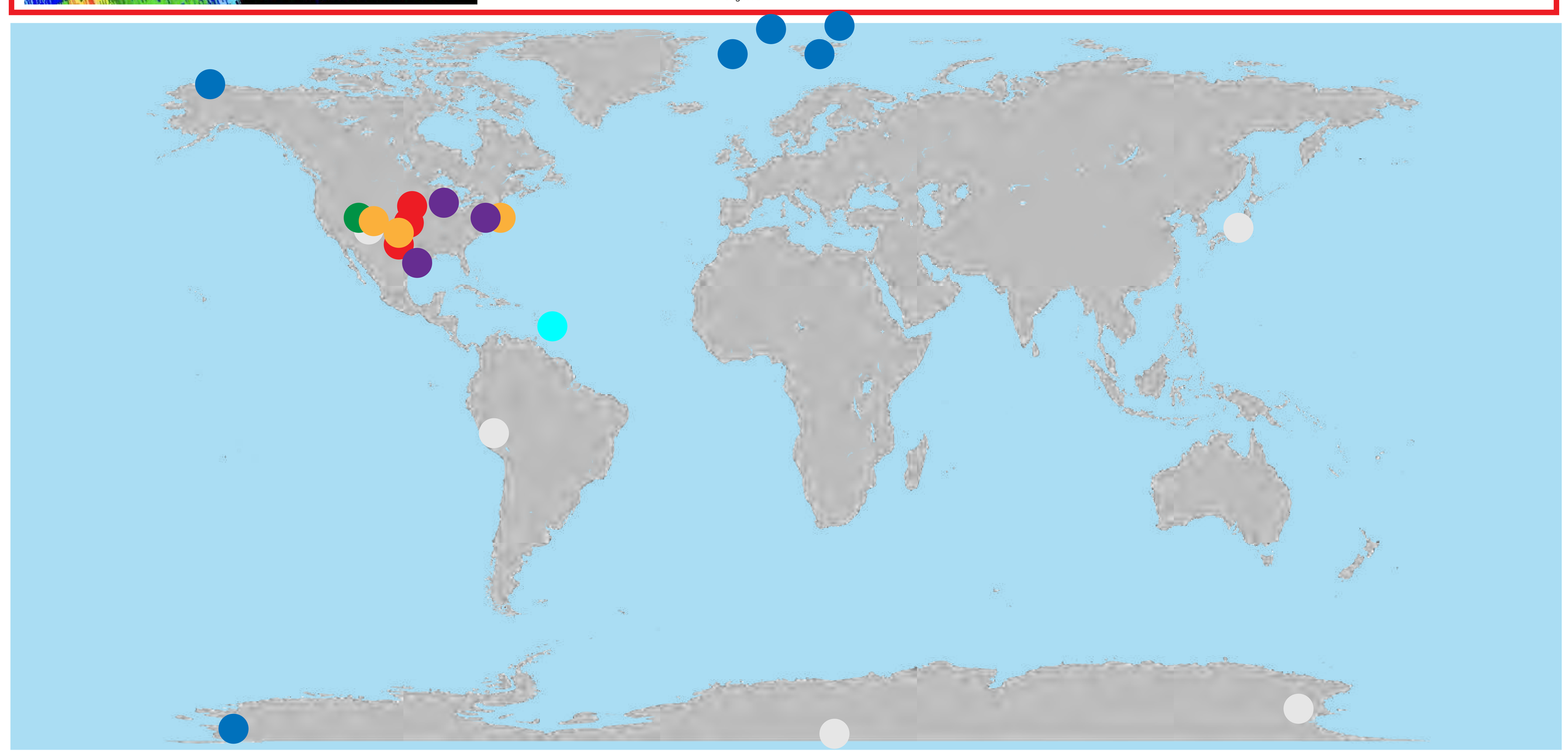


Understanding Severe Storms

Severe thunderstorms are low-likelihood, high risk events that can damage life and property through precipitation, tornadoes, lightning and hail. They represent a unique observational challenge due to their rapid development and potential to damage observing equipment. IRISS and RECUV have deployed autonomous observing assets into these dangerous environments as part of the NSF-supported Targeted Observation by Radars and UAS of Supercells (TORUS) project to collect unique perspectives to help predict how storms may react to changing climate.



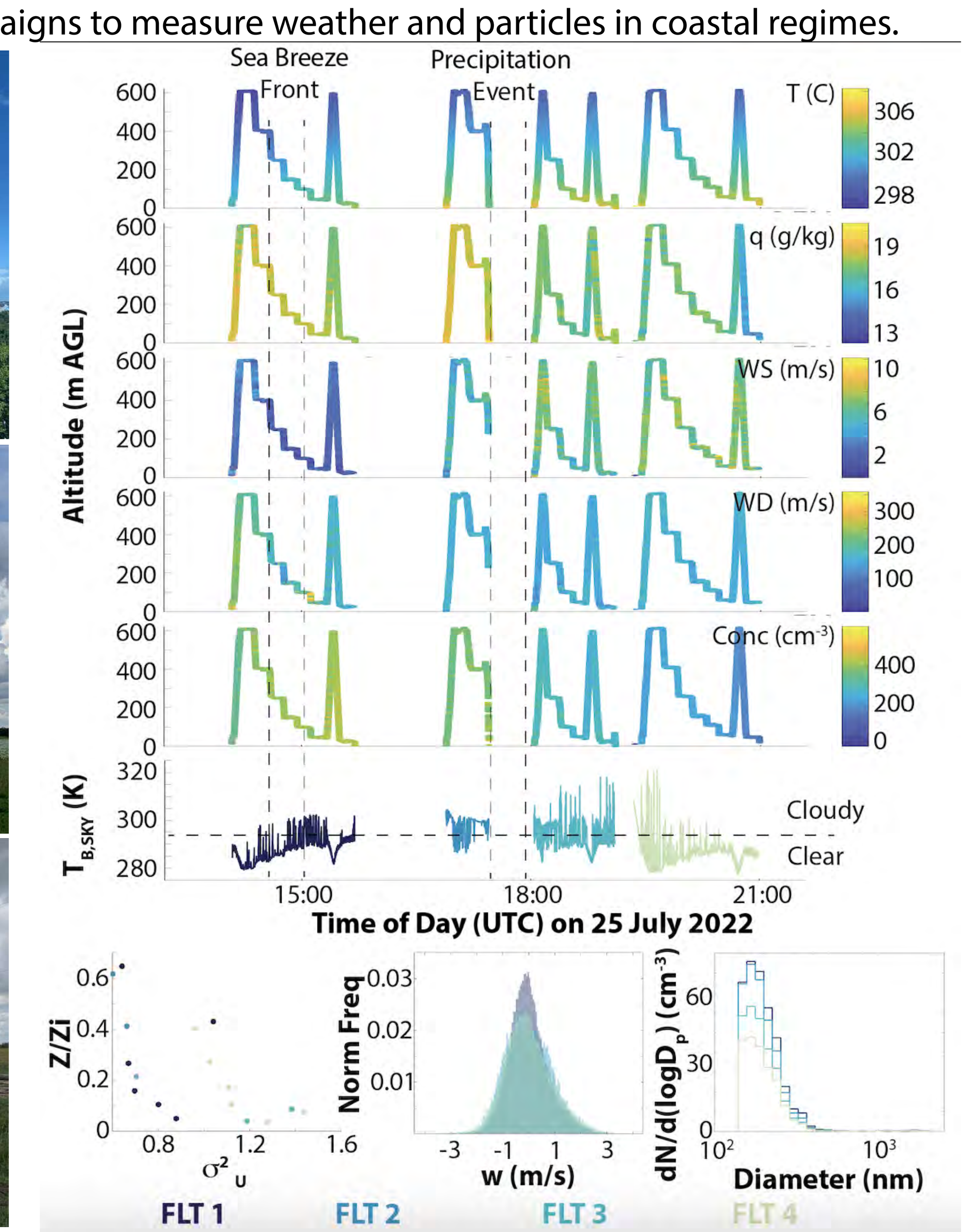




A map illustrating where CIRES, IRISS and RECUV teams have deployed over the past several years to collect novel datasets that offer new insight on physical processes relevant for prediction of climate, weather, and water.

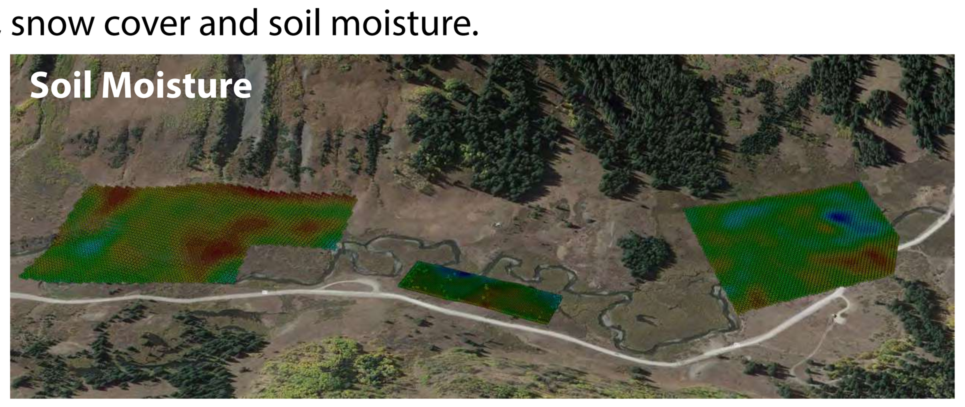
Observing the Urban Coastal Interface

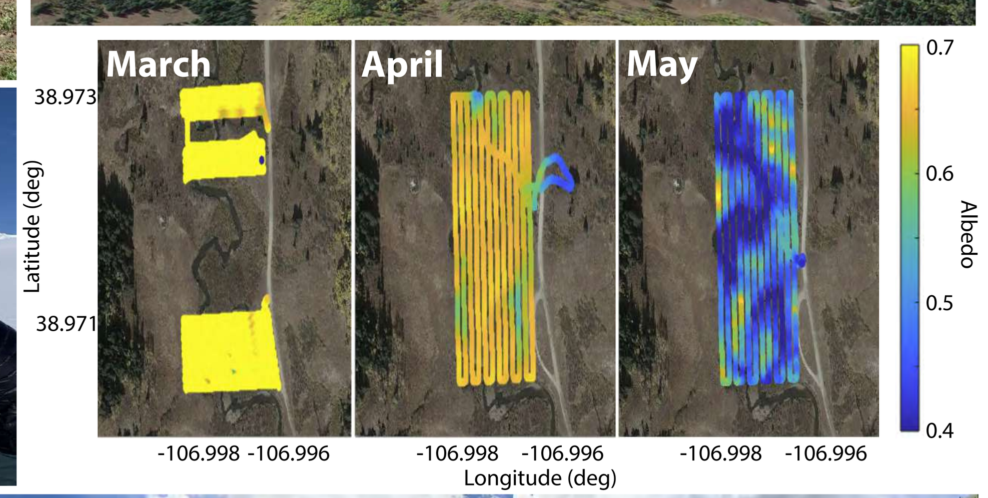
Nearly three billion people live within 200 km of a coastline. These coastal regions are vulnerable to strong storms, significant precipitation, and local circulations that drive microclimates and air quality. UAS offer critical perspectives on the lower atmosphere in coastal regimes, to offer insight into weather and climate events in these densely-populated areas. As such, CIRES and IRISS have deployed UAS as part of the NSF-supported Wisconsin's Dynamic Influence of Shoreline Circulations on Ozone (Wisco-DISCO) and DOE-supported Tracking Aerosol Convection Interactions Experiment (TRACER) campaigns to measure weather and particles in coastal regimes.

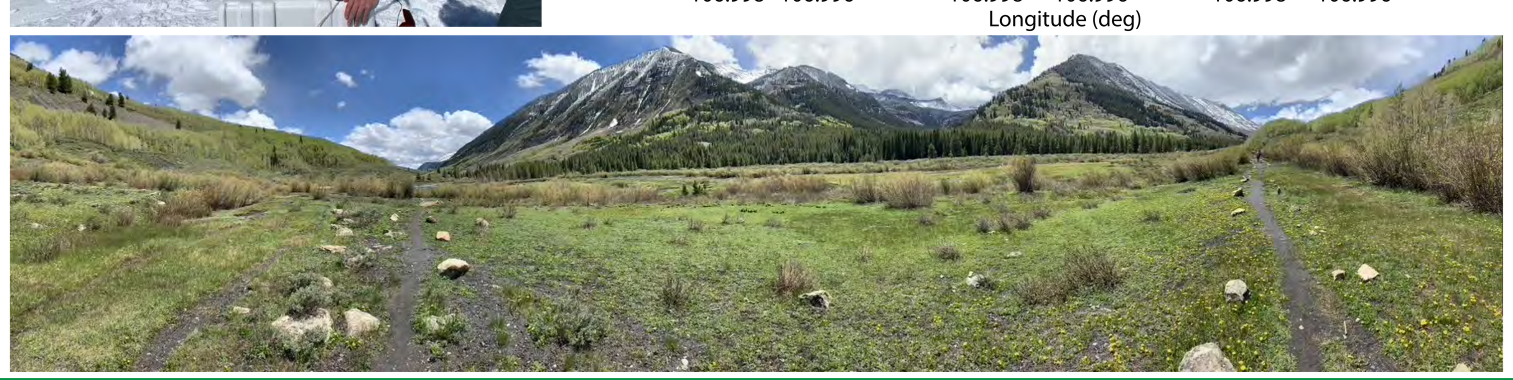


Tracking Mountain Weather and Water

As with polar regions, areas of complex terrain have seen significant shifts in weather and snow cover as a result of climate change. These shifts have impacted water security for millions of people, dictating that new tools be deployed to understand the physical processes that make up hydrometeorology. In response, CIRES, RECUV, IRISS and industry partners have deployed equipment to the headwaters of the Colorado River as part of the NOAA-supported Study of Precipitation, the Lower Atmosphere and Surface for Hydrometeorology (SPLASH), to observe surface properties like reflectivity, snow cover and soil moisture.

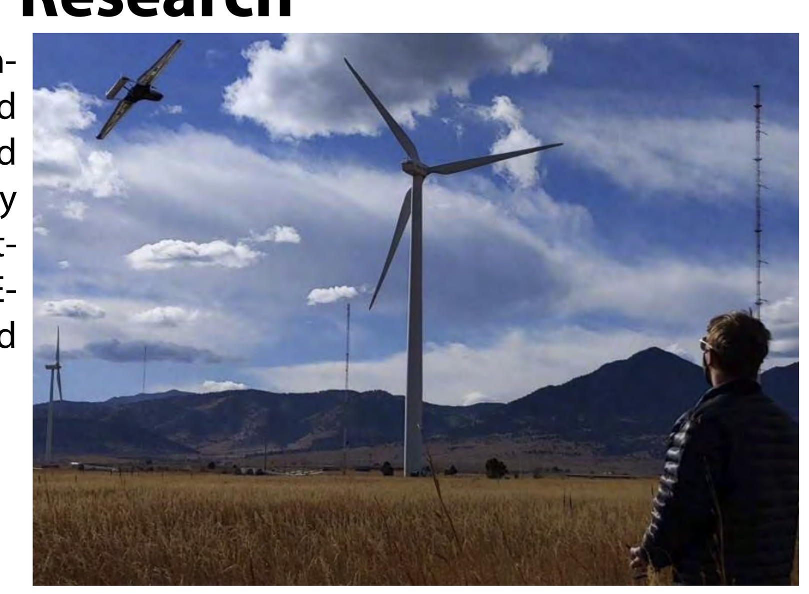


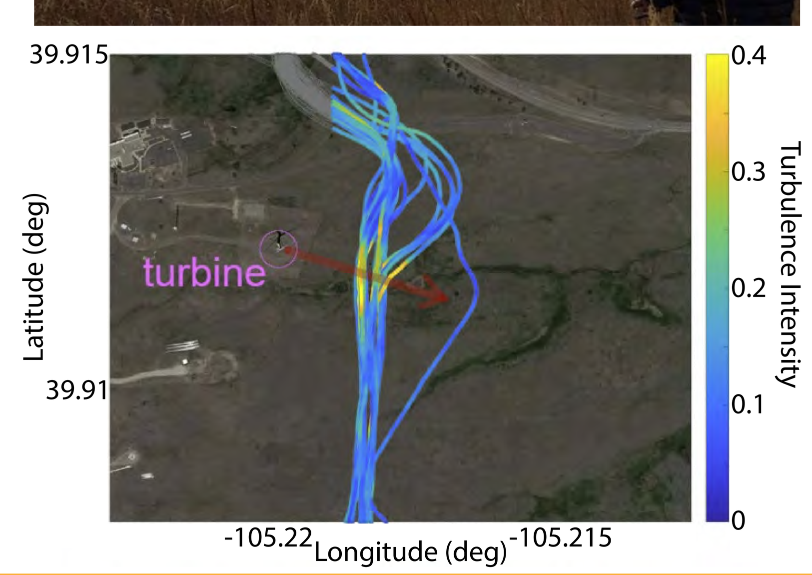




Supporting Renewable Energy Research

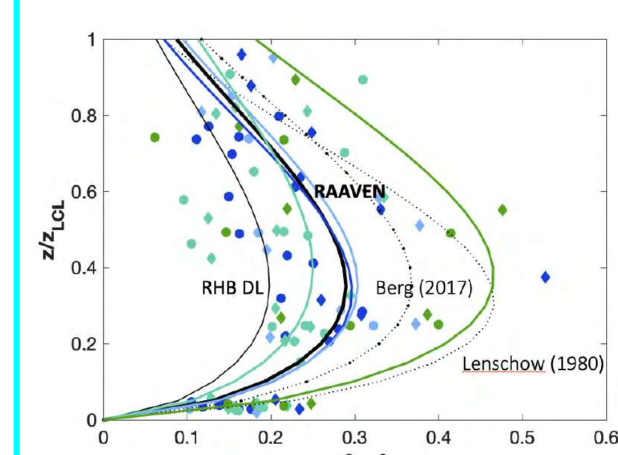
As governments continue to trend towards the implementation of renewable energy harvesting, questions are raised about the implications of such equipment on weather and water. To answer these questions, IRISS and CIRES deploy UAS to make detailed measurements of turbulence and atmospheric state downwind of wind plants, supporting DOE- and NOAA-funded efforts to characterize potential wind plant influences in land-locked and offshore regions.

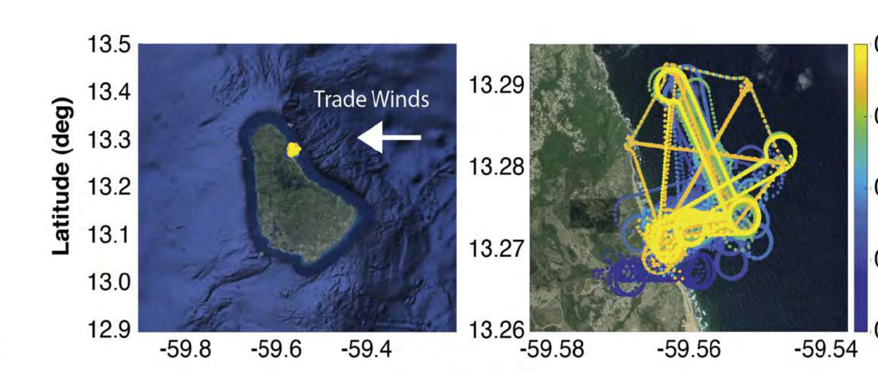


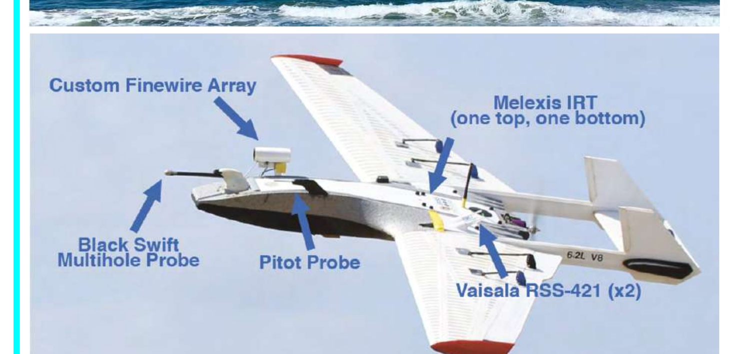


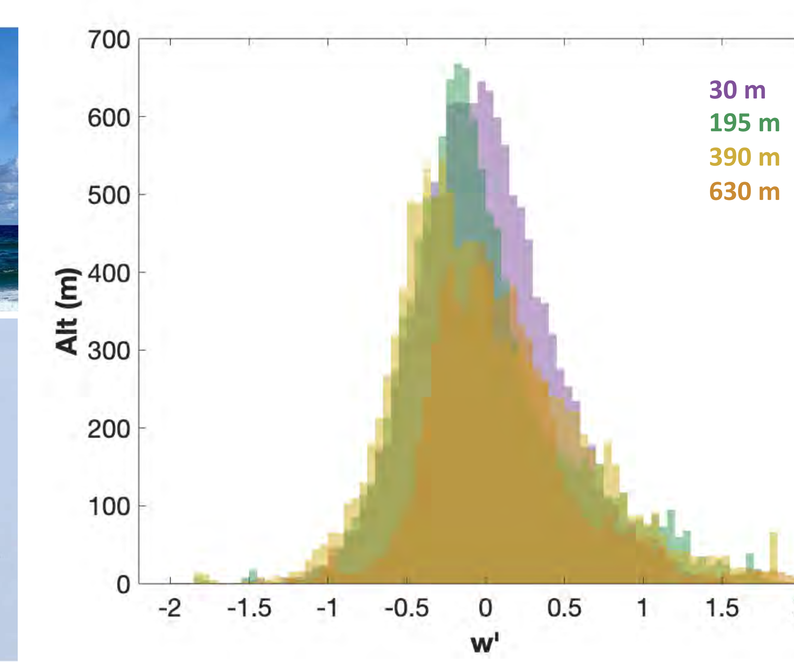
Offering New Perspectives on Tropical Clouds

Clouds in the tropical trades play a significant role in regulating climate as the amount of cloud cover strongly modulates how much solar energy can be absorbed by the underlying ocean surface. Because climate models have been shown to struggle with the accurate representation of these clouds and their response to environmental changes, this geographic regime introduces a significant amount of uncertainty to projections of future climate states. In support of narrowing this uncertainty, CIRES and IRISS deployed UAS to Barbados as part of the NOAA-funded Atlantic Tradewind Ocean–Atmosphere Mesoscale Interaction Campaign (ATOMIC), collecting over a month of data on the vertical structure of the sub-cloud layer over the tropical Atlantic Ocean.









Funding and Laboratory Partners

Sandia National Laboratories · BROOKHAVEN NATIONAL LABORATORY · Berkeley Lab · Pacific Northwest NATIONAL LABORATORY · NREL NATIONAL RENEWABLE ENERGY LABORATORY · NCAR

Contact and Additional Information

Gijs de Boer (gijs.deboer@colorado.edu)

https://www.colorado.edu/iriss/
https://www.colorado.edu/recuv/