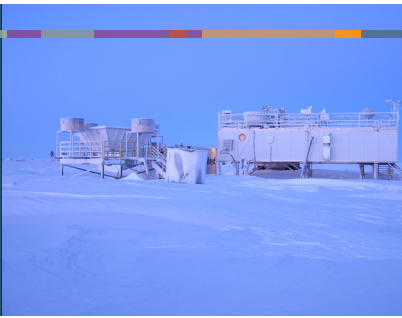




Sandia
National
Laboratories



Arctic Modeling and Measurements

As the weather changes, energy consumption, security, and infrastructure are impacted. Reliable earth system and atmospheric models based on comprehensive measurements can be used to anticipate energy consumption demands, security concerns, and infrastructure risks.

Modeling for Global Earth System Capabilities

Sandia National Laboratories' scientists, together with members of the Department of Energy (DOE) labs and university partners, develop and improve earth system models to create projections of potential changes in temperature and precipitation for stakeholders. These projections can then be used to anticipate energy consumption demands, security concerns, infrastructure risks, and other sector-specific concerns.

Sandia National Laboratories' scientists have computational expertise in developing codes to be used on leading high performance computing facilities. These codes include Albany/FELIX for ice sheet dynamics and HOMME for atmospheric dynamics. Sandia couples historical expertise in high performance computing to produce variable resolution atmospheric meshes. High resolution meshes can resolve critical physics and meteorological phenomena such as Arctic storms, which disperse heat and water across the globe, making them an essential component of the earth weather system.

Global Earth System Measurements

In collaboration with other national laboratories, Sandia develops and validates climate models. Our capabilities include:

- Uniquely located data collection to refine and validate weather data
- Satellite simulators to robustly evaluate climate models compared to traditional methods

Regional Modeling

In collaboration with other national laboratories, Sandia also develops and validates regional earth system models.

- **Regional Refined Models (RRMs):**RRMs provide insight into regional climate model behavior. RRM enable model users to focus on regions of interest. Users can examine regional earth system behaviors without implementing the global model at a high resolution, allowing users to view and validate regional models faster. RRM meshes may help predict the timing, amount, and cycles of rain that impact society and the economy.
- **Software Modernization:** Sandia can improve earth system models, expediting the development of trusted, high-fidelity models.
- **Large Eddy Simulations (LES):** Regional large eddy simulations (LES) of low clouds in the Arctic illustrate how and where improvements can be made in future, higher resolution global climate models.

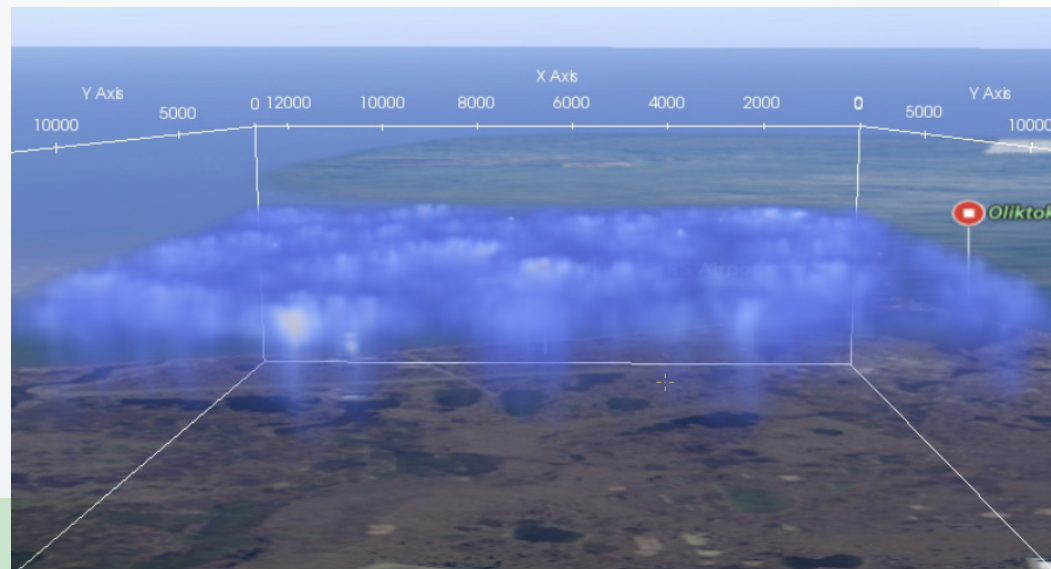


Atmospheric Radiation and Measurement Climate Research Facility

Sandia National Laboratories manages two Arctic sites under the DOE Atmospheric Radiation Measurement (ARM) program. These sites provide unique data collected for global atmospheric and earth system model development and verification. Satellite retrievals are also used in a satellite simulator software to compare with the global earth system model. ARM facilities provide:

- A rare, strategically placed window into the cloud and radiative processes in Earth's atmosphere at high latitudes.
- Data collection for Arctic model refinement and parameterizations
- Unique opportunities to collect climate data at various altitudes using tethered balloons and unmanned aerial systems.

We combine modeling capabilities and expertise in high performance computing with measurements to improve our understanding of complex natural processes.



Contact:
Lori Parrott
lkparro@sandia.gov
(505) 844-2745

Revealing precipitation that is large enough to fall, this large eddy simulation enhances understanding of the physical processes in the Arctic cloud that determine its optical properties and lifetime—knowledge that can lead to more accurate atmospheric earth systems predictions. Such predictions can support planning for national energy and sector-specific needs, such as the development of water availability projections.