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Title:	Climate Signatures Fingerprints of a Dynamic Planet
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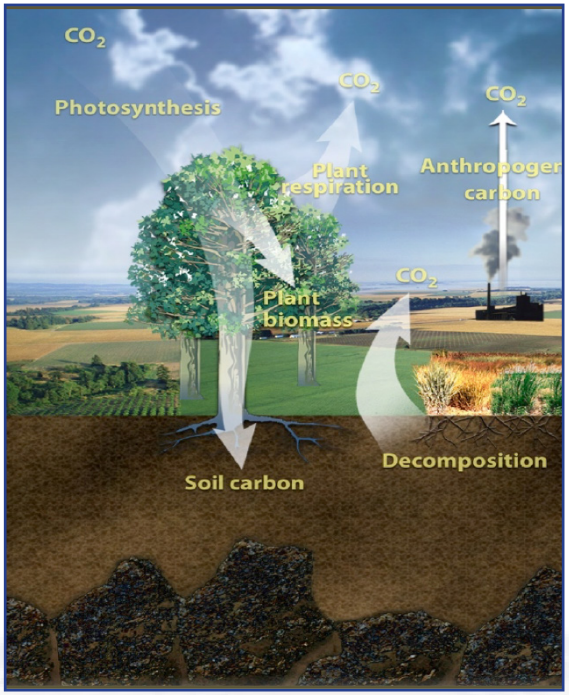
LANL Strenths

- Climate uncertainly quantification.
- Infrastructure vulnerability and planning.
- Atmospheric measurements of greenhouse gases and pollutants.
- Improved models of climate through massively parallel simulation capabilities and other advances in computational and measurement technologies.
- Modeling and quantifying changes in sea ice and permafrost landscapes and their feedback to climate.
- Development and deployment of mobile/portable multi-sensor platforms for measurements of chemical, isotopic, and energy balance signatures.
- Field/modeling studies of climate impacts in water-limited ecosystems.
- Impacts on surface water and groundwater systems, and the linkages between water and energy production.
- Development of better sensors and measurement technologies/approaches for climate studies including in situ and remote sensing systems.
- Development and application of tools for interpreting remotely sensed data including land surface classification and atmospheric chemistry.
- Microbial and metagenomics studies to understand effects of climate on nutrient cycling and soil ecosystems.



LANL participates in a Science Focus Area (SFA) supported by the U.S. DOE Biological and Environmental Research, Biological Systems Science Division. The SFA investigates the roles that the microbial residents of soil play in Northern temperate ecosystems, specifically comparing the drylands of the Western U.S. to the hardwood and pine forests of the Eastern U.S.

To learn more about LANL Climate Science and the Science of Signatures, visit the Los Alamos National Laboratory web page and search for "Climate."

http://www.lanl.gov/

CLIMATE SIGNATURES

Fingerprints of a Dynamic Planet

The Science of Signatures

Los Alamos
NATIONAL LABORATORY

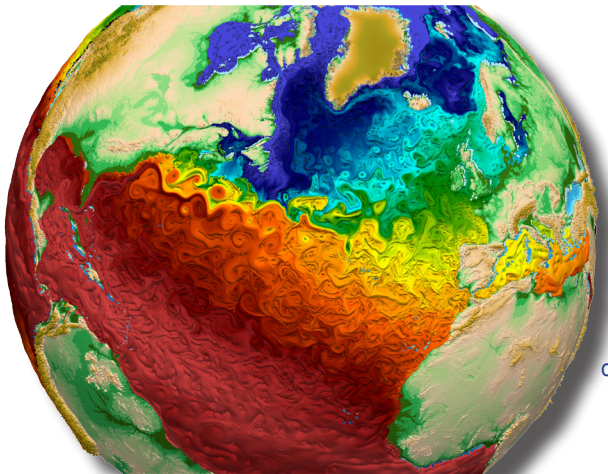
Climate Research

Because of the ramifications for future generations, climate research must have a solid scientific foundation. At Los Alamos, we are building that foundation by developing signal detection systems that span from software to hardware.

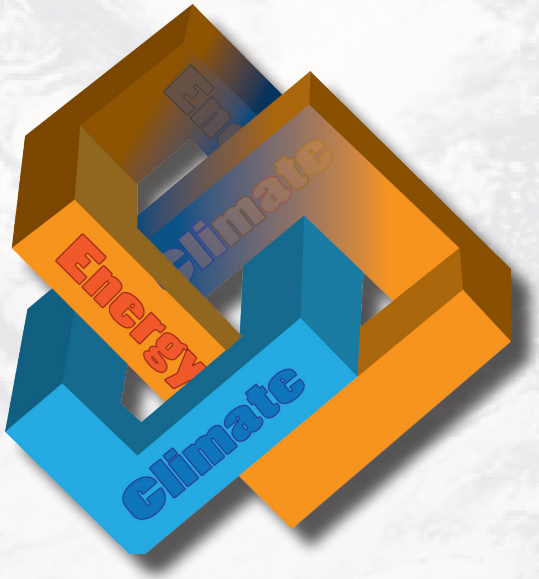
Our approaches strongly rely on integrating observational data with analytic and computational models. They help identify the most important aspects of climate systems for further study and measurement, and they target new signatures that may reveal important dynamics that are currently difficult to asses so that we can increase accuracy and reduce uncertainties in the predictions that come from our models.

Our end goal is to provide practical, science-based decision support to managers and policy makers at local- to national-levels so that they have the right information to make the best decisions concerning climate policy and action.

At the heart of our approach is understanding and predicting critical controls on climate processes and mechanisms at multiple spatial and temporal scales. We use experiments and integrated observations and modeling to address a variety of climate related issues



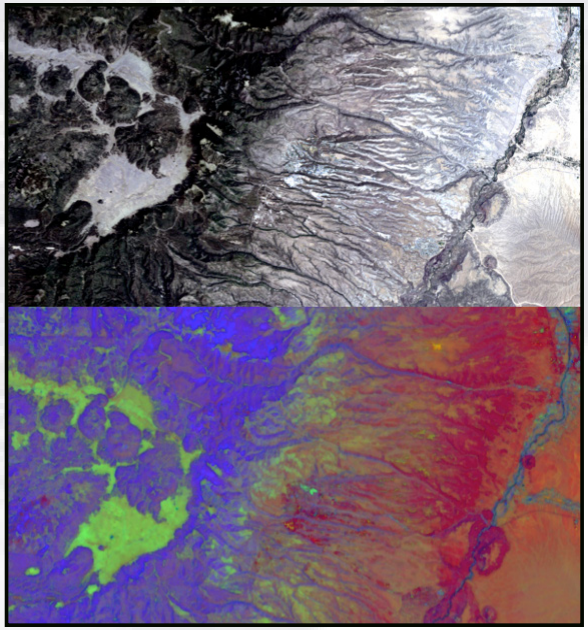
Modeling A Warming Ocean. The paint-like swirls of this visualization depict global water-surface temperatures, with the surface texture driven by vorticity. Cool temperatures are designated by blues and warmer temperatures by reds. Trapped regions of warmer water (red) adjacent to the Gulf Stream off the eastern coast of the U.S. indicate the model's capability to simulate eddy transport of heat within the ocean, a key component necessary to accurately simulate global climate change.



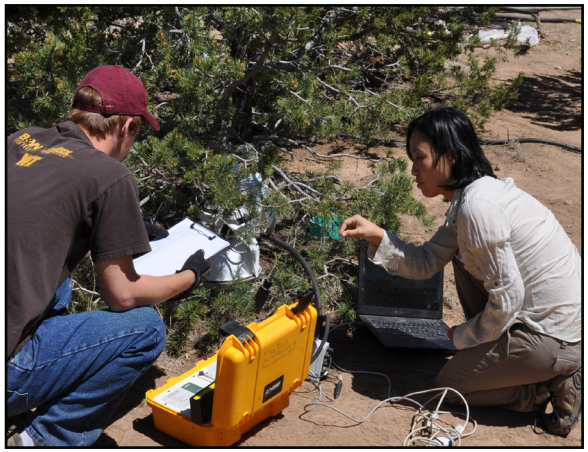
What are climate signatures?

Signatures include both visibly detectable "signals" such as melting polar ice or sea level rise; and physical, chemical, and biological data/characteristics that are tightly coupled to the machinery of the Earth's climate system and reflect impacts of climate change and variability on human and natural environments.

Changes in sensitive ecosystems such as in polar regions can be used as early warning systems and inform us about potential future changes in other parts of the Earth. At Los Alamos, scientists are integrating such observational data with analytical and computational models. They then use these models to develop new observations and signatures to enhance the accuracy of climate predictions, assess climate impacts, and conduct infrastructure and policy analyses.



Hyperspectral vision. A machine learning technology called GENIE uses hyperspectral techniques to analyze landforms. GENIE allows categorization of this visible/infrared Landsat satellite image into forest, grasslands, bare ground, & farmlands, for input to wildfire models.



Drought and Tree Mortality. What are the exact physiological mechanisms that lead to tree death during prolonged drought and rising temperatures? These are the questions that scientists are trying to answer at a LANL research project called SUMO. SUMO stands for SUrvival/MOrtality study and it is the largest study of its kind in the world.