

How to get nuanced details at the top of the world

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At the study site near Barrow, Alaska, monitoring transect and pole-mounted cameras are part of a new system that gathers data above and within the permafrost. Credit: US Department of Energy

At the top of the world, once permanently frozen soil holds vast pools of carbon. Microbes could free that carbon under the right conditions. To predict how the Arctic will respond to seasonal freeze-thaw-growing conditions, scientists need data. They built a system that gathers detailed data. It obtained data for a year, took measurements deep underground, and monitored a wide area on the surface. The data revealed insights about tundra system behavior that might help accelerate long-term thaws resulting in carbon releases in coastal permafrost regions.

The new system was the first to provide [data](#) on what's happening both above and below the ground. The first demonstration in an Arctic

ecosystem illustrates its potential to remotely "see" interactions among permafrost, soil, and vegetation ecosystems. It offers a [high resolution](#) over a field dozens of yards long.

Researchers designed a novel strategy that exploits measurements obtained four ways: (1) electrical resistivity tomography to monitor soil properties, (2) pole-mounted optical cameras to monitor vegetation changes, (3) point probes to measure [soil temperature](#), and (4) periodic measurements of thaw layer thickness, snow thickness, and soil dielectric permittivity. The data collected offered several insights. For example, it indicates a significant correlation between the temperature of the soil and the amount of water available to vegetation. The amount of water peaks during the growing season, highlighting the interactions between processes above and within the permafrost. Scientists confirmed these and other correlations at larger spatial scale using an unmanned aerial system platform.

More information: Baptiste Dafflon et al. Coincident aboveground and belowground autonomous monitoring to quantify covariability in permafrost, soil, and vegetation properties in Arctic tundra, *Journal of Geophysical Research: Biogeosciences* (2017). [DOI: 10.1002/2016JG003724](#)

Provided by US Department of Energy

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