Using InSAR to Study Permafrost Dynamics

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ABSTRACT

Permafrost occurs under 24% of the northern hemisphere land surface and has already begun to thaw, with a myriad of potential impacts to ecosystems, hydrology and global climate. Permafrost occurs underground, limiting our ability to monitor permafrost dynamics to in situ field measurements, leaving vast stretches of the Arctic unmeasured. Interferometric Synthetic Aperture Radar (InSAR) techniques can measure the surface heave and subsidence as water in the soil freezes and thaws, allowing us to lift the veil and peer underground at permafrost dynamics that, until now, have remained hidden from view. We will describe basic permafrost processes, the impact of climate change on permafrost, and the impact of thawing permafrost on global climate. We will describe the Remotely Sensed Active Layer Thickness (ReSALT) products, which use InSAR and Ground Penetrating Radar (GPR) to study active layer dynamics, long-term permafrost thaw, thermokarst lake hydrology, thermokarst and thermal erosion, and the impacts of fire on permafrost. We discuss the future of these techniques in NASA’s Arctic Boreal Vulnerability (ABoVE) field experiment and NASA-ISRO SAR (NISAR) satellite.