How much snow disappears into thin air?

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NCAR scientist Jacqueline Witte (kneeling) and software engineer Isabel Suhr (standing) measure the distance between sonic anemometer arms on an Integrated Surface Flux System (ISFS) weather tower. As the snowpack melts, they move the instruments down to stay close to the surface. This allows them to collect data on what happens to snow and water vapor at different levels in the air. Credit: Rosalyn Stilling, UCAR

Scientists have wrapped up a major field project high in the Colorado mountains that will eventually help water resource managers to better quantify critical water resources stored in mountain snowpacks.

The Sublimation of Snow (SOS) project, which ran from October 2022 to May 2023, aims to advance understanding of the process of snow evaporating into the atmosphere instead of melting into water. This process, known as sublimation, has a major effect on water resources in the western United States, where runoff from mountain snowpack is needed to ensure adequate water for farms, businesses, and growing numbers of residents.

In order to improve predictions of water availability in the spring and summer, officials must be able to quantify how much water is being lost to sublimation. The main culprits of sublimation are sunshine beating down on the surface of the snow and dry winds sweeping across it.

The SOS project was led by the University of Washington and the Aspen Global Change Institute in collaboration with NCAR.

To observe what happens to snow as it falls and piles up on the ground, scientists set up the SOS field site near the Rocky Mountain Biological Laboratory outside of Crested Butte, Colorado. The site consisted of four towers, 10–20 meters high, loaded with a variety of instruments that collected data on wind speed, snowfall, and blowing snow. This enabled the scientists to measure the depth of the snowpack, temperature of the snowpack surface, and intensity of the sun.

The three-pronged claws on this sonic anemometer are 3-D wind sensors that use sound to measure wind direction and speed. These measurements are vital for understanding exactly how sublimation occurs. Credit: NCAR & UCAR

One of the early findings that has emerged from the data is that blowing snow is sublimating higher above the snowpack than previously thought.

"As the wind lofts up the loose snow on the surface of the snowpack, the sensors are showing that a portion of the blowing snow is sublimating into the air rather than falling back down," said NCAR scientist Ethan Gutmann. "The 20-meter tower showed that wind is blowing plumes of snow higher than the instruments can measure, so it is likely that more

sublimation is occurring even higher in the air."

He and his colleagues said they're looking forward to further analyzing the data and narrowing the range of uncertainty around how much snow is sublimating.

"The brighter the sun and the higher the wind, the more will be sublimated," said Isabel Suhr, an NCAR software engineer and field technician supporting the SOS campaign. "It could be anywhere from 10% to 90% of total snowfall that is sublimating. We don't really know how much."

Provided by NCAR & UCAR

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