

## SNAPSHOT

# Citizen snow-scientists trek into the back country

Each winter, many adventurous snow enthusiasts leave the groomed trails and journey into the back country, carrying with them an essential piece of safety equipment — the avalanche probe. Although the collapsible pole's primary use is to identify the location of buried avalanche victims, a group of mountain hydroclimatologists have found that it is also the perfect tool for collecting snowpack data from places and timepoints not previously possible.

This has led to the creation of the Community Snow Observations (CSO) project (<http://communitysnowobs.org>), part of NASA's Citizen Science for Earth Systems Program. The project, which is in its second of four years of funding, recruits back-country professionals, including climbing and ski guides, as well as recreationists, to gather data on snow depth. The current project grew from early campaigns by Gabriel Wolken, a research scientist and manager of the Climate and Cryosphere Hazards Program at the Alaska Division of Geological and Geophysical Surveys (DGGS), to enlist the snowmobile community in Valdez, Alaska, in data collection efforts. Although the project is still heavily influenced by its Alaskan roots, it continues to grow in terms of the number of observations collected and the diversity of areas measured.

Anthony Arendt, a research scientist and engineer at the University of Washington's Polar Science Center serves as the project's principal investigator, but the CSO is supported by three groups: a team at Alaska's DGGS that is charged with leading recruitment and community engagement, a team at the University of Washington that manages the web service used to store and visualize the data being sent via the smartphone app, and a team at Oregon State University that uses the data in snow simulation models. However, "the most important group of scientists" says Arendt, "is the citizen scientists themselves who volunteer their time to make this work possible".

Skiers, snowshoers, snowmachiners and other back-country enthusiasts submit measurements into a smartphone application powered by MountainHub



Credit: PR Images/Alamy Stock Photo

(<http://about.mountainhub.com>) that tags the volunteer's GPS location. Many participants, like Sarah Carter, the Education Director at the Alaska Avalanche Information Center, collect snow measurements in conjunction with their regular work. As a forecaster for the Valdez Avalanche Center, Carter traverses a unique sample of maritime, transitional and interior snow climate zones in the Chugach Mountains. "Valdez, Alaska, is unique in that, within 30 miles we travel from the warm and deep snowpack in our portside forecast area to cold and thin snowpack on the interior side of Thompson Pass" says Carter.

The snowpack data collected by citizen scientists is currently being used by the CSO team to validate snow distribution products derived from airborne and satellite remote sensing data<sup>1</sup>. It also feeds into SnowAssim, a sub-model within the process-based snow modelling system SnowModel<sup>2</sup>, which uses observational data to constrain seasonal snow water equivalent (SWE) output. Research presented by the team at the 2017 Fall Meeting of the American Geophysical Union suggests that the CSO data

provides an important constraint on overestimation of SWE<sup>3</sup>.

Thousands of observations are included in the CSO database, but like any volunteer project, encouraging participation and retaining contributors is a challenge. To address this concern, the CSO has launched an Ambassador programme to recognize their core citizen scientists (<http://communitysnowobs.org/ambassadors/>). They have also conducted give-aways of free equipment to encourage participation and are working with community-based advocacy and educational groups such as Protect Our Winters (<https://protectourwinters.org>) to connect directly with affected communities. The project is not just about collecting data, but is also about giving back. The CSO makes the snow data available in the form of a web app, and is working to provide more direct feedback to participants to let them know how their work informs the science.

Volunteer data collection can provide valuable information at a density that is not easily obtained from other methods. Before the CSO project was funded, a small number of scientists would charter a helicopter for several hours, or spend time skiing or snowmobiling across glaciers to collect a handful of observations for a single watershed. "We recognize that many snow recreationalists visit terrain that is not commonly sampled by conventional snow observation methods, so we decided to build a citizen science campaign to support that community" says Arendt. Although some formal field data collection will still be required, the CSO project has the potential to yield hundreds of valuable, new measurements per season. □

Adam Yeeles

Published online: 29 October 2018  
<https://doi.org/10.1038/s41558-018-0329-0>

## References

- Liston, G. E. & Hiemstra, C. A. *J. Hydrometeorol.* **9**, 989–1004 (2008).
- Wolken, G. J. & Wikstrom Jones, K. Evaluating controls on snow distribution in the eastern Chugach Mountains, Alaska. In *AGU Fall Meeting Abstracts 2017 C53B-1031* (AGU, 2017).
- Crumley, R. L. et al. Improving snow modeling by assimilating observational data collected by citizen scientists. In *AGU Fall Meeting Abstracts 2017 C43B-04* (AGU, 2017).