Enabling Comprehensive Low Latency Snow Pit Data

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ABSTRACT

Current methods of monitoring snow water equivalent (SWE) from space, such as measuring the differential scatter darkening in the radio brightness at 19 and 37 GHz, rely on snow microphysical properties, such as grain size, in addition to the snow macroscopic properties like snow depth. The algorithms to invert the observations to SWE or snow depth are region-specific and require substantial ground truth to characterize the snow climatology of that region. And, of course, the climate is changing.

This research addresses this concern by automating the collection of snow ground truth. We will do this by integrating two technologies that already exist: 1. the SoilSCAPE system enables low-latency soil moisture data collection from areas that are large enough to be representative of a passive microwave footprint. 2. the University of Michigan snow sensor is a small, easily replicated data logging device that implants in the snowpack and logs the snow's temperature, density, and grain size, together with (yet uncalibrated) information on moisture and ambient light levels local (within a decimeter) of the sensor. The two systems can be integrated because the SoilSCAPE system uses the 900MHz ISM band for wireless communications, while the snow sensor system uses the same band for the measurement of the density and moisture of the snow. The printed circuit board for the snow sensor includes a space for the addition of a 900 MHz antenna. With the addition of the antenna to the snow sensor, the two systems' hardware are compatible. The bulk of the effort will be in implementing the software needed to allow the two systems to communicate, and thereby turn the SoilSCAPE system into one that can also monitor snow over a wide area.

Advantages of merging the two systems include giving to the snow sensor the intelligence of the SoilSCAPE system. Power management of a device embedded in the snowpack is important to preserving the snowpack properties. Judicious alterations of the measurement schedule, possible with the SoilSCAPE system, will enable rapid measurements of the snowpack when the snow is expected to be changing, and sparse sampling of the snowpack when excess power dissipation is undesired.

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