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Using COSMOS sensors to measure snow water equivalent on the ground and in the forest canopy

Darin Desilets
Hydroinnova, Albuquerque, NM, USA (darin@hydroinnova.com)

Recent data from the southern Rocky Mountains demonstrate how a COSMOS sensor can be used in two different modes, invasive and non-invasive, for measuring snow. The non-invasive mode provides an average snow water equivalent (SWE) depth over an area of approximately 40 ha, but only up to a depth of about 10 cm SWE. Using two different energy channels, the non-invasive technique can also be used to infer the presence of canopy intercepted snow, and shows promise for quantifying SWE in the canopy. Because of its large footprint, the non-invasive sensor can also measure SWE from a moving motor vehicle. The invasive mode provides a much greater depth range, theoretically at least several meters of SWE, but over only a few square meters. SWE measured with the invasive COSMOS sensor correlates closely ($R^2 > 0.96$) with SWE measured by an adjacent snow pillow during the snow accumulation season. In summer, both invasive and non-invasive sensors can be used to monitor soil water content, thus constraining another key variable in hydrologic forecasting models.