Newly installed soil moisture monitoring network at middle and high elevation in Switzerland: setup and first results

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Motivation

Soil moisture is a key factor controlling the energy and water exchanges at the soil-atmosphere interface. In-situ measurements are essential in order to provide ground truth for atmospheric models and small-scale process understanding in various disciplines including the cryosphere. Technical challenges as well as its high variability and dependence to the subsurface properties, make soil moisture rather difficult to measure. Here we will present the objectives and the actual state of progress of the SOMOMOUNT project, which aims at filling the data gap at middle and high altitude in Switzerland

Network setup

Soil moisture is monitored at 10, 30 and 50cm depth.

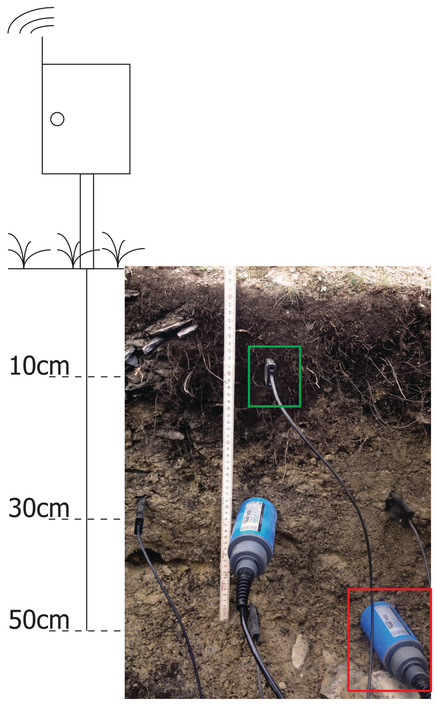
Two soil moisture sensors are installed in parallel:
- PICO64 (IMKO GmbH, Germany)
- SMT100 (Truebner GmbH, Germany)

Site specific calibration performed at each site for the SMT100 measrured soil moisture

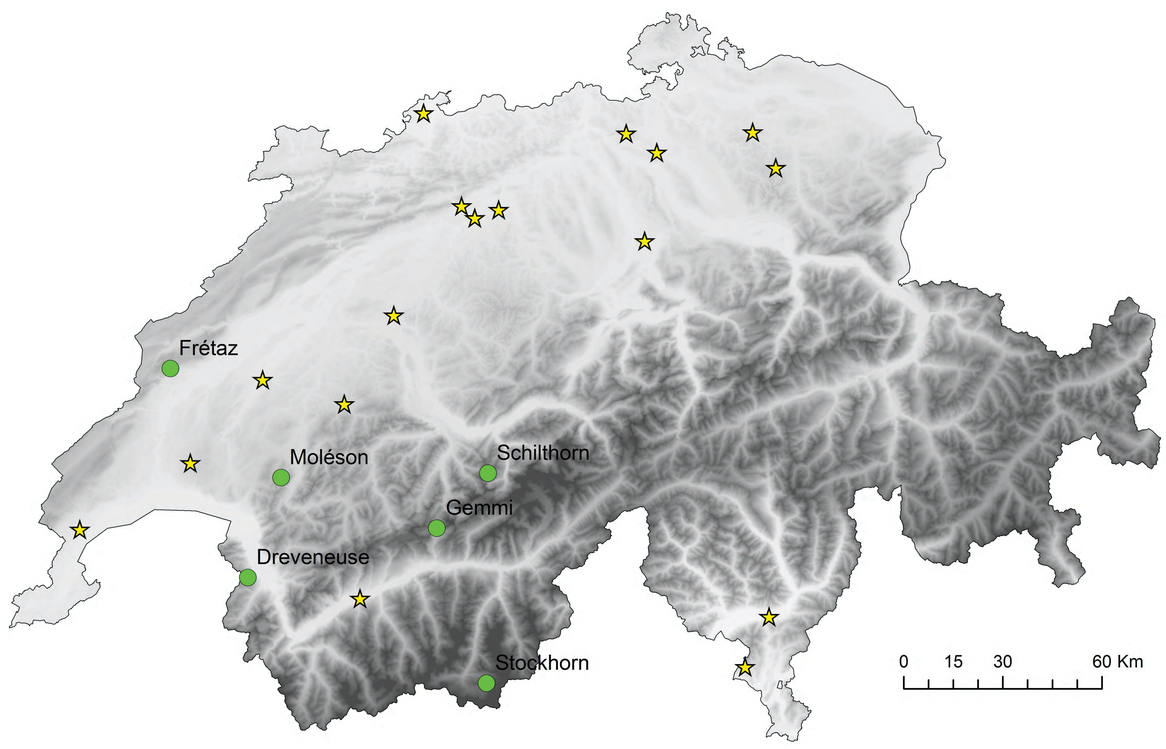
All sensors also measure ground temperature

Instrumentation and measurment protocole similar to the low elevation soil moisture network SwissSMEX

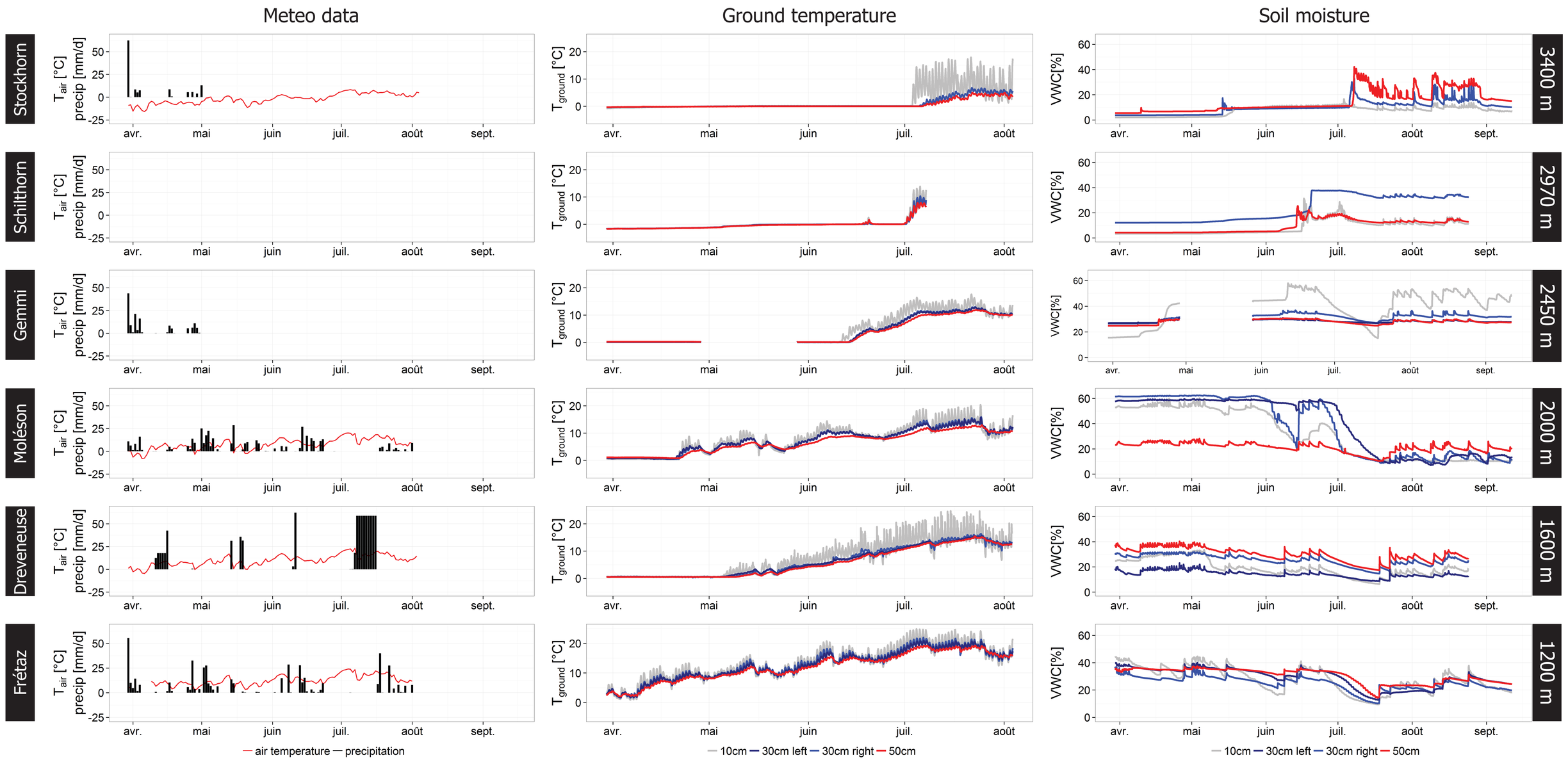
Different ground thermal regimes:
- permafrost (Stockhorn, Schilthorn and Dreveneuse)
- seasonal frost (Gemmi)
- unfrozen conditions (Moléson and Frétaz)



Station location



Results



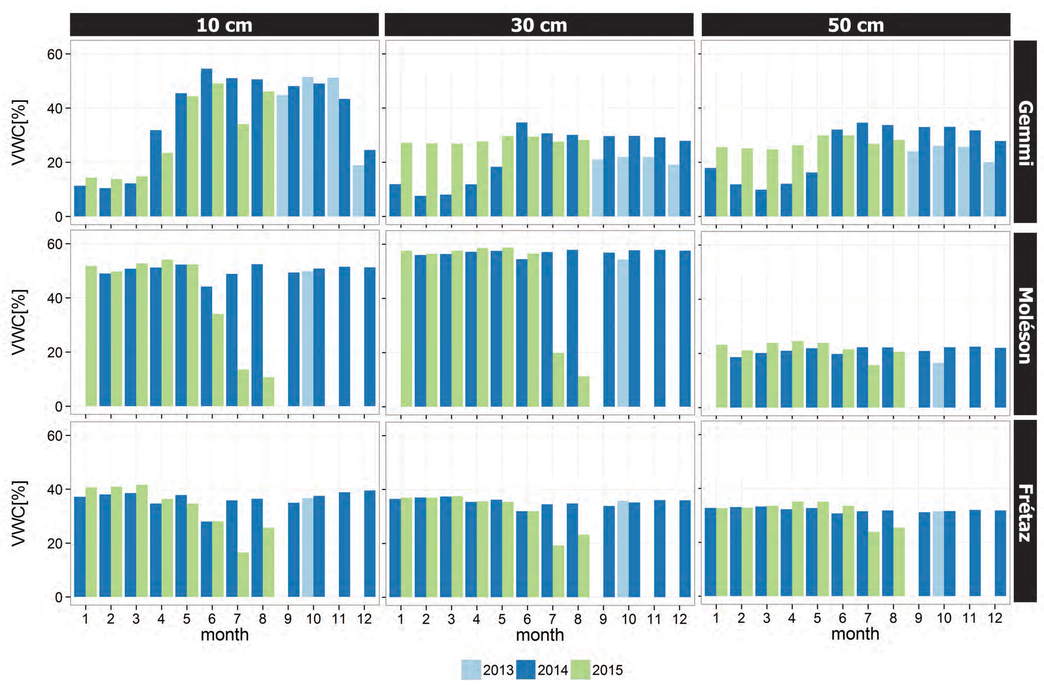
Annual variation

Comparing the monthly mean values from 2013, 2014 and 2015, the impact of the warm temperatures of the summer 2015 is clearly visible.

At Moléson and Frétaz the effects are visible down to 50cm and at Gemmi in the uppermost 10cm.

The strongest impact is observed at Moléson, where the decrease in VWC is around 45%.

The rest of the year show comparable values at all sites and depths



Conclusion

The presented network setup is capable of measuring accurately the soil moisture at middle and high elevation areas.

Soil moisture at Stockhorn, Schilthorn and Gemmi exhibit distinct phases related to freeze/thaw processes:
- Steady minimum in winter (frozen and snow covered conditions)
- Strong increase at the beginning of the summer (thawing of the ground and snow melt)
- High variability during the summer (unfrozen conditions and snow free)

The onset, duration and amplitude of each phase are site specific and depend on the ground properties and the atmospheric forcing.

Soil moisture at Moléson and Frétaz show no sign of frost related influence:
- High variability throughout the whole year (some snow covered period can be ovserved)
- Drying period in the summer

The impact of the heat wave of July 2015 is much less important at high elevation (Stockhorn and Schilthorn)