GPS-derived data of SWE, HS and LWC and corresponding validation data

This dataset includes GPS-derived snow water equivalent (SWE), snow depth (HS) and liquid water content (LWC) data for three entire snow-covered seasons (2015-2016, 2016-2017, 2017-2018) at the study plot Weissfluhjoch 2540 m a.s.l. (Davos, Switzerland) in daily resolution. The procedure to derive these snow properties is described in Koch et al. (submitted). The novel approach is based on a combination of GPS signal attenuation and time delay.

The dataset also includes corresponding validation data for SWE and HS measured at Weissfluhjoch, and some additional meteorological data used for interpretation of the snow cover evolution.

Lacking data, e.g. due to sensor failure are marked with 'NaN'.

In the following, we describe the data for each column and indicate for which Figures and Tables in Koch et al. (submitted) and in the corresponding supporting information the data were used.

Column	Label	Unit	Description	Figure/Table
1	Date	-	Date of measurements, given as dd.mm.yyyy.	-
2	SWE GPS-derived	mm w.e.	Snow water equivalent derived by the approach described in Koch et al. (submitted), and for dry-snow conditions in Henkel et al. (2018). This approach is based on a combination of GPS signal attenuation and GPS carrier phase information. Daily values for 8 a.m. are given.	Fig. 4, Fig. 5, Table S3
3	SWE snow pillow	mm w.e.	Snow water equivalent recorded at the snow pillow (Sommer Messtechnik SP3) at 8 a.m. The snow pillow data were offset-corrected at the beginning of the snow-covered season.	Fig. 4, Fig. 5, Table S3
4	SWE snow scale	mm w.e.	Snow water equivalent recorded at the snow scale (Sommer Messtechnik SSG1000) at 8 a.m.	Fig. 4, Fig. 5, Table S3
5	SWE manual measurement M1	mm w.e.	Snow water equivalent manually measured (bi-)weekly while recording a snow profile (Marty, 2017).	Fig. 4, Table S3
6	SWE manual measurement M1	mm w.e.	Snow water equivalent calculated by combining snow density data of (bi-)weekly snow profiles (Marty, 2017) and manual snow height recordings taken at a stake at approx. 8 a.m.	Fig. 4, Table S3
7	HS GPS-derived	m	Snow height derived by the approach described in Koch et al. (submitted), which is based on a combination of GPS signal attenuation and GPS carrier phase information. In addition, a simple snow densification model is needed to derive snow height. Daily values for 8 a.m. are	Fig. 4, Fig. 5, Table S4

			given.	
8	HS Ultrasonic 1	m	Snow height measured with an ultrasonic sensor at the MST station at 8 a.m. For this sensor, no data were available in the winter season 2016-2017.	Fig. 4, Fig. 5, Table S4
9	HS Ultrasonic 2	m	Snow height measured with an ultrasonic sensor at the IMIS automatic weather station at 8 a.m.	Fig. 4, Fig. 5, Table S4
10	HS manual measurement M3	m	Manual snow height recordings at a stake at approx. 8 a.m.	Fig. 4, Table S4
11	HS manual measurement M4	m	Snow height measured at location of (bi-)weekly recorded snow profiles (Marty, 2017).	Fig. 4, Table S4
12	LWC GPS-derived	% vol.	Liquid water content in snow derived by the approach described in Koch et al. (submitted). This approach is based on a combination of GPS signal attenuation and GPS carrier phase information. Daily values for 8 a.m. are given.	Fig. 4, Table S2
13	GPS Carrier-to-noise-power ratio	dB Hz	Normalized daily GPS Carrier-to-noise-power ratio (C/N_0), recorded at the GPS antenna placed on the ground (GPS_2). The C/N_0 values recorded at 8 a.m. are given.	Fig. 4
14	Lsyimeter outflow	mm	Meltwater outflow measured by a 5 m² snow lysimeter. Daily sum for 8 a.m. is given.	Fig. 4, Table S2
15	Air temperature	°C	Air temperature measured at the IMIS automatic weather station at 8 a.m.	Fig. 4
16	Snow surface temperature	°C	Snow surface temperature at the IMIS automatic weather station at 8 a.m. This data were available since 18.03.2016.	Fig. 4

References

Koch, F., Henkel, P., Appel, F., Schmid, L., Bach, H., Lamm, M., Prasch, M., Schweizer, J., and Mauser, W., Retrieval of snow water equivalent, liquid water content and snow height of dry and wet snow by combining GPS signal attenuation and time delay. Water Resources Research, submitted.

Henkel, P., Koch, F., Appel, F., Bach, H., Prasch, M., Schmid, L., Schweizer, J., & Mauser, W. (2018). Snow water equivalent of dry snow derived from GNSS Carrier Phases. *IEEE Transactions on Geoscience and Remote Sensing*, 56(6), 3561-3572.

Marty, C. (2017). GCOS SWE data from 11 stations in Switzerland; WSL Institute for Snow and Avalanche Research SLF, Tech. Rep., WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland, doi:10.16904/15.