EGU21-12760, updated on 17 Oct 2021
https://doi.org/10.5194/egusphere-egu21-12760
EGU General Assembly 2021


# Trends in snowmelt rates over Europe inferred from historical snow depth observations converted to SWE

**Adrià Fontrodona-Bach**[1], Josh Larsen[1], Ross Woods[2], Bettina Schaefli[3], and Ryan Teuling[4]
[1]School of Geography, Earth and Environmental Sciences, University of Birmingham, UK (axf984@bham.ac.uk)
[2]Department of Civil Engineering , University of Bristol, UK
[3]Institute of Geography, University of Bern , Switzerland
[4]Hydrology and Quantitative Water Management group , Wageningen University, The Netherlands

There is strong evidence that rising temperatures mostly lead to less snow accumulation and to an earlier melt onset. However, changes in the frequency and intensity of snowmelt events remain unclear. While higher temperatures should intuitively lead to faster snowmelt, some studies find that melt rates are slower because the melt onset occurs earlier in the year when less energy is available for melt. Modelling of these snow dynamics is challenged by a lack of continuous observations on water content of the snowpack, the highly sought after SWE. However, high quality observations of snow depth can be more available in both space and time, even at higher altitudes. Therefore, an increasing number of models try to estimate SWE from snow depth and other variables. Here we first investigate if these models accurately reproduce the snow accumulation and melt dynamics, and to what extent they can be used for hydrological studies. We then convert a long-term pan-European snow depth dataset to SWE by making use of these models and we assess model performance. Historical trends of snowmelt rates, melt onset, and frequency and intensity of melt events are shown for several seasonal snow locations across Europe. Trends across a variety of timescales are generally weak and spatially inhomogeneous, suggesting local conditions dominate over regional climate trends. However, it seems that under the current climate change conditions, the decrease of snowpack depth over most of Europe causes snowpacks to melt faster (i.e. in less days) than before.