

# Trends in soil temperature in the Icelandic highlands

Guðrún Nína Petersen

gnp@vedur.is

## Abstract

With increasing air temperature in a warming climate the soil temperature also increases. Such changes impact flora, fauna and natural hazards. Thus, it is important to monitor soil temperature. In Iceland, the highland station Hveravellir has the longest reliable time series of soil temperature. The station is located in a barren landscape at 641 m a.s.l., but the site itself is grass covered. Soil temperature has been measured there since 1965 at 10, 20, 50 and 100 cm depth but the data is not fully digitized. Here, the time series used span 42 years, from 1977 to 2019. Annual and seasonal trends are calculated as well as the annual number of thawing degree days (TDD) and freezing degree days (FDD). During this period, there has been a considerable warming in Iceland, not only because of global warming but also because of its start coinciding with the end of a local cold period. In the soil, warming is detected in all seasons except May to June, which is the melting season, the end of which varies greatly from year to year. The most warming is found during the autumn and winter months. These results contrast with those from continental cool sites where the largest warming has been seen in the spring months. The autumn cooling starts 2–3 weeks later now than at the start of the time series, resulting in a longer summer in the soil. The number of TDD has increased and the number of FDD has decreased, both in air and in soil. At 100 cm depth TDD has increased by  $80^{\circ}\text{C day dec}^{-1}$  and FDD decreased by  $38^{\circ}\text{C day dec}^{-1}$ . There is a correlation between the increase in air temperature and soil temperature, for every  $1^{\circ}\text{C}$  increase in 2 m temperature the soil temperature at 100 cm has increased by  $0.6^{\circ}\text{C}$ . The implication of this warming is firstly seen in terms of flora, fauna and agriculture, by the lengthening of the growing season in Iceland, and secondly in terms of natural hazard, by increased risk of landslides due to thawing of permafrost in mountainous regions.