



Unprecedented spring frost event in Switzerland and Germany in April 2017

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In the second half of April 2017, a cold air mass from the Arctic penetrated central and western Europe, causing severe damage to natural and cultivated vegetation over broad areas. We analyzed to what extent this event had been exceptional in Switzerland and in Germany.

We selected 50 stations covering elevations between 4 m (Bremen, Germany) and 588 m asl (Rottweil, Germany and Meirigen, Switzerland) and latitudes between 46.3°N and 53.5°N. The data started from 1864 (Bern / Zollikofen, Switzerland) and included at least the last 40 years. Among these 50 stations, temperature was recorded below -4°C at 14 stations during the late spring frost event 2017.

Our results show that, although the time of the spring frost 2017 was not particularly late compared to previous decades, its severity was exceptional in contrast to the amount of accumulated warmth during the period preceding the frost event. For stations where the temperature dropped below -4°C during this event, the frost of April 2017 was unprecedented in relation to the accumulated growing degree days (GDD), at least since the beginning of instrumental temperature records (1864).

Our results highlight how, at lower elevations in Switzerland and in Germany, global warming has considerably increased the number of days with mean temperature above 5°C in late winter and early spring, i.e. by about $+17.8 \pm 4.8^{\circ}\text{C.days.decade}^{-1}$ since 1970 or $+4.0 \pm 0.8^{\circ}\text{C.days.decade}^{-1}$ since 1864.

Late spring frosts at lower elevations now occur earlier by about $1.3 \pm 0.3 \text{ days.decade}^{-1}$ for frost $\leq 4^{\circ}\text{C}$ and 1.5 ± 0.2 for frost $\leq 2^{\circ}\text{C}$ since 1864.

In spite of this unprecedented event, our results do not show any trend in the spring frost risk over the last 150 years in lowlands of Switzerland and Germany.