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Identifying late spring frost impacts on European beech near its upper elevational limit using climatic and dendrochronology data

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Global warming has considerably advanced the start of the growing season of temperate trees. However, the rate of this phenological change does not necessarily track the changes in the date of the last spring frost, also induced by climate change, which may result in a higher risk of false spring. When a late spring frost (LSF) occurs during tree leaf emergence, it can lead to complete tree defoliation. Although the impacts of LSFs are rarely fatal for a tree, it is essential to identify those years to understand its effect on tree performance and vitality.

Here we aimed at identifying the years with potential frost damages, i.e., when frost have occurred around the time of leaf emergence of European beech (*Fagus sylvatica* L.) growing at two different elevations (1,065 and 1,365 m asl) at the Weissenstein (Swiss Jura mountains). We calibrated several phenological models using the Phenology Modeling Platform gathering various models considering forcing temperatures only or with a combination of chilling and photoperiod using high-resolution climate datasets and available phenological observations from a nearby station conducted from 2005 to 2022 (9 km away from our study sites, 1,120 m asl). The analyses are ongoing and will be compared to dendrochronology data collected from the same sites and be used to disentangle the pure effect of LSF from drought impacts on beech growth. Further investigations should be conducted on this aspect as the frequency and severity of extreme droughts are expected to increase while spring onset will continue to advance under a warmer climate, potentially increasing the risk of frost damage.