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Temperature-induced differences in timing of intra-annual growth of subalpine Larix decidua and Picea abies

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Phenological observations of plants are mostly concentrated on foliar life-cycle events such as bud break, leaf unfolding or leaf falling, which are observable from "outside" the plant. Additionally, as such phenological cues primarily characterize the beginning and the end of the growing season, many important growth processes within the growing season and within the plants remain poorly quantified.
Our research aims at describing tree growth over the full life cycle, i.e., from the beginning to the end of both primary and secondary growth along a 4 degrees Celsius natural temperature gradient. This gradient is roughly what is projected to occur over most land areas due to global warming. In this talk, we will present results about differences in timing of needle break and tree-ring formation, including timing of cambial division, cell enlargement, cell wall thickening and maturation, between two different species (deciduous Larix decidua versus evergreen Picea abies) growing in the subalpine forest of the Lötchen valley, in the central Swiss Alps. Growth observations are based on weekly micro-coring of 48 trees distributed along a 900 m elevation gradient sampled during the 2007 and 2008 growing seasons. We observed that the onset of the growing season changed by 3–4 days per 100 m elevation whereas the ending of the growing season appeared minimally related to altitude. The timing of cell enlargement, wall thickening and maturing tend to delay in a somewhat cumulative manner and cause increasing lags with elevation. This cumulative behavior is not observed for phase endings.
If associated with the monitored altitudinal lapse rate of -0.5 degrees Celsius per 100 m, these results translate into a lengthening of the growing season by $\sim$7 days per degree Celsius.
Observed differences along the altitudinal/temperature gradient and between the species will be the focus of discussion and may be linked with possible species-specific growth response to projected climate warming.