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New Station-Specific Limits in Phenology to Improve Data Quality During Online-Data-Entry

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Background and Aim

The Swiss Phenology Network counts 160 stations where private persons observe up to 69 phenological events. Currently, 68% of the observers transmit their data online by a recently developed tool called Phenotool. In order to reduce typing errors during data entry, the values are instantly checked and the observer receives a visual warning (see Fig. 1), if the date exceeds defined limits of an expected time-period. These limits need to be as suitable as possible for each station and phenological event, as numerous false warnings reduce the sensitivity of the observers and cause them to ignore the warning.
Until June 2019, general limits had been used for five altitudinal layers and for each phenological event, resulting from the mean ±2 standard deviation (SD). However, for some stations those limits were not appropriate, therefore, we decided to calculate station-specific limits.

Fig. 1: Warning in Phenotool

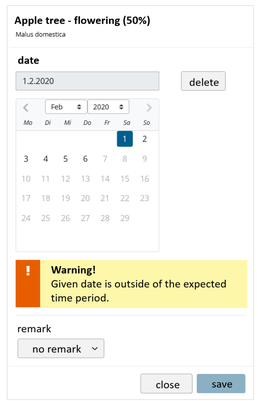


Fig. 2: Example of a deviant data series

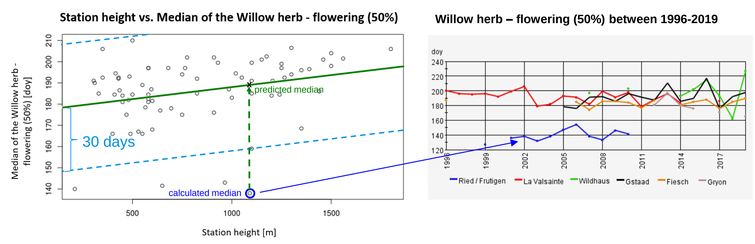
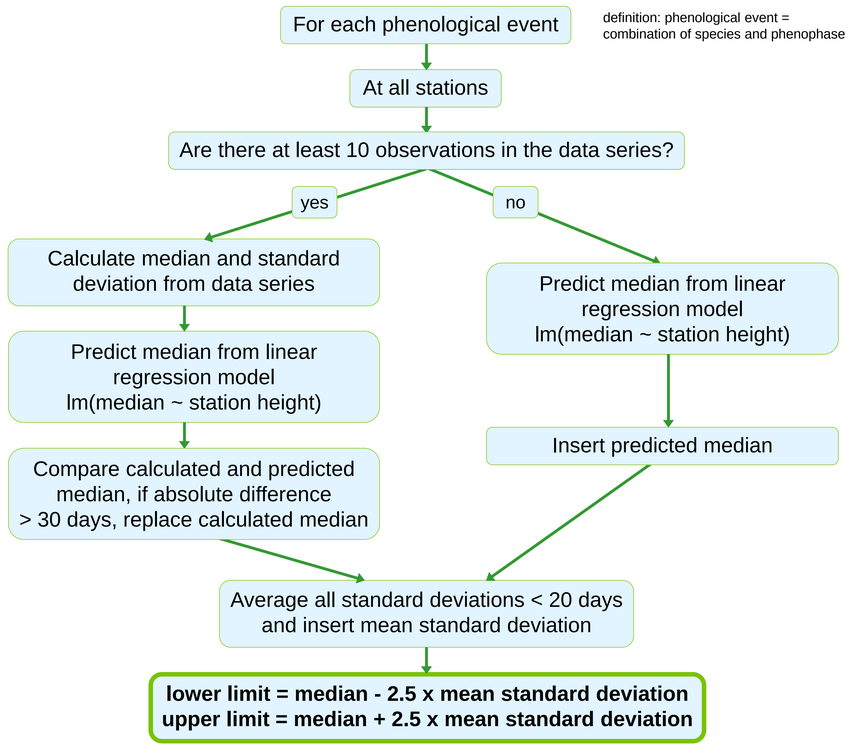


Fig. 3: Scheme for the calculation of the new station-specific limits



Method

We calculated the median and SD for each phenological series consisting of at least 10 observations within the years 1985-2019. In a second step, for each phenological event, the mean of all SDs < 20 days was calculated across all stations and 2.5 times added (subtracted) from the median in order to obtain the upper (lower) limits of the expected time-period. This approach leads to the same range of the limits for each phenological event, while the limits are specific for each station depending on the previously calculated medians. In case of deviant data series (when calculated median differs more than 30 days from predicted median, see Fig. 2) the calculated median is discarded and instead the predicted median is used. For data series with less than 10 observations, the limits are also based on the predicted median (Fig. 3).

Results and Conclusion

The comparison of the old and new limits revealed that the newly calculated limits have in average a range which is 10 days smaller. 57 out of the 69 phenological events have a smaller range, one has the same, and the remaining 11 have a larger range. As shown in Fig. 4, the range is now better adapted to early flowering in spring and late leaf colouring in autumn due to climate change.
Using the previous limits, 6.67% of the data from 1985-2019 was outside the defined ranges, however, applying the new limits results in 3.11% of the observations not fitting the limits. For the year 2019, the visual warnings in Phenotool could be reduced from 395 to 140. Considering the fact that the new limits have in average a smaller range, this improvement becomes even more significant. To conclude, we can say that the new limits produce clearly less and more appropriate warnings in Phenotool enhancing data quality.

Fig. 4: Examples of the comparison of the old and new limits