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Linking ground phenology with the NDVI derived from remote sensing observations

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The photosynthetic activity of the plant cover can be observed very well in the infrared range from space, e. g. via the NDVI, which is the Normalized Difference Vegetation Index. This paper is concerned with establishing a relationship between satellite-based land surface phenology (LSP) and ground phenology (GP) in such a way that different phenological phases can be determined in the vegetation cycle across Europe, for example the leaf shoots of birch and beech from space. In addition, MODIS satellite data previously used, which have a spatial resolution of 250m, will be compared with the high-resolution data of the new Sentinel-2 satellites with a spatial resolution of 10m. The spring phases 2016 and 2017 for Vorarlberg, Tyrol and southern Germany, southern Sweden, as well as Upper and Lower Austria are considered. The phenological ground observations are provided by the Central Institute of Meteorology and Geodynamics (PEP725) and cover Austria, Germany, Switzerland and Sweden.

For the year 2017, the PEP725 database shows the highest number of phenological ground observations for leaf unfolding of birch and beech. Beech can be the dominant tree species in Central European deciduous forests, whereas birch forests are restricted to Scandinavian countries. In Austria, the birch begins to sprout its first leaves in about mid-March. The higher the latitude, the later the leaf unfolding occurs, so it only begins in the north of Sweden from about mid-May. At the end of March and the beginning of April, the beech trees will also start to green in Central Europe, and in Sweden from the end of April. Since 1949, the time series of the beginning of leaf unfolding in Austria has shown a trend for the birch tree, for example, towards an earlier occurrence of about 10-15 days, for the beech by about 5-10 days. The main focus of this work will be to evaluate whether the spatial resolution of 10m and temporal resolution of 10 days of the NDVI index calculated from the Sentinel-2A data is sufficient to determine the entry dates of leaf unfolding of selected deciduous tree species from satellite data.