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Direct Attribution of the Anthropogenic climate signal to PHENological observations - DATAPHEN

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Warming of the climate system has been widely observed during the last decades. Attribution analyses suggest that the global pattern of warming during the past half century is very likely caused by human-induced greenhouse gas forcing. Although up to present a considerable number of detection and attribution studies have been published dealing with the problem over a range of atmospheric parameters and over a large spatial range, there is still a dearth on direct attribution studies, which quantitatively link the human influence on the climate system with observed impacts for instance on the biosphere. This work intends to apply the direct attribution method via an end-to-end modelling system to quantitatively link anthropogenic forcing with the observed shift of phenological entry dates.
From the PEP725 (Pan European Phenology data base, www.pep725.eu) 36 phenological phases have been select with a sufficient spatial coverage over Central Europe. In order to deduce the parameters for the Temperature Sum Model (TSM), daily mean temperatures from the ECA&D station network have been prepared.
While working on the project a sufficient number of CMIP5 runs have become available, so that we could compile 7 models with an ensemble of 27 runs for the historicalNat case (20th century runs with natural forcing only) and 6 models with altogether 35 runs for the historical case (20th century runs with all forcings). Additionally there is one observational data set (ECA&D 0.25° resolution grid over Europe, http://eca.knmi.nl), two reanalysis runs (ERA40 and NCAR-NCEP) one 1000 year piControl (preindustrial control run), adding up to 66 data sets.
The daily mean temperature data of the 66 above mentioned data sets are interpolated to all ECA&D stations, where the TSM parameters have been deduced. After the phenological entry dates have been modelled for 66 cases at the ECA&D stations, a mean Central European phenological time series is calculated. The subsequent statistical analysis includes a validation of the TSM and some consistency considerations.
As a first step the monthly mean temperature time series from 1850 – 2000 of the GCM ensemble of different forcings (historical versus historicalNat) have been compared. Before applying the TSM it was checked, if above selected GCM temperature data sets already indicate any significant differences between the two forcing scenarios considered. In the global case a systematic difference in trend of about 0.5°C can be observed from 1970 – 2005. In case of the Central European area (0°E – 25°E, 45°N – 55°N), which is the area, where most of the phenological observations come from, the difference of the two forcing scenarios are much less pronounced, but still clearly visible in case of yearly means and in all individual seasons.