COST725 => PEP725 and BACCHUS

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Phenology what for?

- Important tool for climate change impact studies - IPCC AR4
- Interaction between atmosphere and biosphere is a crucial area of study for increasing knowledge of critical exchanges in the planetary carbon balance
- Important and necessary to have ground truth observations for NDVI-data (normalized differential vegetation Index – photosynthetic activity)
- Vegetation influences the albedo, the evapo/transpiration and thus the energy budget of the earth – atmosphere system
- Knowledge about and the input of the status of vegetation leads also to a better performance of NWP models
Box 1.3. Phenological responses to climate in Europe: the COST725 project

The COST725 meta-analysis project used a very large phenological network of more than 125,000 observational series of various phases in 542 plant and 19 animal species in 21 European countries, for the period 1971 to 2000. The time-series were systematically (re-)analysed for trends in order to track and quantify phenological responses to changing climate. The advantage of this study is its inclusion of multiple verified nationally reported trends at single sites and/or for selected species, which individually may be biased towards predominant reporting of climate-change-induced impacts. Overall, the phenology of the species (254 national series) was responsive to temperature of the preceding month, with spring/summer phases advancing on average by 2.5 days/°C and leaf colouring/fall being delayed by 1.0 day/°C.

The aggregation of more than 100,000 trends revealed a clear signal across Europe of changing spring phenology with 78% of leaf unfolding and flowering records advancing (31% significantly sig.) and only 22% delayed (3% sig.) (Figure 1.6). Fruit ripening was mostly advanced (75% advancing, 25% sig.; 25% delayed, 3% sig.). The signal in farmers’ activities was generally smaller (57% advancing, 13% sig.; 43% delayed, 6% sig.). Autumn trends (leaf colouring/fall) were not as strong. Spring and summer exhibited a clear advance by 2.5 days/decade in Europe, mean autumn trends were close to zero, but suggested more of a delay when the average trend per country was examined (1.3 days/decade).

The patterns of observed changes in spring (leafing, flowering and animal phases) were spatially consistent and matched measured national warming across 19 European countries (correlation = −0.69, P < 0.001); thus the phenological evidence quantitatively mirrors regional climate warming. The COST725 results assessed the possible lack of evidence at a continental scale as 20%, since about 80% of spring/summer phases were found to be advancing. The findings strongly support previous studies in Europe, confirming them as free from bias towards reporting global climate change impacts (Menzel et al., 2006b).

![Figure 1.6. Frequency distributions of trends in phenology (in days/year) over 1971 to 2000 for 542 plant species in 21 European countries. From Menzel et al. (2006b).](image-url)
PEP725 Pan European Phenological Database

PEP725
Key-Deliverables

D1 Development, operations and management of the PEP725 database
  D1a Improve Data Quality Checks
  D1b Data organisation

D2 Development, operations and management of the PEP725 webportal with free unrestricted data access
  D2a Development data input and data query
  D2b Visualisation of data

D3 Workshops conferences, reporting
PEP725       Project core team & members

PM:                Elisabeth Koch

Project team:   Silke Adler, Wolfgang Lipa, Markus Ungersböck, Susanne Zach-Hermann

+ 16 European NMHS and 8 NOPS

<table>
<thead>
<tr>
<th>Country</th>
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<td>ZAMG, Austria</td>
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<td>RMI, Belgium</td>
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<td>NMAR, Romania</td>
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<td>SHMÚ, Slovak Republic</td>
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Redesign of COST725 database
Open for new plants/animals and phases
Implementation of the COST database: 8 Mill. Records
Update of new data
About PEP725

PEP725, a project funded by ZAMG, the Austrian ministry for science & research, EUMETNET, and the network of European meteorological services, started in 2010 and will be running for 5 years.

The main objective of PEP725 is to promote and facilitate phenological research by delivering a pan-European phenological database with an open, unrestricted data access for science, research and education.

So far 16 European meteorological services and 7 partners from different phenological network operators have joined PEP725.
Getting PEP725 datasets

As mentioned before, the main topic of PEP725 is the exchange of phenological datasets - so how can you get it?

**Step 1: Registration or Login**
The access to the dataset is free of charge but requires a registration on our website and you have to agree with our terms and conditions (PEP725_Data_Policy_201012.pdf). If you have already done the registration, just login with your email address and username (on the top right) or here.

**Step 2: Select your data**
At the moment you can only select by plant and country - our next step would be a more sophisticated selection method. If you need many different plants or only certain phases (large datasets) please get in contact with us!

**Step 3: Check your mailbox for the download link**
The download links to your selected datasets will be mailed to you - it is not allowed to redistribute the link or the data outside your working group.

**Step 4: Use the data and give us feedback**
For us, this is the most important point. If you use the PEP725 Dataset for any publication you have to cite the data source (of course) as mentioned in the Data Policy and we'd like to show at least the bibliographic information on this site - if possible send us a copy of your work (for the website or just for our internal use - that's up to you).

[PEP725, Imprint & Legal Notes](#)

[back to homepage](#)
These results raise questions about:
- Model structure that test predicts future phenology,
- Model forecasts of phenological response to climate change (2050–2100),
- What are the sources of uncertainty?
- What are the impacts of the uncertainty of phenological forecasts in ecosystem models and land surface schemes?
PEP725 is a 5 years project having started in 2010 is funded by EUMETNET and ZAMG with its main objective to collect and distribute phenological data from all of Europe.

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*free and unrestricted for science, research and education!
BACCHUS * historical phenological vine data

Temporal (1500 – today)

Spatial
Vienna, Klosterneuburg, Retz
BACCHUS – Historical sources

- Serial sources
  - annals
  - chronicles
  - newspapers

- Archival sources
  - Diaries – winemakers in Klosterneuburg and Retz
  - Accounts – Buergerspital Vienna and Retz
  - calendars
  - letters
  - …
BACCHUS Running Correlation
between „historic“ Klosterneuburg GHD and mean temperatures Vienna

Running Correlations (10-year-windows) are largely stable, if several months are combined, exception around 1860-1870

=> sum of squared errors reaches its maximum in the corresponding decade of the temperature reconstruction
BACCHUS – temperature reconstruction May to July - comparison

Temperature records from Austria, Burgundy and Swiss Plateau

- Instrumental temperature data
  
  **HISTALP data base**  www.zamg.ac.at/histalp

  Basel-Binningen  >= 1760
  Geneva-Cointrin  >= 1760
  Hohe Warte-Vienna  >= 1775
  Strasbourg-Entzheim  >= 1801

  **sources:**
  Auer et al., 2007
  Böhm et al., 2008 - bias-corrected version
Methods: definition of extremes

searching for:

- **„historical“ pre-instrumental period 1523-1774**
  grape harvest, flowering and mellowness dates exceeding the *double standard deviation* with regard to 105-year reference periods.

- **„historical“ instrumental period 1775-1960**
  grape harvest, flowering and mellowness dates as well as multi-month mean temperatures (AMJJ,MJJ) exceeding the *double standard deviation* with regard to the same reference periods.

- **„modern“ instrumental period 1961-2007**
  grape harvest dates and highly significantly correlated multi-month mean temperatures exceeding the double standard with regard to the same reference periods.
Results: time series GHD Burgundy
Results: time series GHD Klosterneuburg and Vienna
Results: time series GHD Swiss Plateau
eruption of Tambora 1815 >> late harvest / cold year 1816

Austria

Puntschert, J.K. : Denkwürdigkeiten der Stadt Retz (Selbstverlag der Stadt Retz 1894)

manuscript121, Stiftsarchiv Klosterneuburg
Gedenck Buch und Wein Chronieck

1815 no harvest (hail)
1816 medium quality and quantity.

1815 Little snow, February and March warm
17 April frost May warm 5 June vine flowering
19 July hail window glass broken
12 October harvest good quality but small quantity
1816 21 to 31 March snow, May cold,
22 June vine flowering
September October cold
25 October harvest vine sour

-2.4° C May to July

temperature records Vienna
eruption of Tambora 1815 > late harvest / cold year 1816

Grape harvest
- +29 days delayed in Swiss plateau
- +24 days delayed in Burgund
- +19 days delayed in Klosterneuburg

Monthly mean temperatures
May to July: -2.4°C all regions
Results: Cold pre-instrumental years 1542, 1675

- **1542:**
  - Harvest was remarkably delayed at all three locations.
  - Bad year for wine in Retz, which is affirmed by a source from Würzburg (Germany) and ascribed to the cold summer.

- **1675:**
  - One of the two years with the latest grape harvest in the region of Vienna and Swiss Plateau, which seems to be due to a very cold May with snow and frost.
  - Retz chronicles tell us about little and bad wine after a late harvest.
  - Quantity was also reduced by a bug plague, therefore an order of the Austrian government called for the collection of the bugs.
Results: Cold instrumental years 1821, 1980

- **1821:**
  - Very wet conditions dominated the vegetation period in nearly all European countries, leading to floods which destroyed large parts of the harvest.
  - An extreme negative anomaly of about -4 degrees Celsius in June mean temperature is reflected in the depiction of an unusually late coldness. Cold winds, morning frost and snowfall are reported in some parts of Austria on June 20th.
  - The Retz chronicles note bad and little wine.
  - One manuscript of Klosterneuburg speaks of a „late grape harvest, the saddest in Austria within living memory“.

- **1980:**
  - Grape harvest date looks record-breaking, but has to be seen under the light of apparent change in vinification in the region of Vienna.
Results: Warm pre-instrumental years 1540, 1718

1540:
- Second earliest grape harvest in the Swiss Plateau Region after 2003.
- Retz experiences a dry and very hot summer, followed by a very early harvest and very good and strong wine.
- Grape harvest in Vienna “yielded such an amount that people did not have enough barrels into which to pour the most“.

1718:
- “Terrible heat“ in Retz, which caused the grape harvest to be finished everywhere at the beginning of October. The wine was praised as being very good.
- Negative grape harvest anomalies at all three investigated sites
- The draught even resulted in a public order to pray for rain. Apart from grapes, all other field crops turned out badly. People had to fight against forest fires; wells dried out.
Results: Warm instrumental years 1811, 2003

- **1811:**
  - Remarkable temperature deviations culminating in a positive anomaly of about 5 degrees in June.
  - No earlier harvest date can be found in the region of Vienna.
  - Retz chronicles report „Famous, brilliant first class wine year. The vines sprouted and withered fast; the grapes ripened in August. Very much and excellent wine.“ The price per 56.59 (= 1 „emer“) l is given between 80-185 fl (!).

- **2003:**
  - Burgundy and the Swiss Plateau Region had never before experienced such an early grape harvest date.
  - The harvest at Klosterneuburg was advanced by 19 days, which is in the range of advances in the „historical“ period.
Conclusions

- This study aimed at quantifying phenological and/or highly correlated mean temperature extremes with regard to a past long term average and their development under the influences of trends. The exclusiveness refers to spring to (early) summer conditions.
- In 1540, 1718, 1811 and 2003 (and 2007) very extreme early phenological conditions occurred at all three vine-growing sites (region of Vienna, Swiss Plateau Region and Burgundy).
- In 1542, 1675, 1816, 1821, 1837, 1879, 1980 were extreme negative temperature anomalies and/or extreme positive phenological anomalies.
Discussion

- **Austrian speciality**: mean temperatures and grape harvest dates in Vienna both show a positive trend, change in vinification explains the unexpected results (only „moderate“ negative extreme in 2003 but record-breaking positive extreme in 1980) at the turn of 20th/21st century.

- **Data gaps in the Viennese and Klosterneuburg data**
  restrictions in finding extremes in the pre-instrumental period. In some years, like 1740, harvest dates were not recorded, perhaps merely because of the fact that vintage turned out to be so bad.

- **Contradictory descriptive information** on a small scale (e.g. Retz chronicles 1797) is rare but occurs local influences??? errors ??? In transcription where we could not find the original sources
THANK YOU

ZAMG - Mehr als nur Wind und Wetter