Ecological long term measurements at Austrian Level II-Plots

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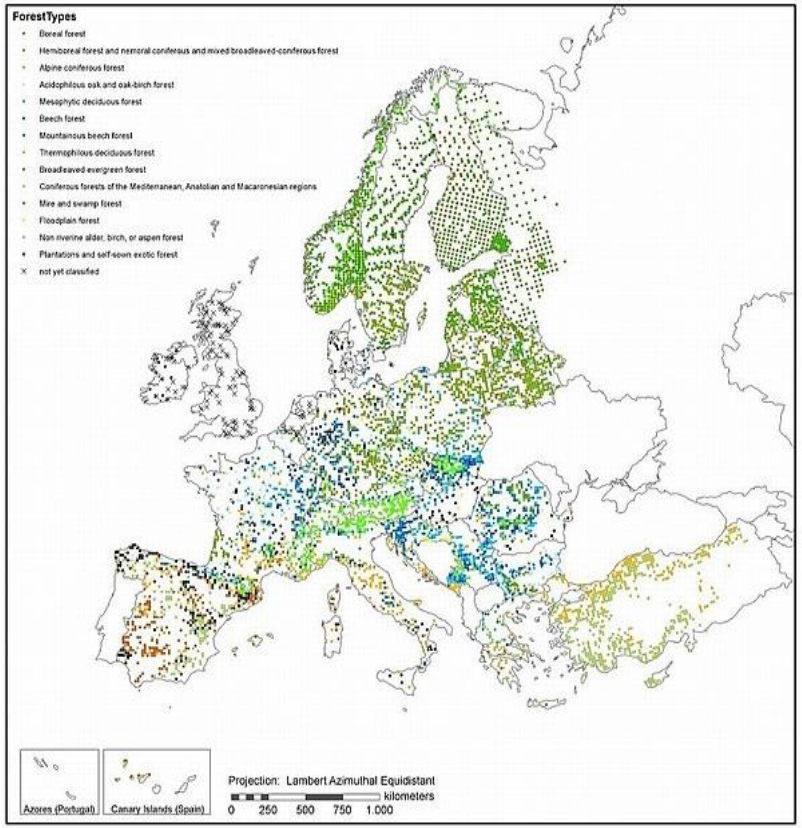
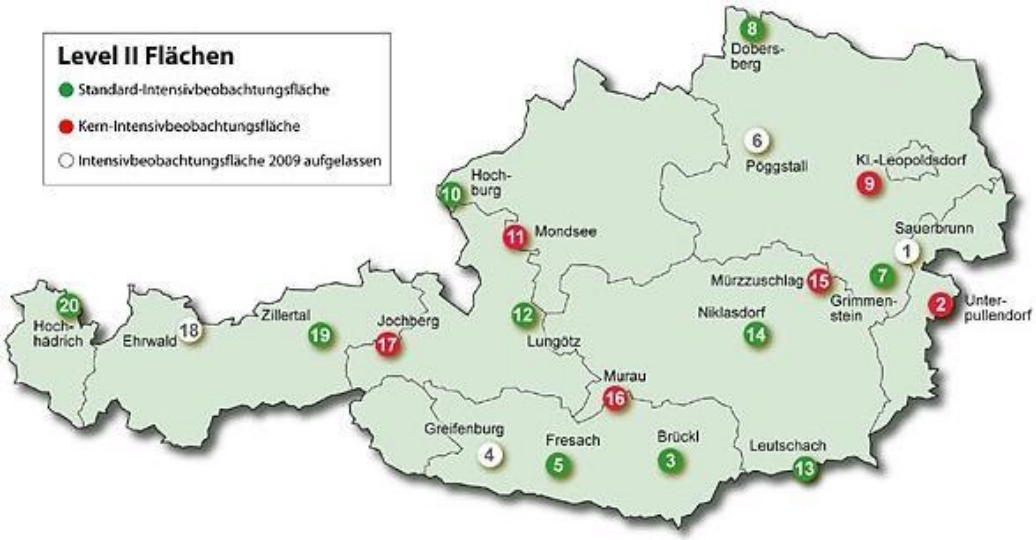
INTRODUCTION

- The International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests **(ICP Forests)** exists since 1985 .
- More than 40 countries throughout Europe participate in this programme.
- Within the framework of ICP Forests the condition of the forests is monitored by two different intensity levels.
- **Level I monitoring** takes place at almost 6000 observation plots at a systematic transnational grid of 16 x 16 kilometers.
- **Level II intensive monitoring** occurs Europe-wide at more than 600 plots in selected forest ecosystems.



Level II-Plots in Austria



- Originally, 20 Level II plots were installed and operated until the year 2009.
- In 2009, the Europe-wide project FUTMON (Future Monitoring) started, which should intensify the monitoring activities.
- The collected data should provide information about the effects of climate change and air pollution, the biodiversity and the health conditions of the European forests.
- One of the main consequences of this project for Austria:
  The total number of Level II-plots was reduced to 16, however, 6 so called „Core-plots“ were installed.

Standard observations

leaf and needle analysis

crown condition

vegetation

soil analysis

growth

deposition

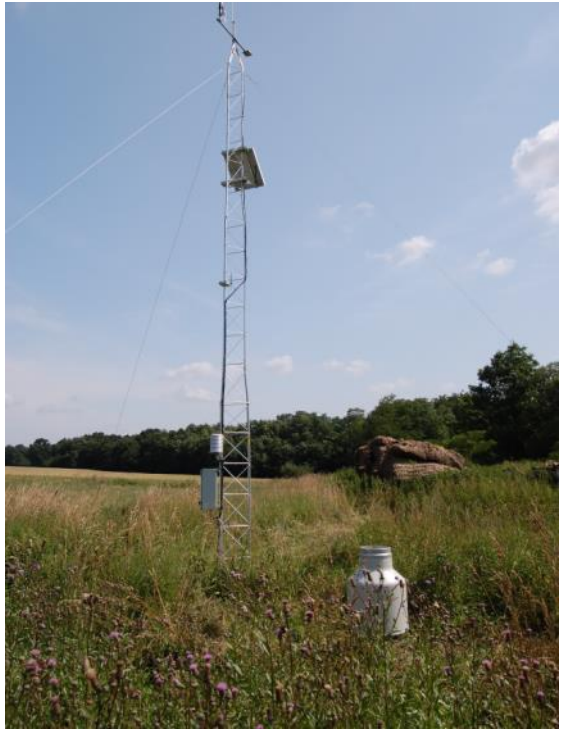
Datalogger measurements at the Core-Plots

- **meteorological measurements**
  air temperature
  relative air humidity
  global solar radiation
  wind speed
  wind direction
  precipitation

- **measurements in the soil**
  soil temperature
  soil water content
  soil solution

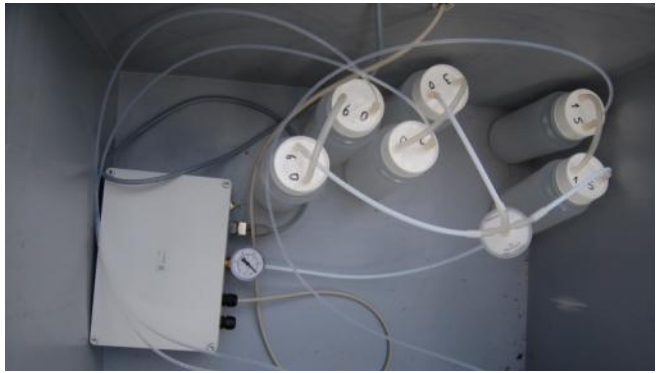
- **measurements at the tree**
  changes of tree circumference

Pictures of a meteorological station



Components of a forest stand station

- data logger and additional equipment
- dendrometer
  10 sensors on 10 trees
- soil moisture sensors
  3 profiles with 3 sensors in 3 different depths
- soil temperature sensors
  1 profile with 6 sensors in 6 different depths
- soil solution pumps
  3 pumps for 3 profiles for soil water sampling in 3 depths



Further development of the forest monitoring in Austria

- The planned follow-up project for continuing the European monitoring activities after the FUTMON-project did not get the grant. All attempts, to achieve a Europe-wide standardized continuation of the forest monitoring failed.
- For the time being BFW decided to continue the measurements at the Level II monitoring plots. However, again and again there are discussions about cost reductions and abandoning of plots.
- For this reasons we tried to incorporate our plots in other networks like LTER = Long Term Ecological Research (www.lter-austria.at) and to increase the potential to get money for the plots..
- This network has international partners ILTER (https://www.ilter.network/) and the European branch ELTER (https://www.lter-europe.net/) is very active.
- At this European level a European Research Infrastructure (RI) (comparable with CERN) is developed. Finally, a part of the LTER-sites will belong to this infrastructure and will be financed by the European countries.

The Infrastructure project LTER-CWN

- In connection with these efforts we got the possibility to be a part of the FFG-project LTER-CWN, where the Level II plot Klausen-Leopoldsdorf is included. (http://www.lter-austria.at/cwn/).
  Project Leader: Univ.Prof. Stephan Glatzel
- Such projects have the focus on single monitoring plots, however, they are a good possibility to get additional money and a better infrastructure for the plots.
- The project started in 2017 und will end in 2022

ICP-Forests Level II/LTER Plot

Klausen-Leopoldsdorf

pre-existing infrastructure and data

- meteorological Station
- soil moisture and soil temperature measuring system
- soil solution samplers
- litter collectors, precipitation collectors
- dendrometers

Data: soil chemistry, soil physics; growth, vegetation monitoring, crown maps

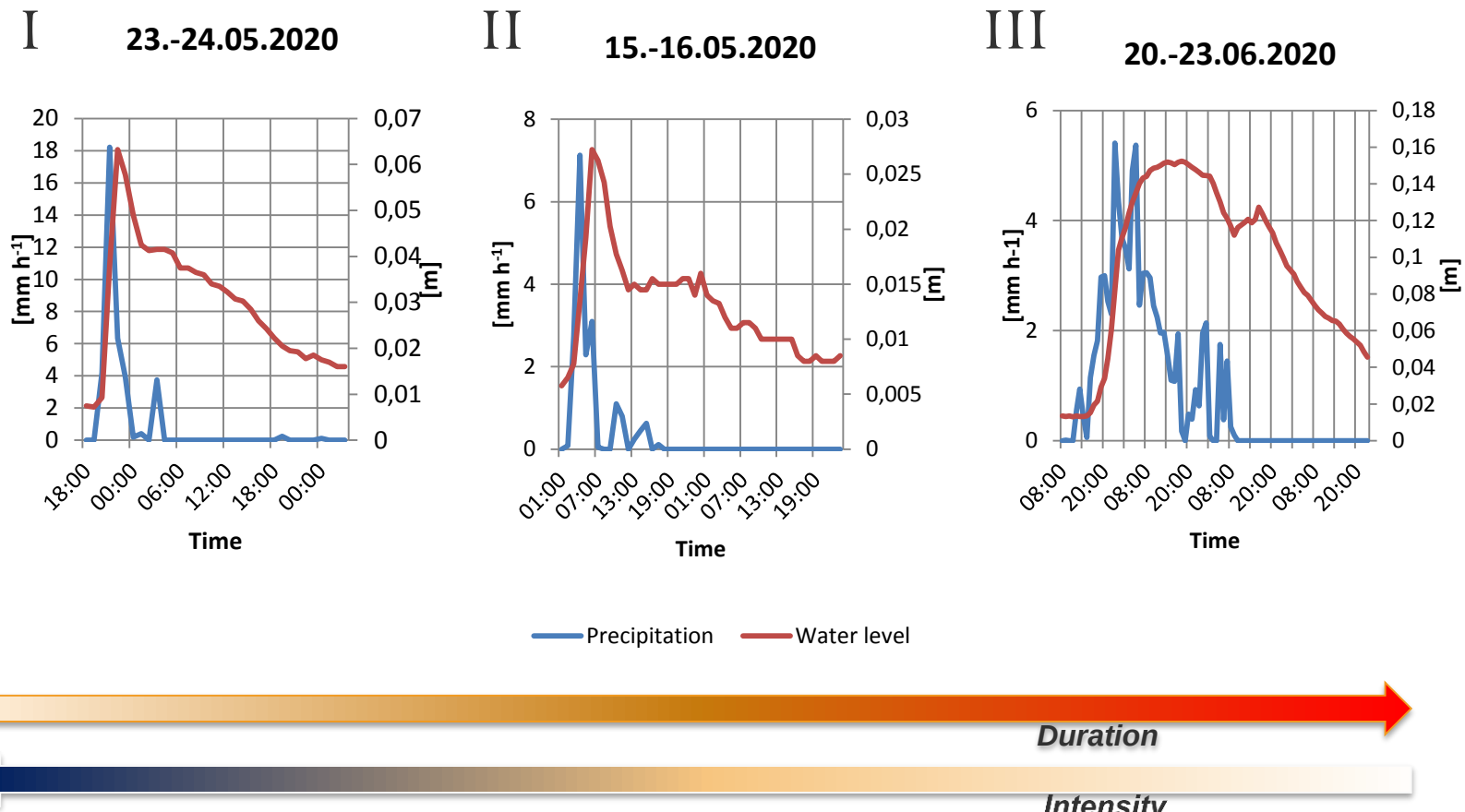
new installed infrastructure

- measuring weir with multi-parameter probe
- sap flow measurement system
- soil gas flux measurement chambers
- registering dendrometers
- infrastructure from the project: Laser for mobile measurements of the soil gas flux in the field on a trailer
- connection for power supply

Measuring weir Klausen-Leopoldsdorf

- The investigated catchment area is about 46 ha.
- The measurements started in February 2019.
- A multi-parameter probe of the Austrian company SCAN is used.

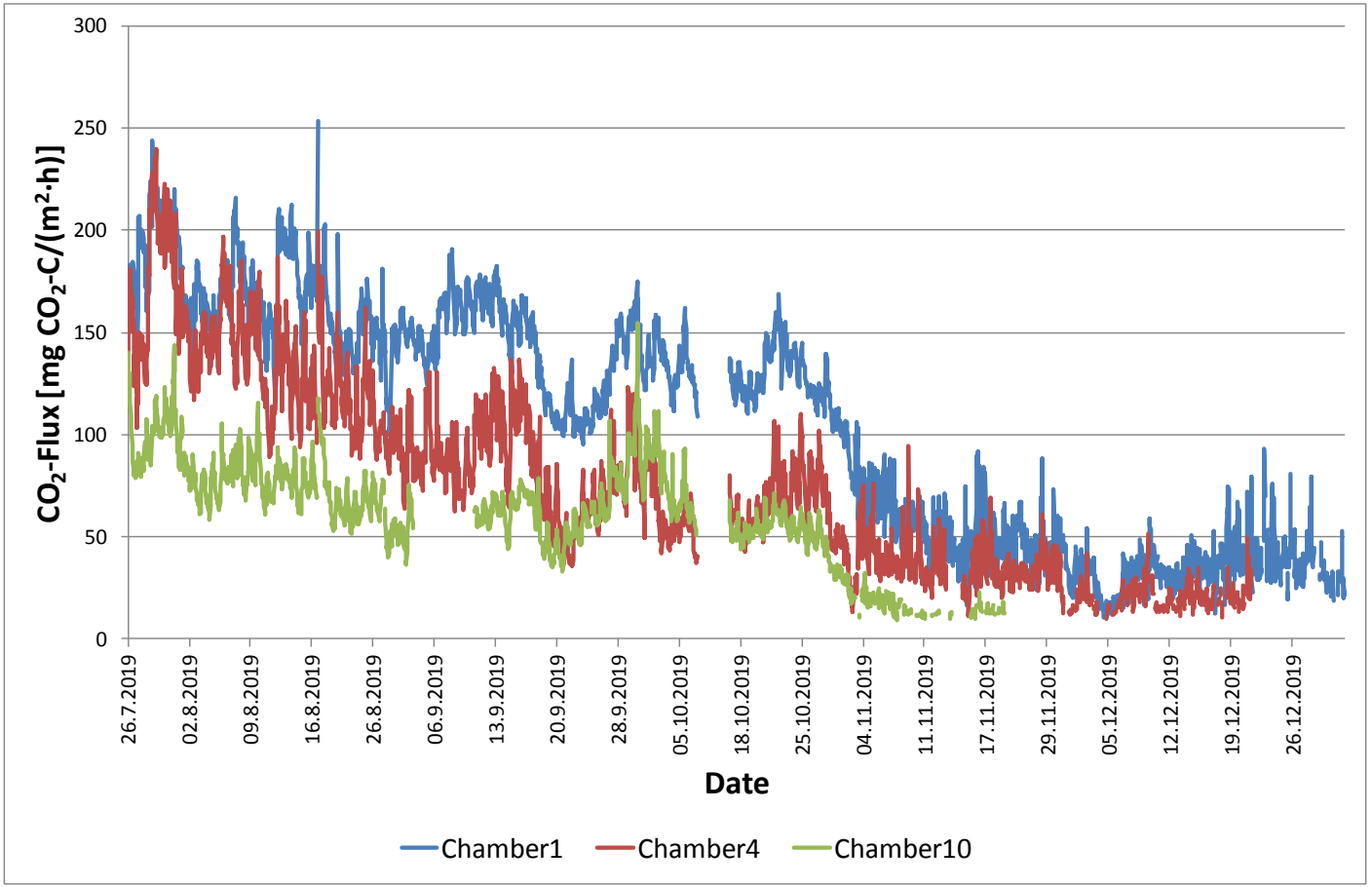
Heay rainfall events in the year 2020
with different intensity and duration at the level II plot Klausen-Leopoldsdorf



CO_2 – soil gas flux chambers Klausen-Leopoldsdorf

- 12 fully automatic soil gas flux chambers were installed in the same area as the sap flow measurement system to measure the CO_2-flux from the soil.
- The measurements started in July 2019.
- The chambers were constructed by the Austrian company Christian Holtermann.

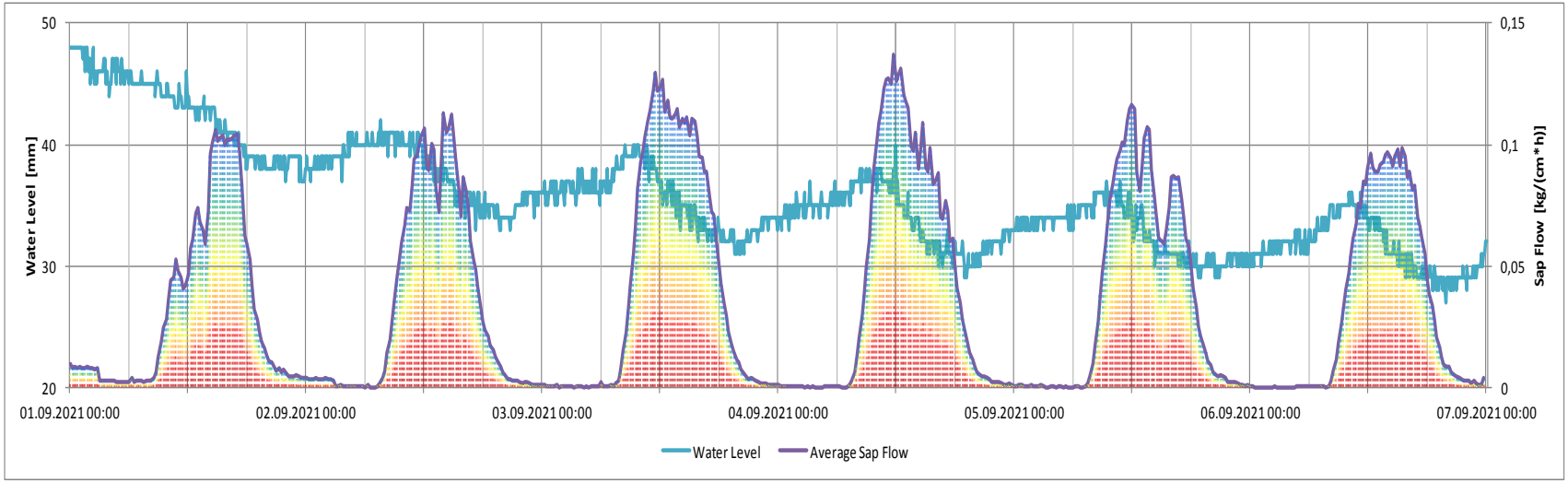
CO_2-flux of three selected soil gas flux chambers during the second half-year 2019 in Klausen-Leopoldsdorf



Sap flow measurement system Klausen-Leopoldsdorf

- 10 beech trees in the vicinity of the level II plot with different stem diameters were equipped with sap flow sensors.
- The measurements started in September 2018.
- The sensors EMS81 of the company EMS (Brno) are used.

Relationship between sap flow of the beech trees and measured water level at the measuring weir during a period of fine weather in September 2021



Graphic provided by Sebastian Riedel

Conclusions

- **Forest monitoring exists already for a relative long time**. The first systematic Europe-wide monitoring program started during the eighties and nineties of the last century. It was developed due to the large problem of the forest decline which occurred during this time.
- However, **the particular subject of the monitoring has changed** during the monitoring process. At the beginning, air pollution damaging the forest, was the main topic to monitor the forest conditions. Nowadays, the main topic is the climate change, which has a lot of direct and indirect effects on the forests.
- With the increasing importance of the LTER-network **a more and more holistic approach** is needed. Apart from natural scientific questions to water-, heat- or energy-balances and the biotic conditions (e.g. biodiversity) of forest sites, socio-economic problems of the forest sector become more important. This induces more and better cooperations with other research institutions.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SF81
www.emsbrno.cz

Foto | Filmstill aus „See Aural Woods" (Luma.Launisch & Takamovsky)

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