CzechGlobe

Global Change Research Institute

Czech Academy of Sciences,
The Czech Republic

Marian Pavelka, Lenka Krupková

OP Výzkum a vývoj pro inovace

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

EVROPSKÁ UNIE
EVROPSKÝ FOND PRO REGIONÁLNÍ ROZVOJ
ŠANCE PRO VÁŠ ROZVOJ

THE STRUCTURE AND INTERCONNECTION OF THE CZECHGLOBE RESEARCH ACTIVITIES

3 basic thematic segments :

Atmosphere

Ecosystems

Socio-economic systems

RESEARCH DOMAINS:

CLIMATE ANALYSIS AND MODELLING

ECOSYSTEM ANALYSIS

IMPACT STUDIES AND PHYSIOLOGICAL ANALYSIS

HUMAN DIMENSIONS OF GLOBAL CHANGE IMPACTS

ADAPTIVE AND INNOVATIVE TECHNIQUES

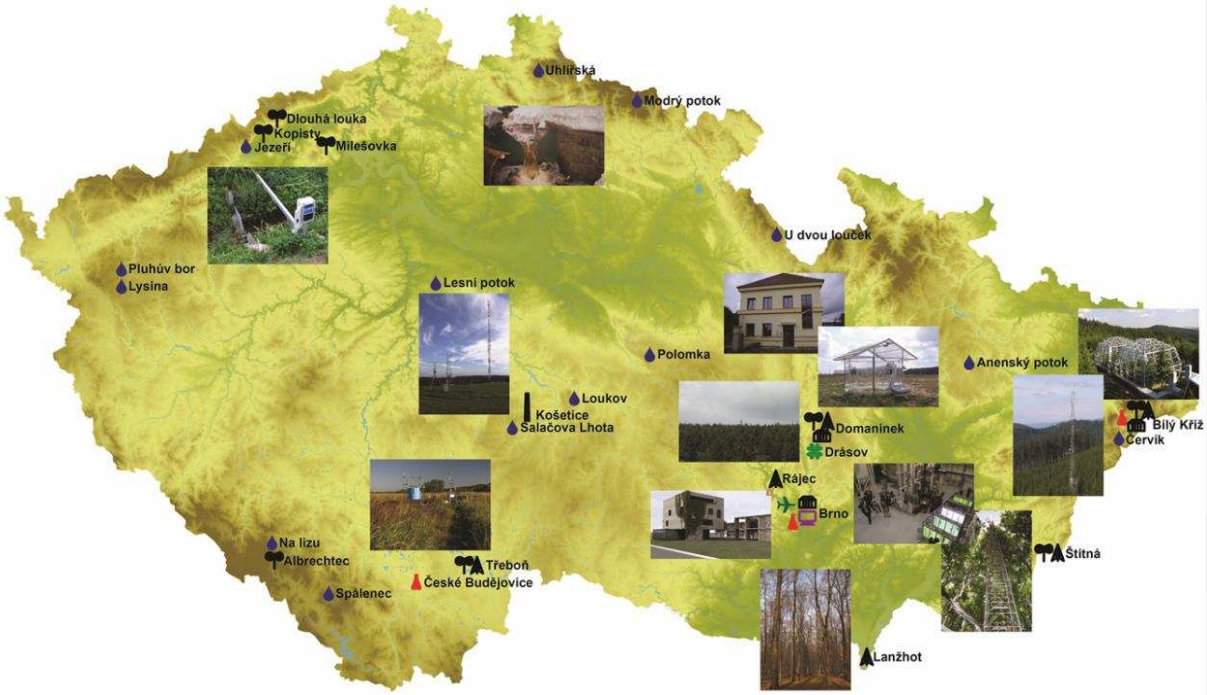
17 research teams

CzechGlobe Global Change Research Institute CAS

Department of Matter and Energy Fluxes

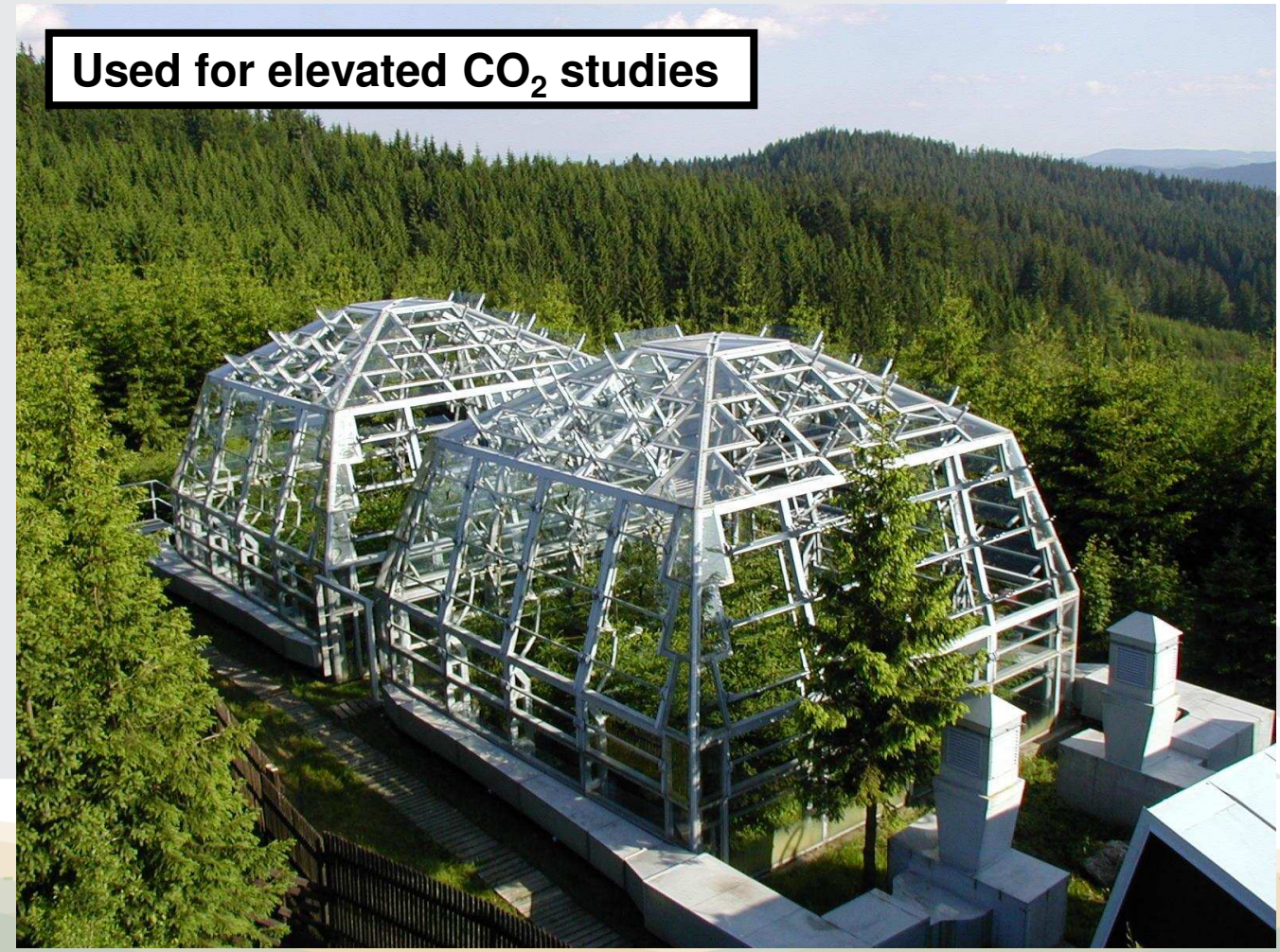
Marian Pavelka

CZECHGLOBE – SPATIALLY DISTRIBUTED INFRASTRUCTURE



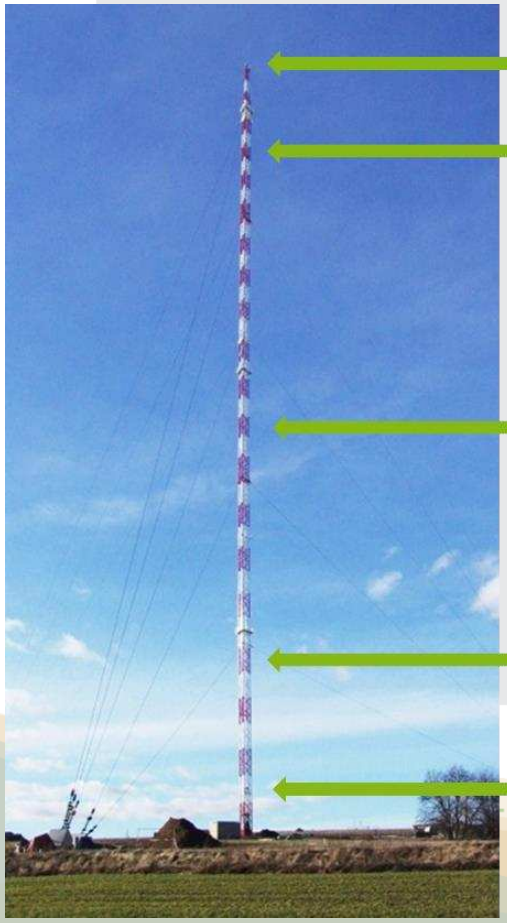
- atmospheric station of greenhouse gases monitoring
- network of ecosystem stations for monitoring and quantification of carbon fluxes within ecosystems
- meteostations
- network of catchments monitoring geo- and hydrological cycles
- physiological, metabolomic and isotopic laboratory
- airborne laboratory of process imaging
- PC terminals of supercomputers for climate simulations, data analyses and process imaging of Remote sensing
- systems of long-term impact experiments
- innovation equipment for the development of third-generation biofuels

Lamella Domes



Atmospheric Tower

National reference point of GHG observation



250 m (meteo, CO_2, CO, CH_4, N_2O, SF_6, ^{222}Rn)

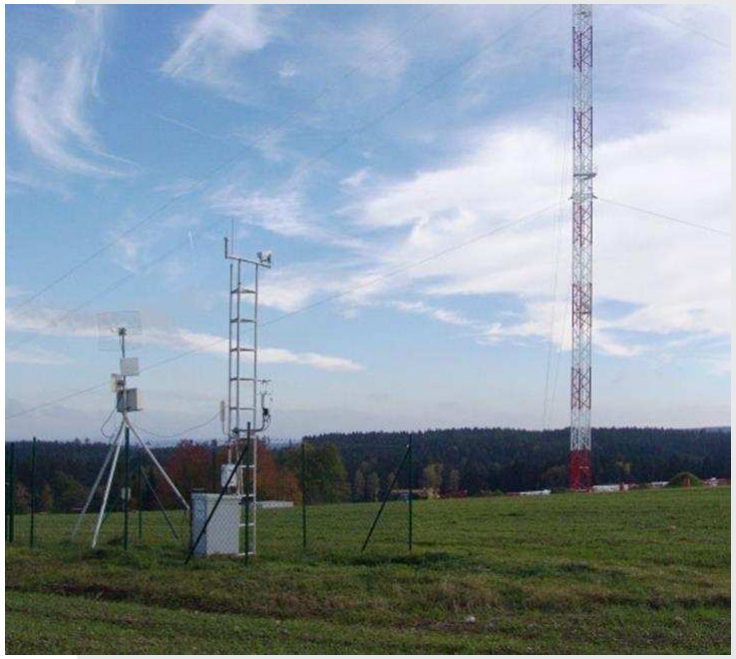
230 m (meteo, O_3, Hg)

125 m (meteo, CO_2, CO, CH_4, N_2O, O_3)

50 m (meteo, CO_2, CO, CH_4, N_2O, O_3)

10 m (meteo, CO_2, CO, CH_4, N_2O, O_3)

Ecosystem station network



Research area of the team

- **Long-term monitoring** of greenhouse gases fluxes and meteorological elements (network of ecosystem stations)

- **Understanding of physiological processes** (level cell – individual – ecosystem) affecting ability of ecosystems to bind atmospheric carbon

- **Quantification and dynamics** of ecosystem CO_2 fluxes and model estimation of future development and up-scaling into the Czech Rep. scale

- Description of ecosystems adaptation to global climate change and a **proposal of arrangements** that will reduce negative impacts and increase the ability of ecosystems to bind CO_2 from atmosphere

What does it mean Ecosystem Station (ES)?

- Infrastructure of Ecosystem Stations are built for precise long term monitoring the functioning of land ecosystems and the exchange of energy and greenhouse gases between the ecosystems and the atmosphere

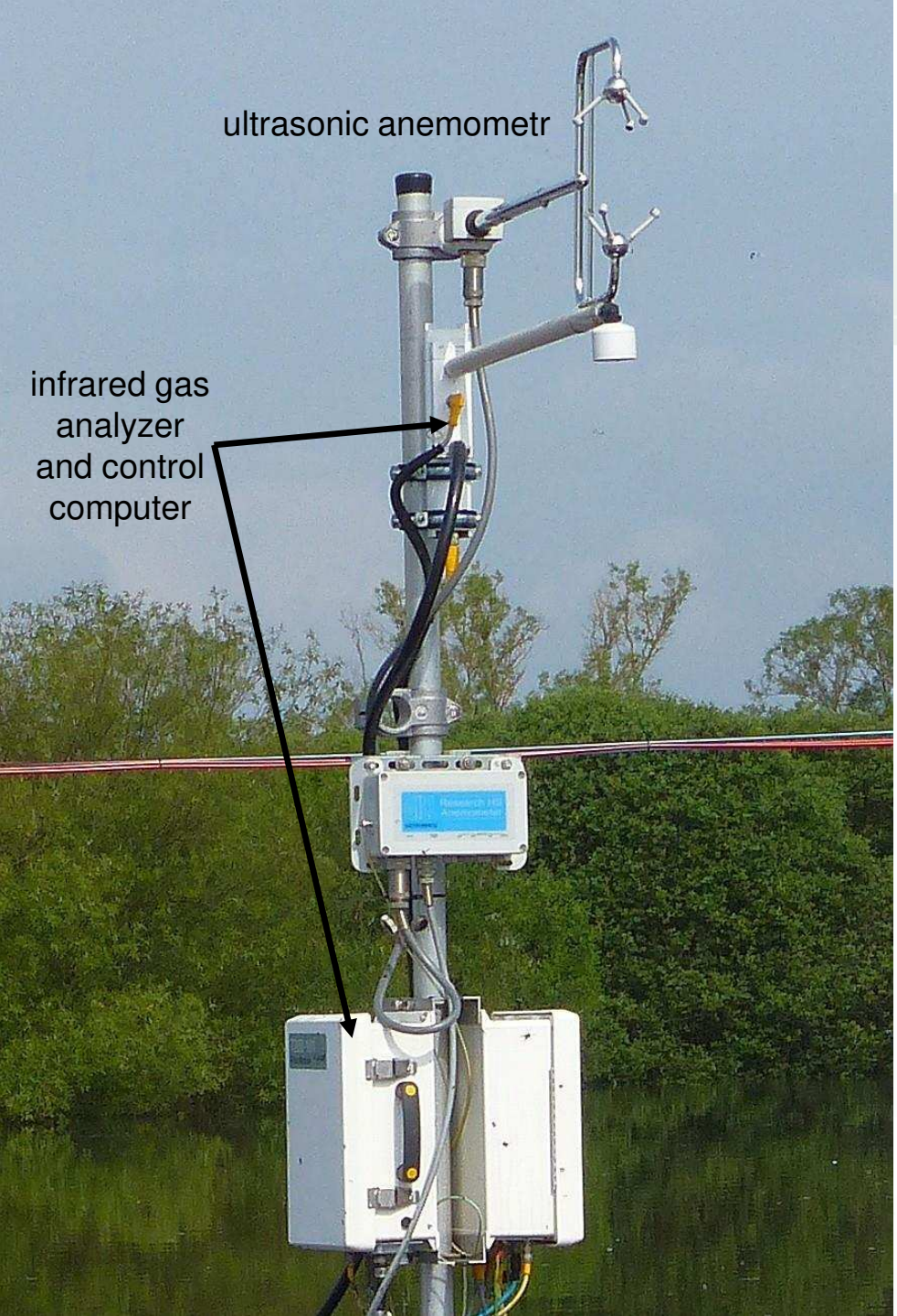
- An essential part of ES is a **tower equipped by eddy covariance** system and set of sensors for measurement of micrometeorological parameters

- Equipped with **standardized sensors** and measurement systems

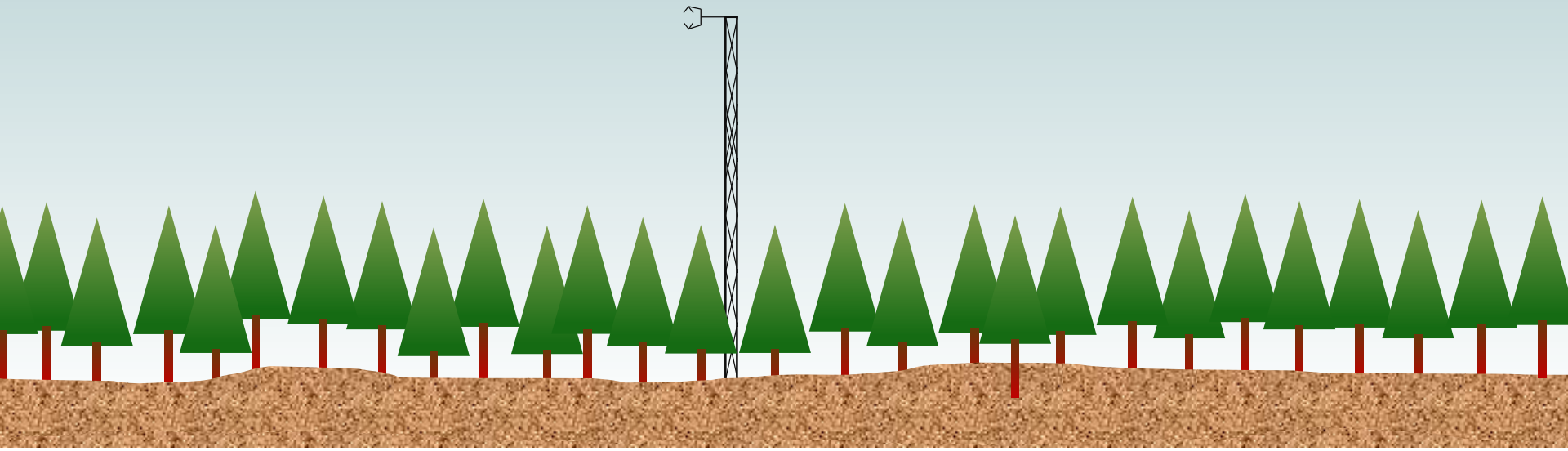
- Standardized **data processing**

Eddy covariance technique

Eddy covariance technique



Principle of eddy-covariance method



Equation: $F_C = \overline{w}\,\overline{\rho_C} + \overline{w'\rho'_C}$

average vertical flux — eddy flux

w – vertical component of a wind velocity vector

ρ - a scalar (temperature, gas concentration)

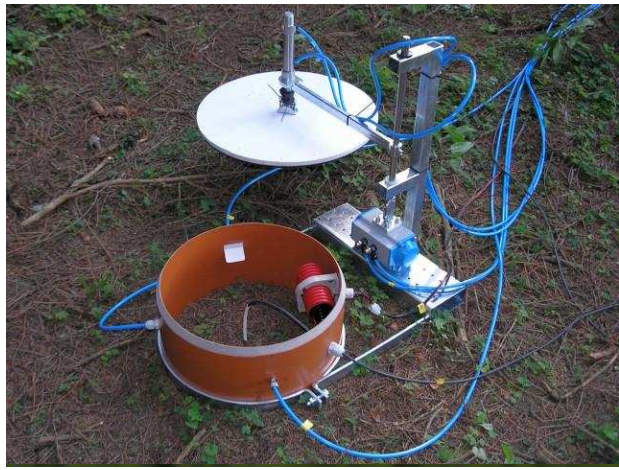
In suitable (long time) interval → $\overline{w} = 0$

Final form : $F_C = \overline{w'\rho'_C}$

eddy flux

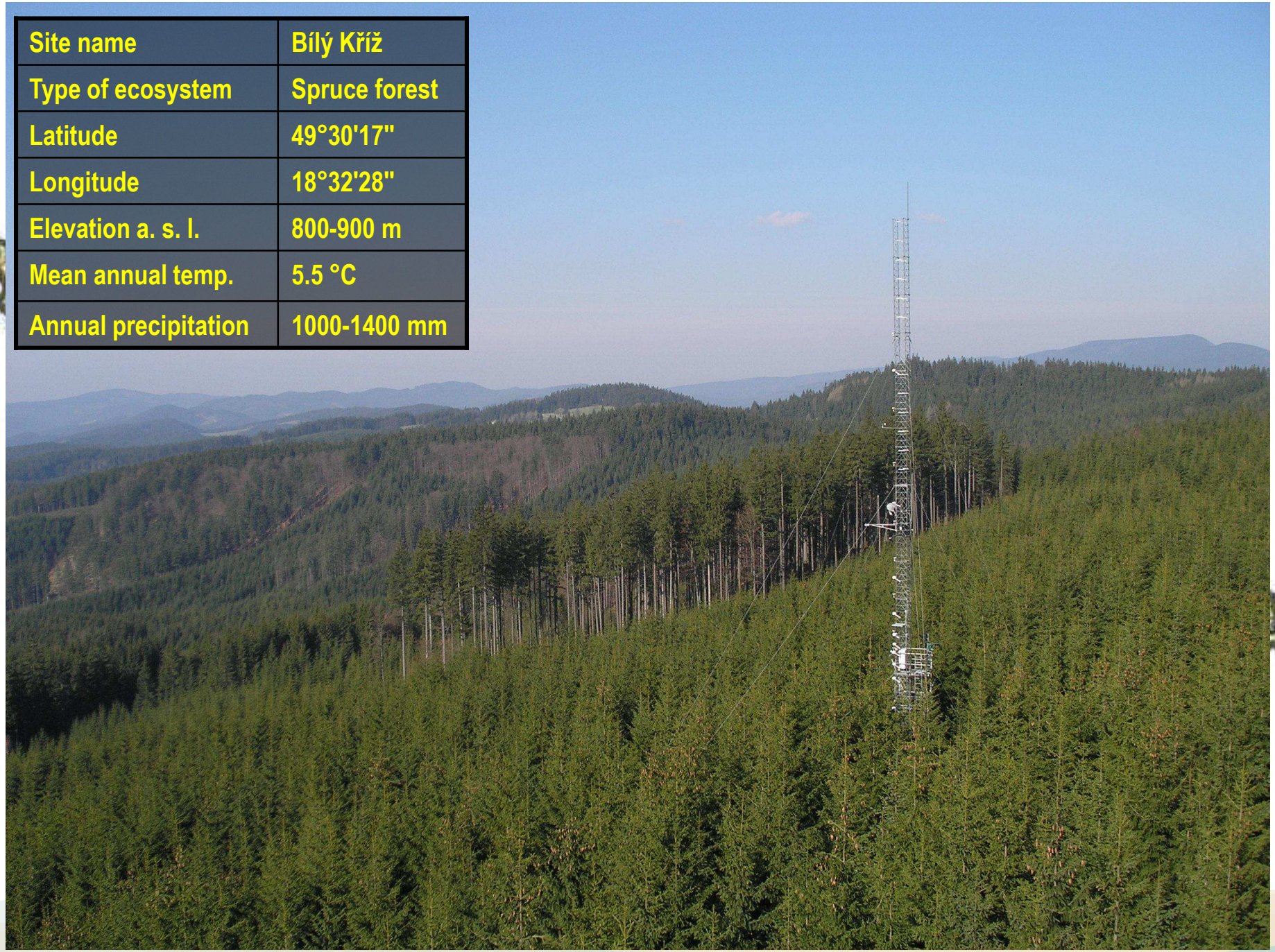
Observed parameters on Ecosystem stations (ES):

- GHG fluxes – especially CO_2, N_2O, CH_4
- energy fluxes
- other parameters:
  - » vertical CO_2 concentration profile in air
  - » water regime (precipitation, evapotranspiration, tree transpiration (flow - heat pulse method), SWC, water table depth)
  - » net radiation; incident, transmited, reflected PhAR
  - » meteorological elements (Ta, Ts, Rh, WS+D, SM…)
  - » phenology observations (with auto. cameras)
  - » hyper spectral remote sensing imagery
  - » biomass inventory
  - » litterfall amount
  - » carbon stock in vegetation and soil
  - » …

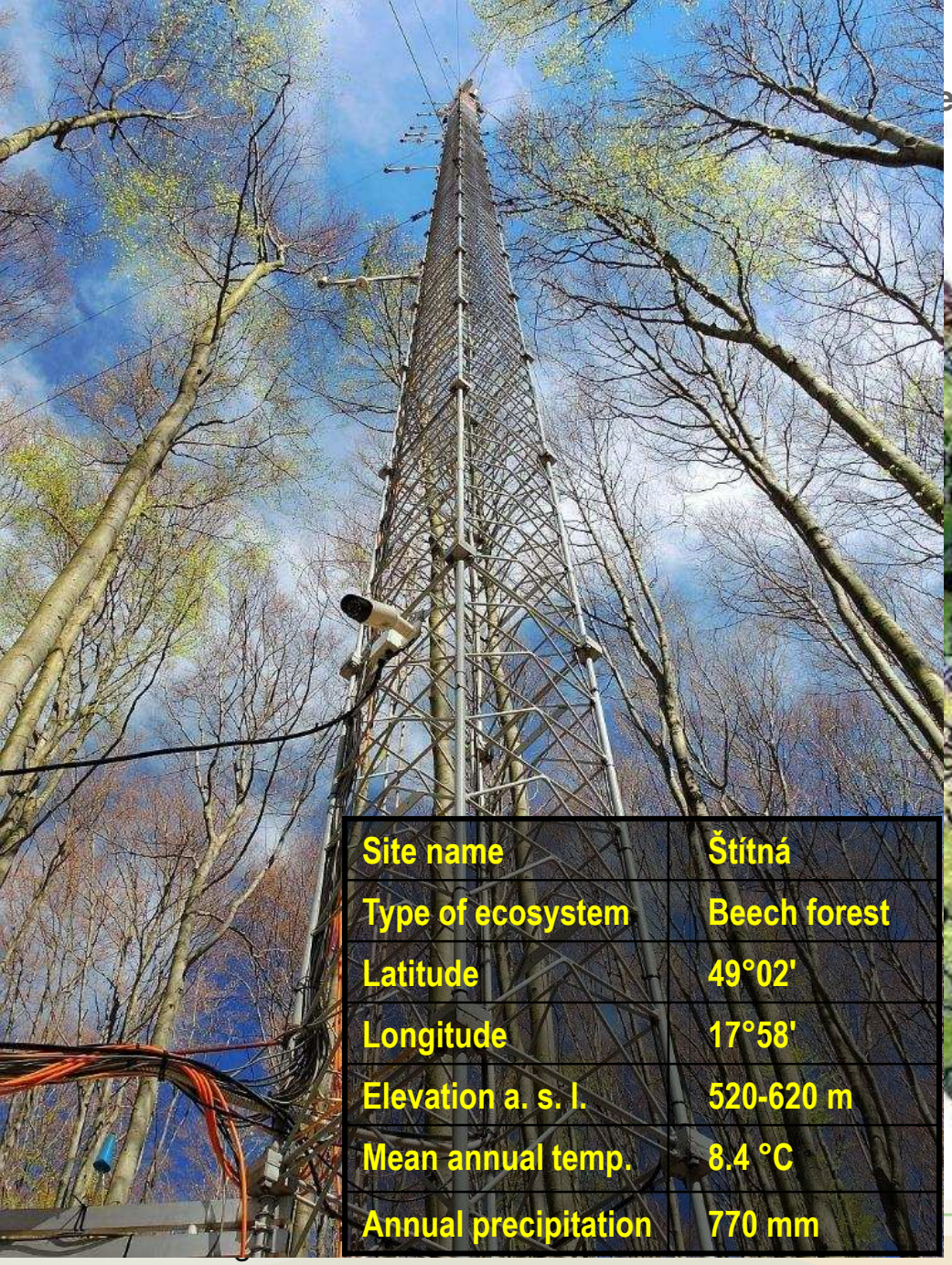


Data stored in 2 levels: final (processed) data and rough data for the possible reprocessing according to the newest procedures.

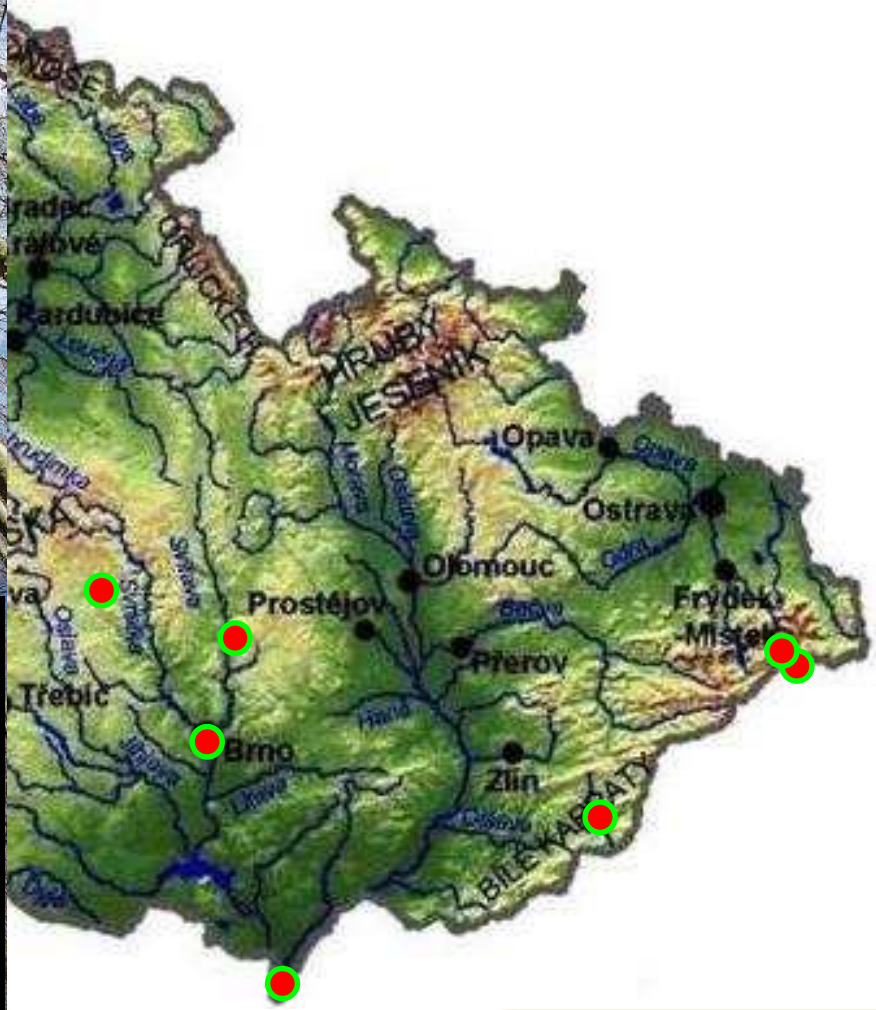
Site name	Bílý Kříž
Type of ecosystem	Spruce forest
Latitude	49°30'17"
Longitude	18°32'28"
Elevation a. s. l.	800-900 m
Mean annual temp.	5.5 °C
Annual precipitation	1000-1400 mm

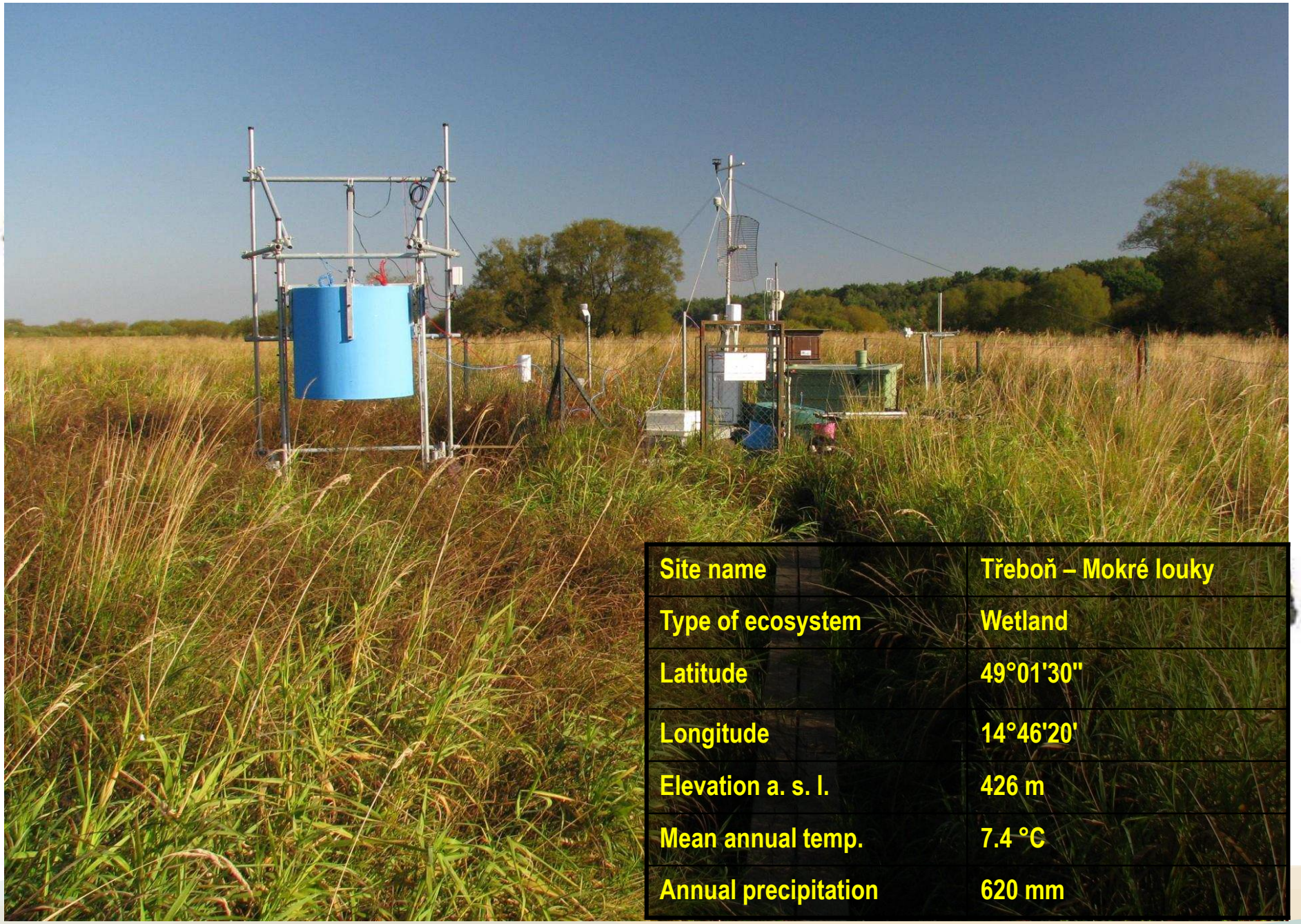


Ecosystem Stations



Site name	Štítná
Type of ecosystem	Beech forest
Latitude	49°02'
Longitude	17°58'
Elevation a. s. l.	520-620 m
Mean annual temp.	8.4 °C
Annual precipitation	770 mm





Site name	Třeboň – Mokré louky
Type of ecosystem	Wetland
Latitude	49°01'30"
Longitude	14°46'20'
Elevation a. s. l.	426 m
Mean annual temp.	7.4 °C
Annual precipitation	620 mm

Site name	Lanžhot
Type of ecosystem	Floodplain forest
Latitude	48°41'
Longitude	16°57'
Elevation a. s. l.	150 m

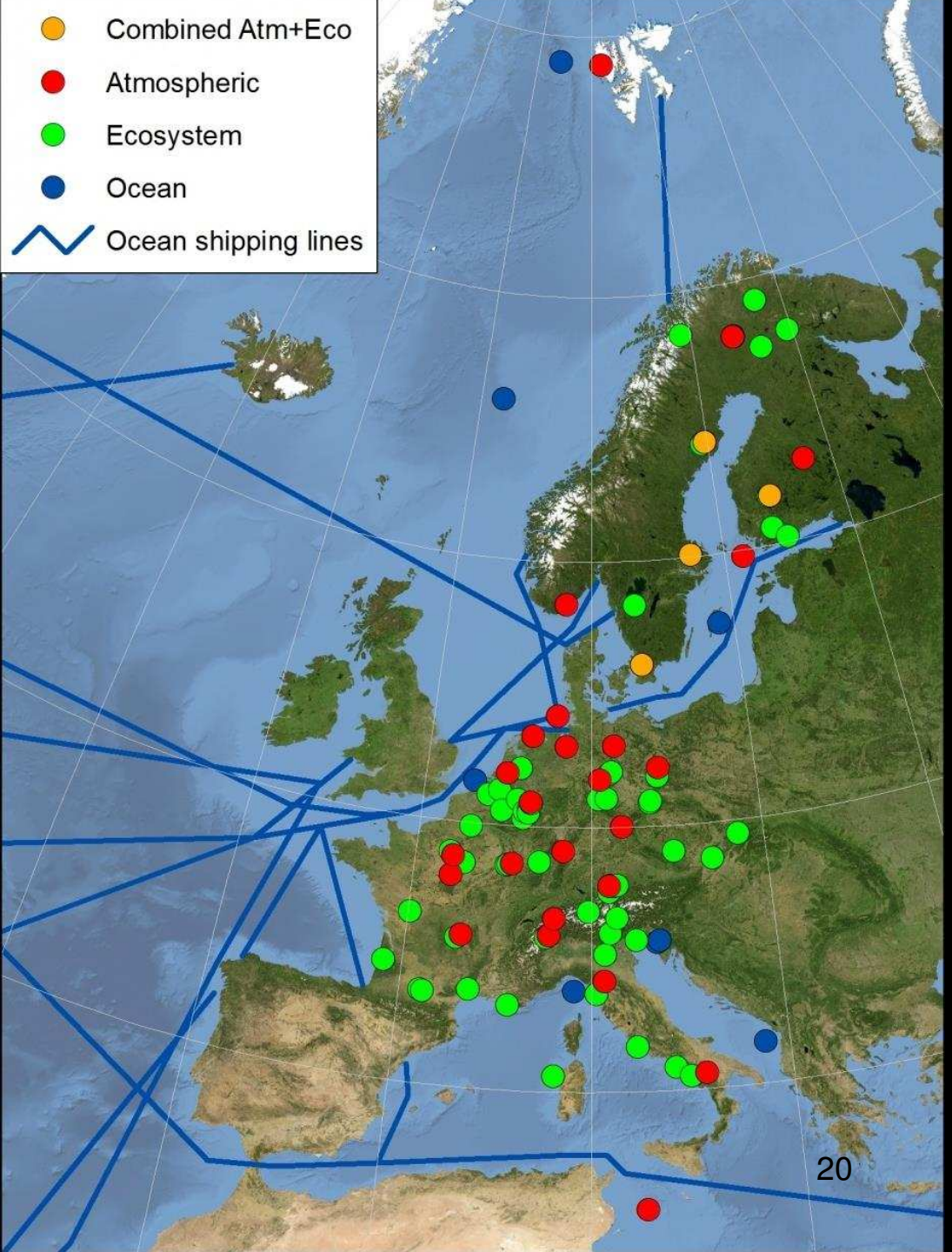

http://jakdychamesto.czechglobe.cz

Net of ICOS stations

Integrated
Carbon
Observation
System

https://www.icos-ri.eu

IN ICOS RESEARCH INFRASTRUCTURE AN EXTENSIVE NETWORK OF STANDARDIZED AND INTEGRATED NATIONAL ATMOSPHERIC, ECOSYSTEM AND MARINE STATIONS, SUPPORTED BY ICOS CENTRAL FACILITIES AND ICOS CARBON PORTAL, FORM THE BASIS FOR ADVANCED CARBON CYCLE RESEARCH IN EUROPE



Net of ICOS stations

Integrated
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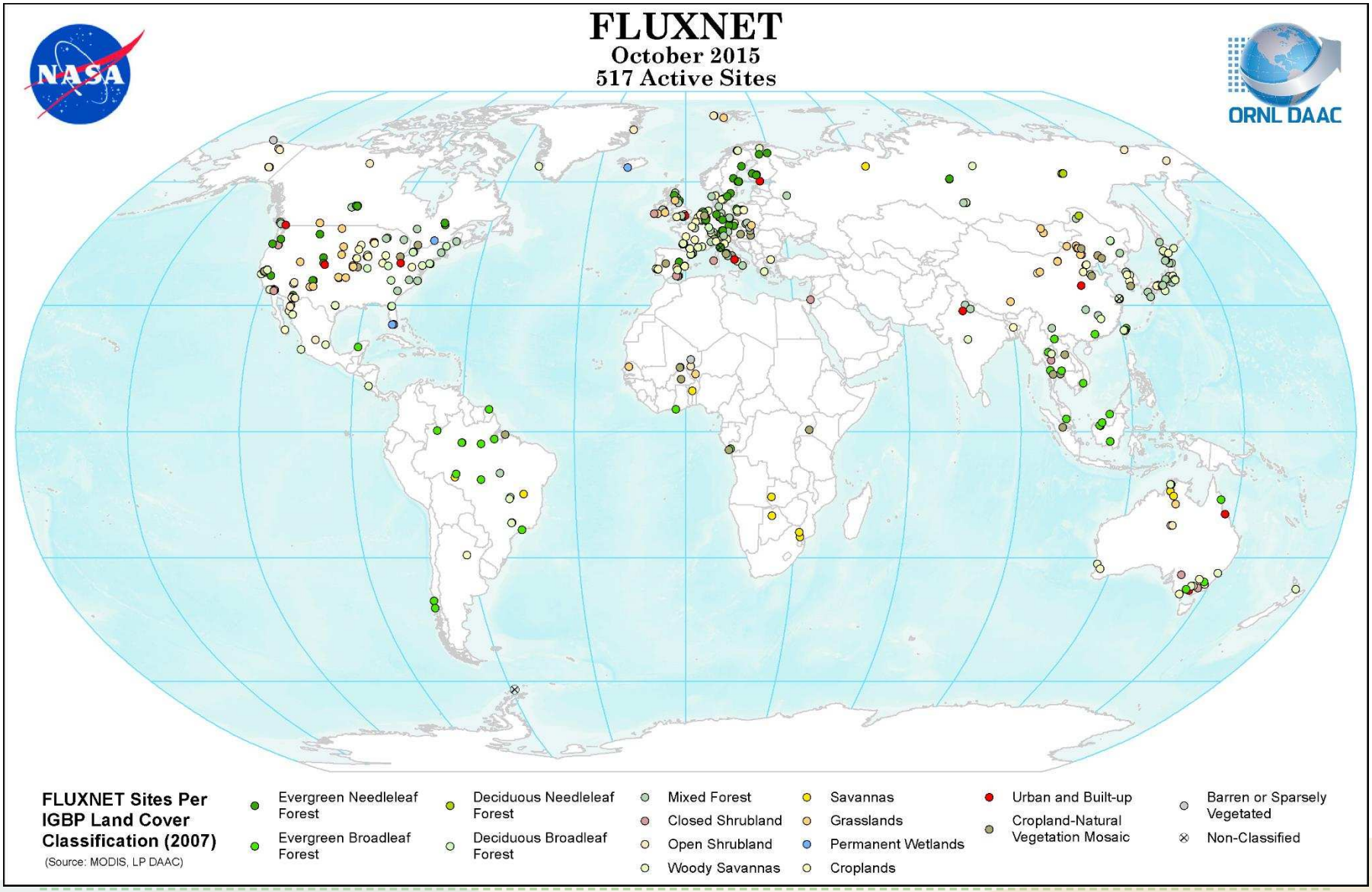
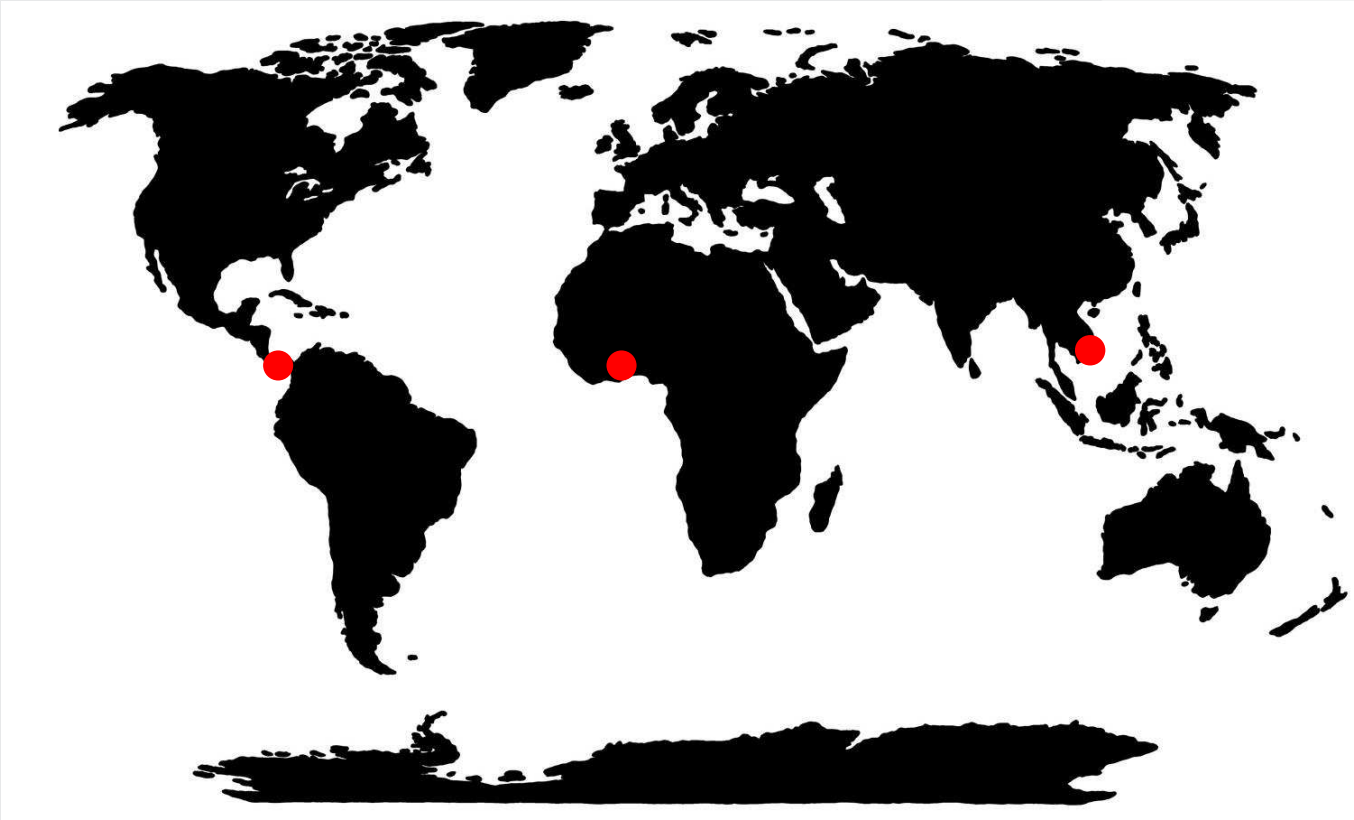
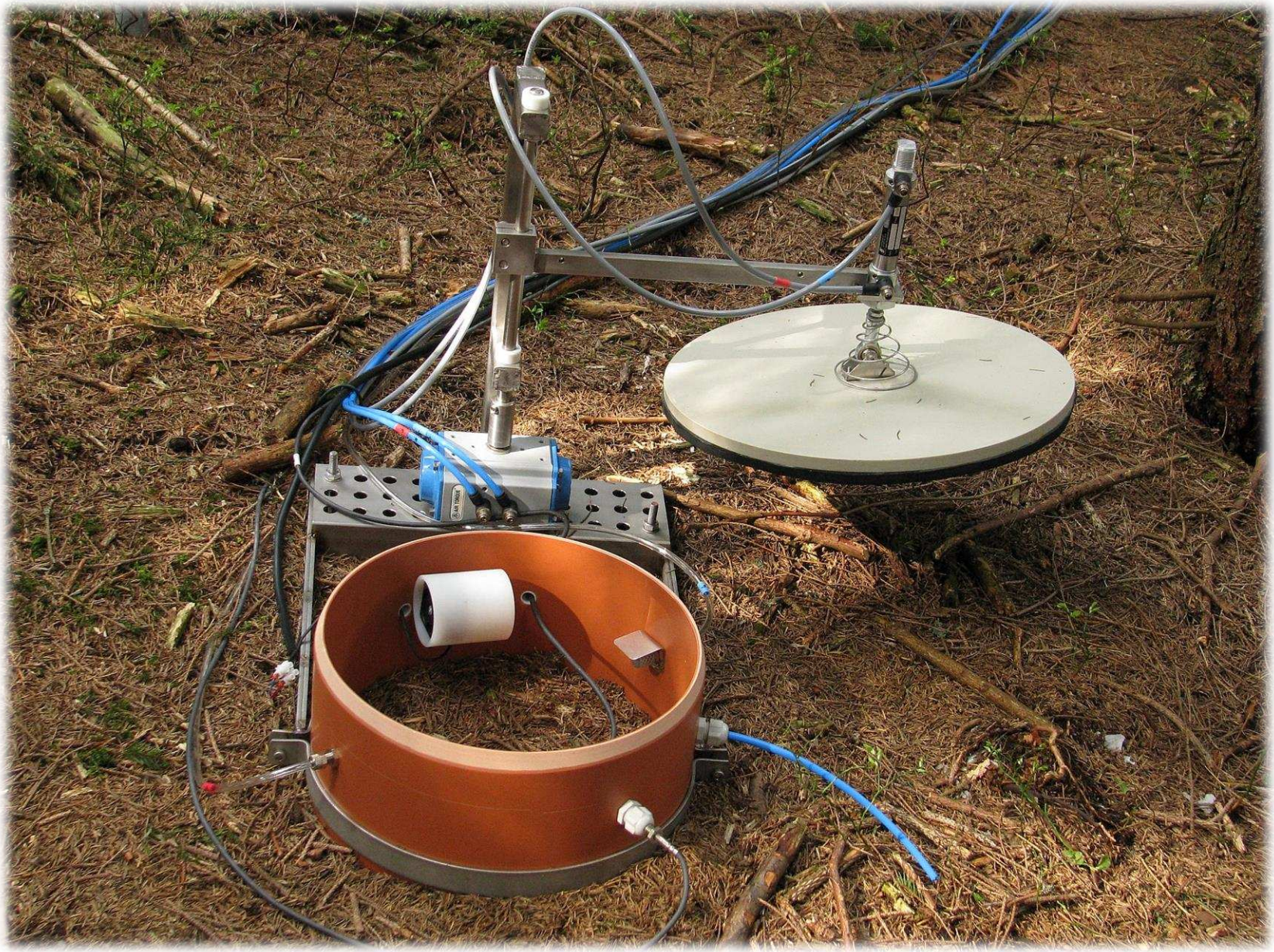

FLUXNET
October 2015
517 Active Sites
ORNL DAAC
FLUXNET Sites Per IGBP Land Cover Classification (2007)
(Source: MODIS, LP DAAC)
Evergreen Needleleaf Forest
Evergreen Broadleaf Forest
Deciduous Needleleaf Forest
Deciduous Broadleaf Forest
Mixed Forest
Closed Shrubland
Open Shrubland
Woody Savannas
Savannas
Grasslands
Permanent Wetlands
Croplands
Urban and Built-up
Cropland-Natural Vegetation Mosaic
Barren or Sparsely Vegetated
Non-Classified

Planned international stations



Soil chamber

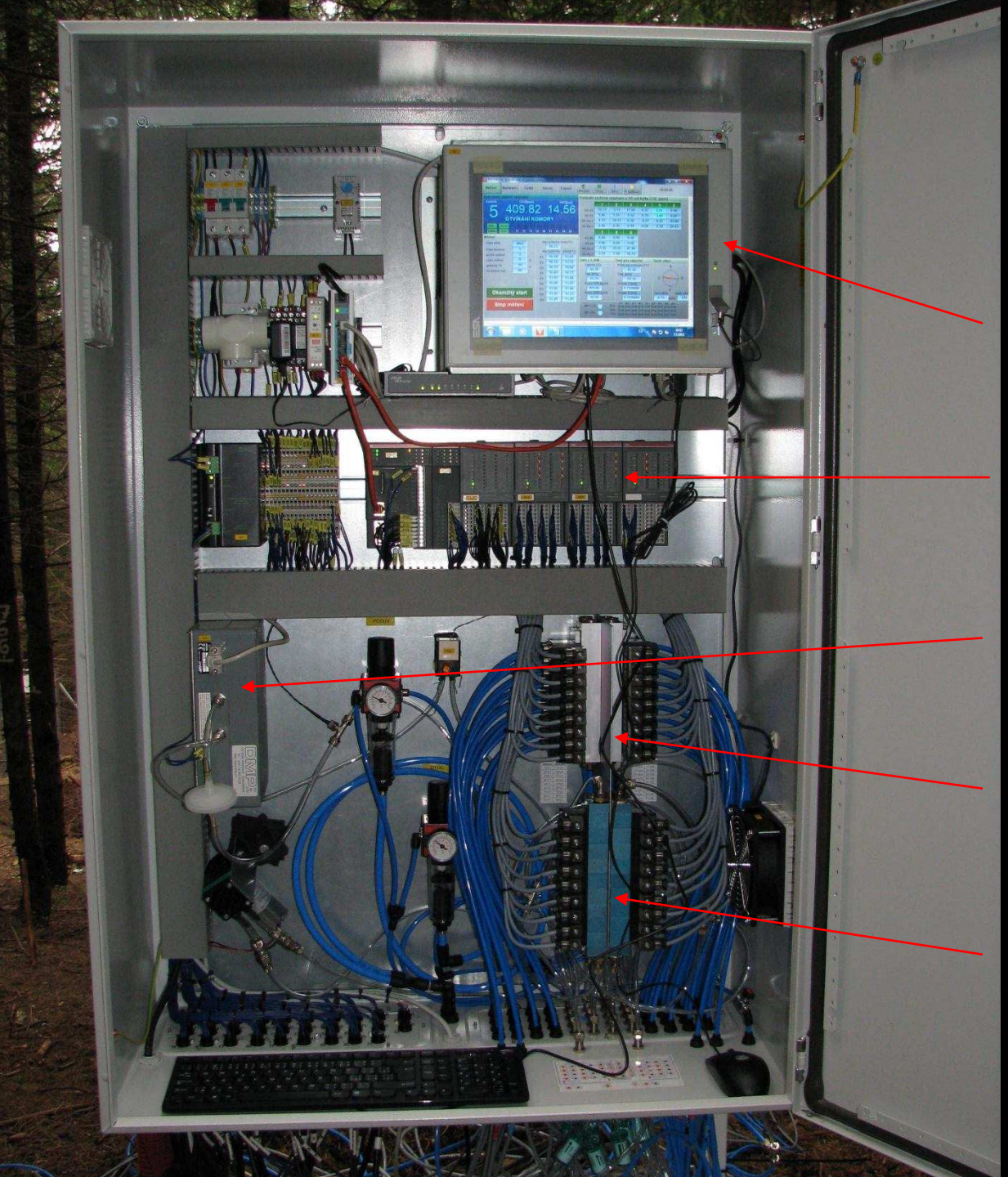


Stem chamber

Shoot/leaf chamber

Ecosystem respiration measurement

SAMTOL-II (CzechGlobe and Konel, CR)



Control box SAMTOL-II

Computer + SF

PLC – modules

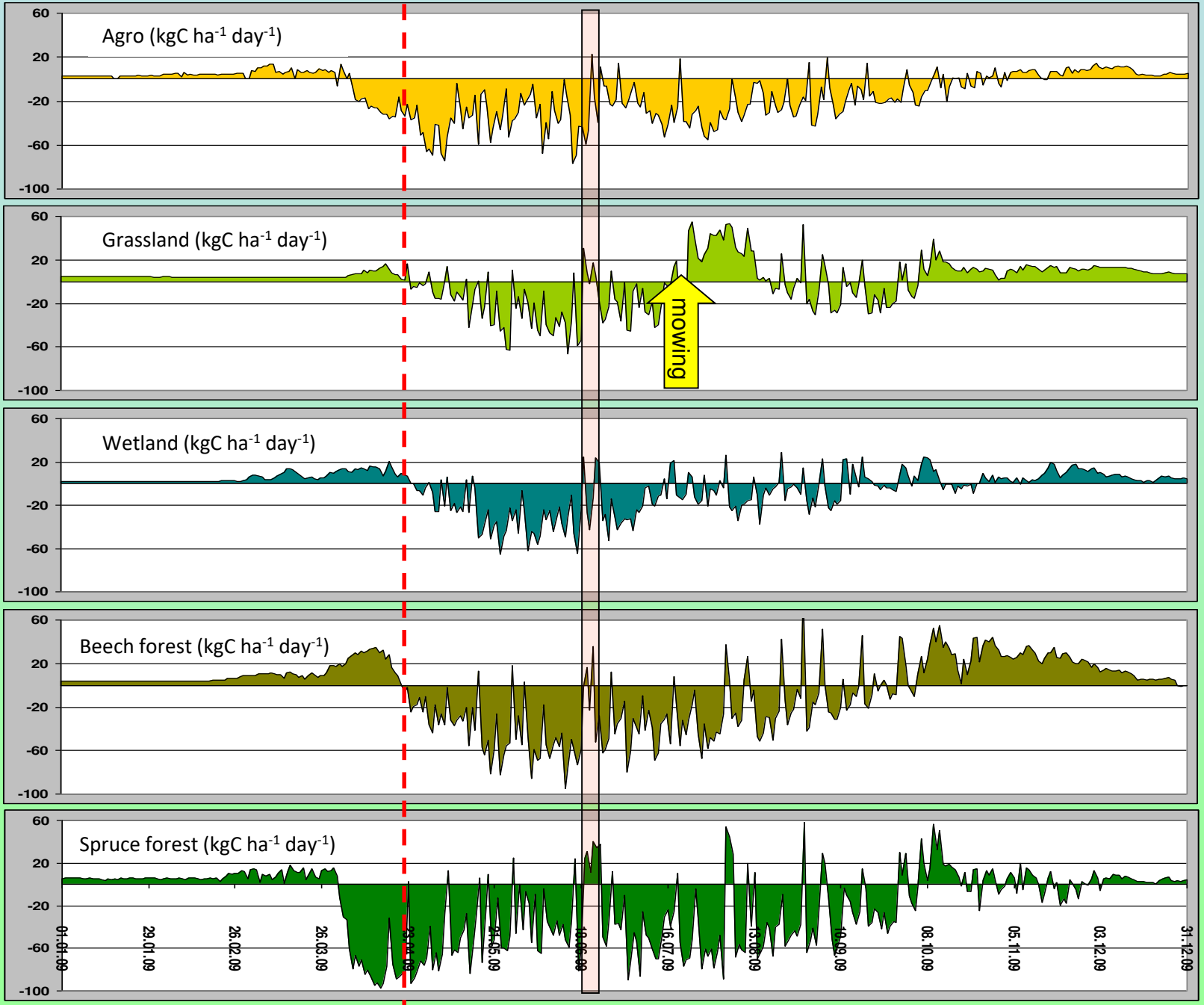
Analyser LI-840A (LI-COR)

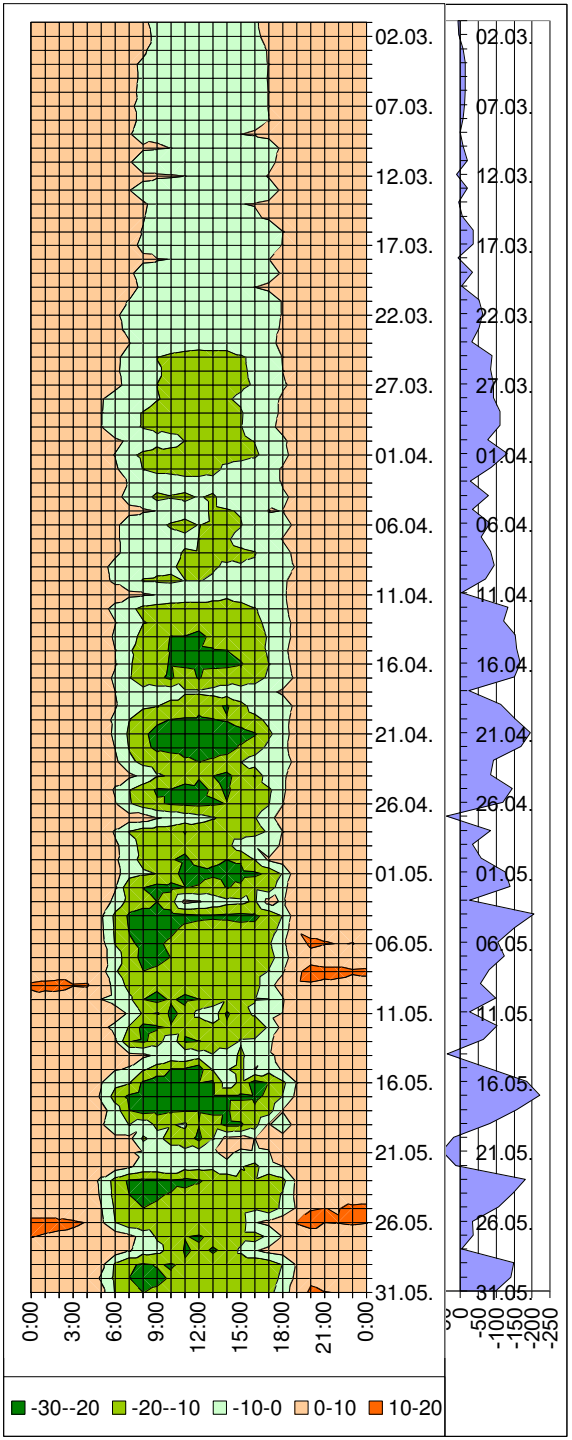
Valves for chamber closing

Valves for air sampling

ES Třeboň
Summer flooding

Net ecosystem production of different ecosystems




02.03.
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17.03.
22.03.
27.03.
01.04.
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21.04.
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18:00
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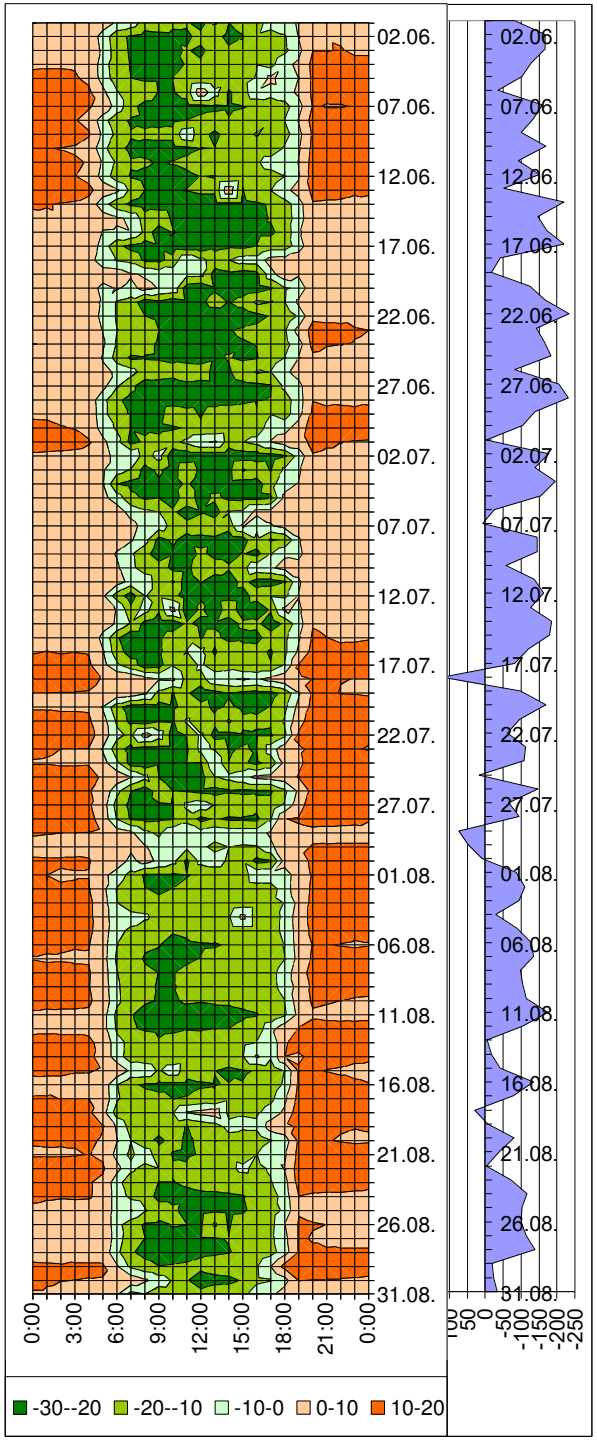
-250
-30--20
-20--10
-10-0
0-10
10-20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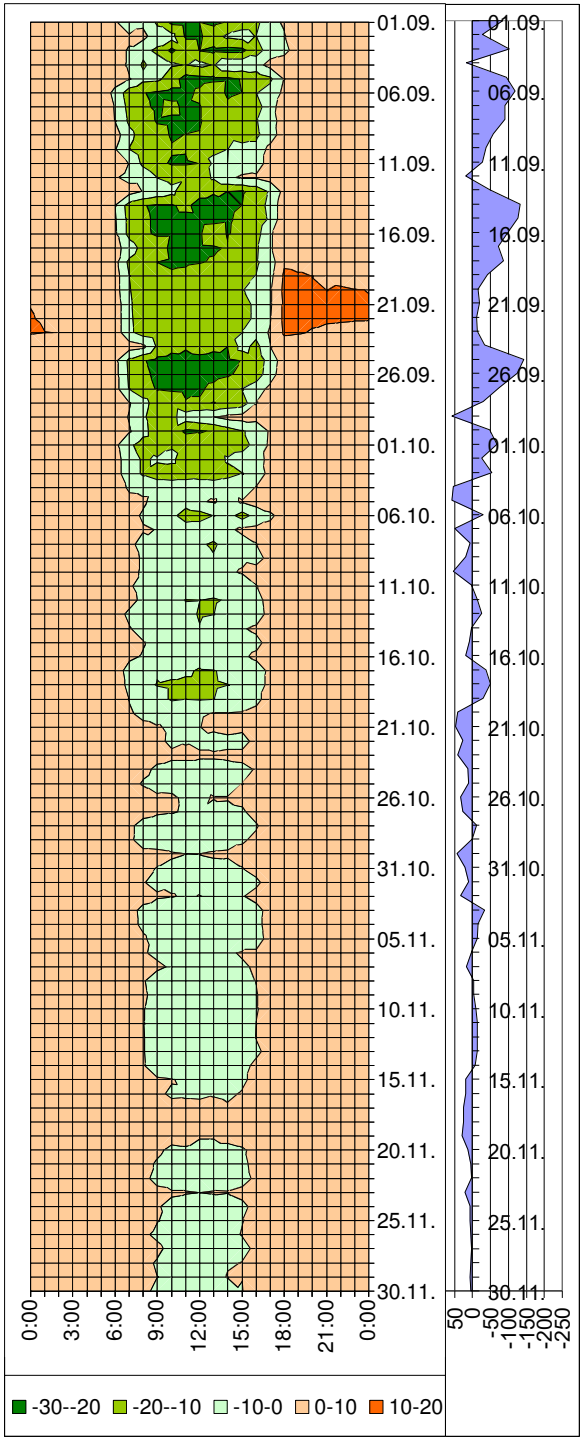
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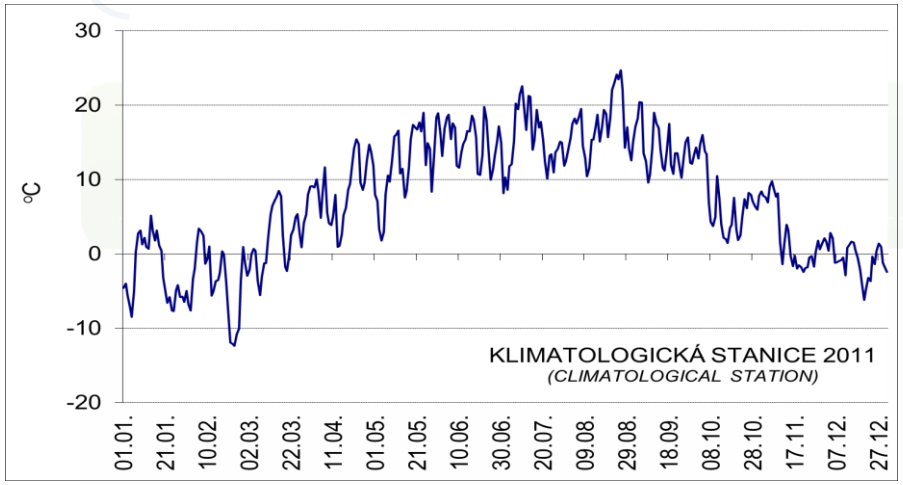
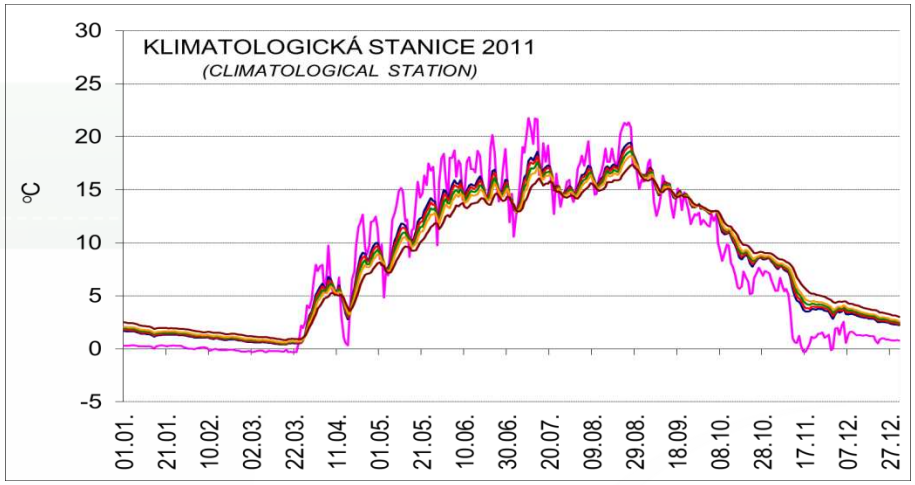
-100
-150
-200
-250
-30--20
-20--10
-10-0
0-10
10-20

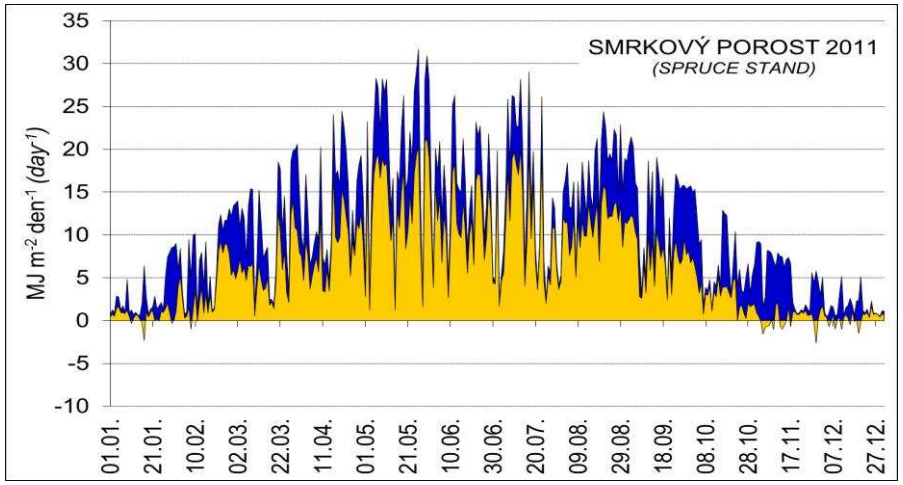
Samples of measured meteo. parameters



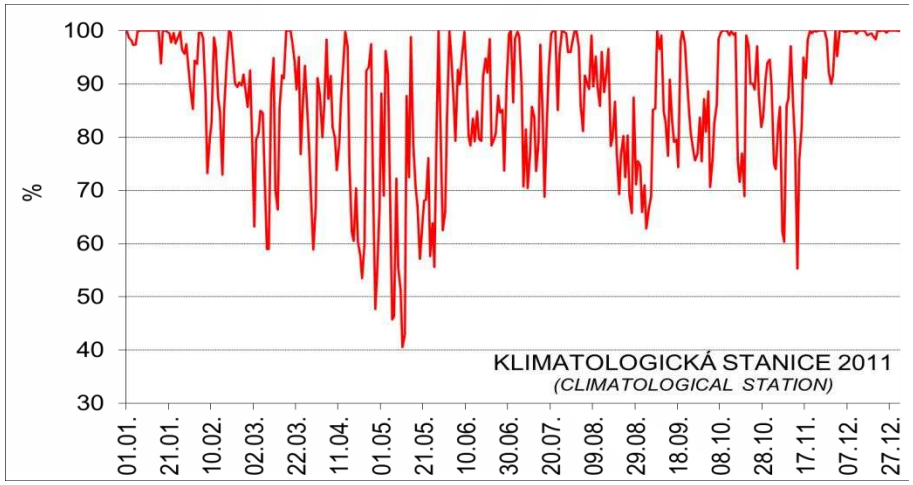
mean daily air temperature (2 meters above the gound)



mean daily soil temp. (depth of 0, 5, 10, 20, 30, 50 cm)

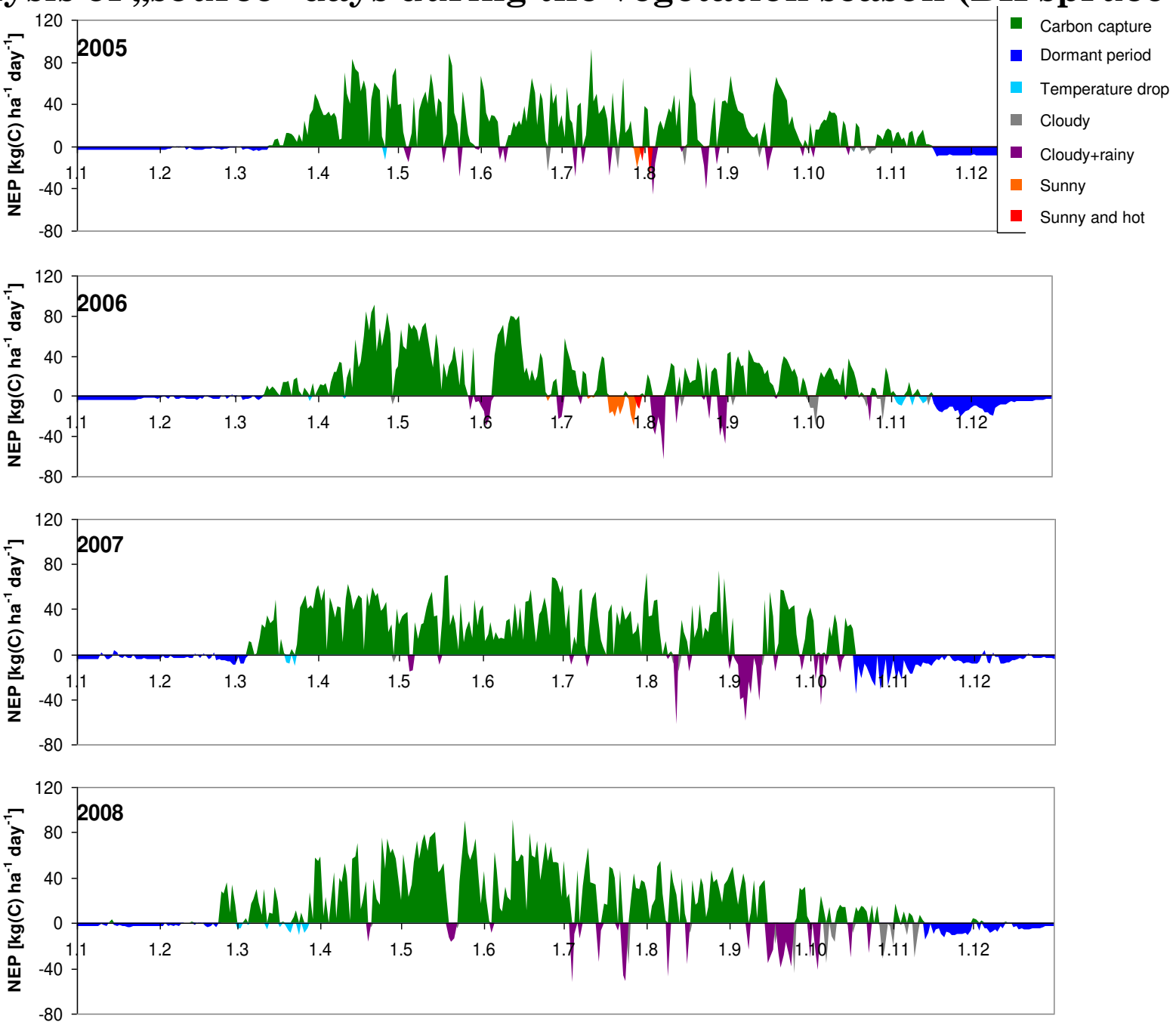


- **Σ S_t** daily sum of global radiation incident on the stand
- **Σ R_n** daily sum of net radiation of the stand



mean daily relative air humidity (2 meters above the ground)

Analysis of „source“ days during the vegetation season (BK spruce forest)



Conclusions

We have a big datasets

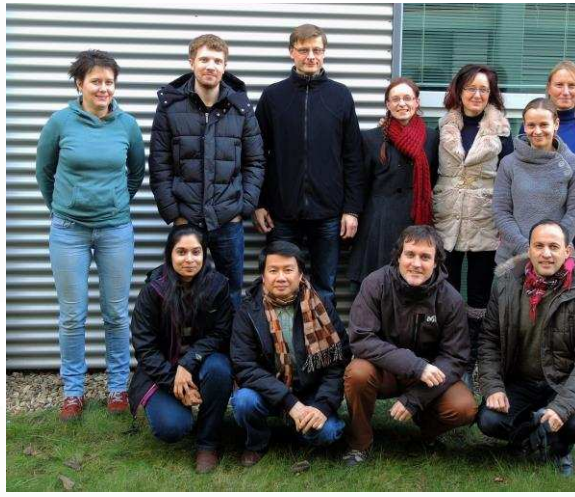
- 20 Hz fluxes measurement – 17 520 rows/year
- 300 meteo sensors (15.7 M values/year)
- data from biomass inventory, remote sensing…

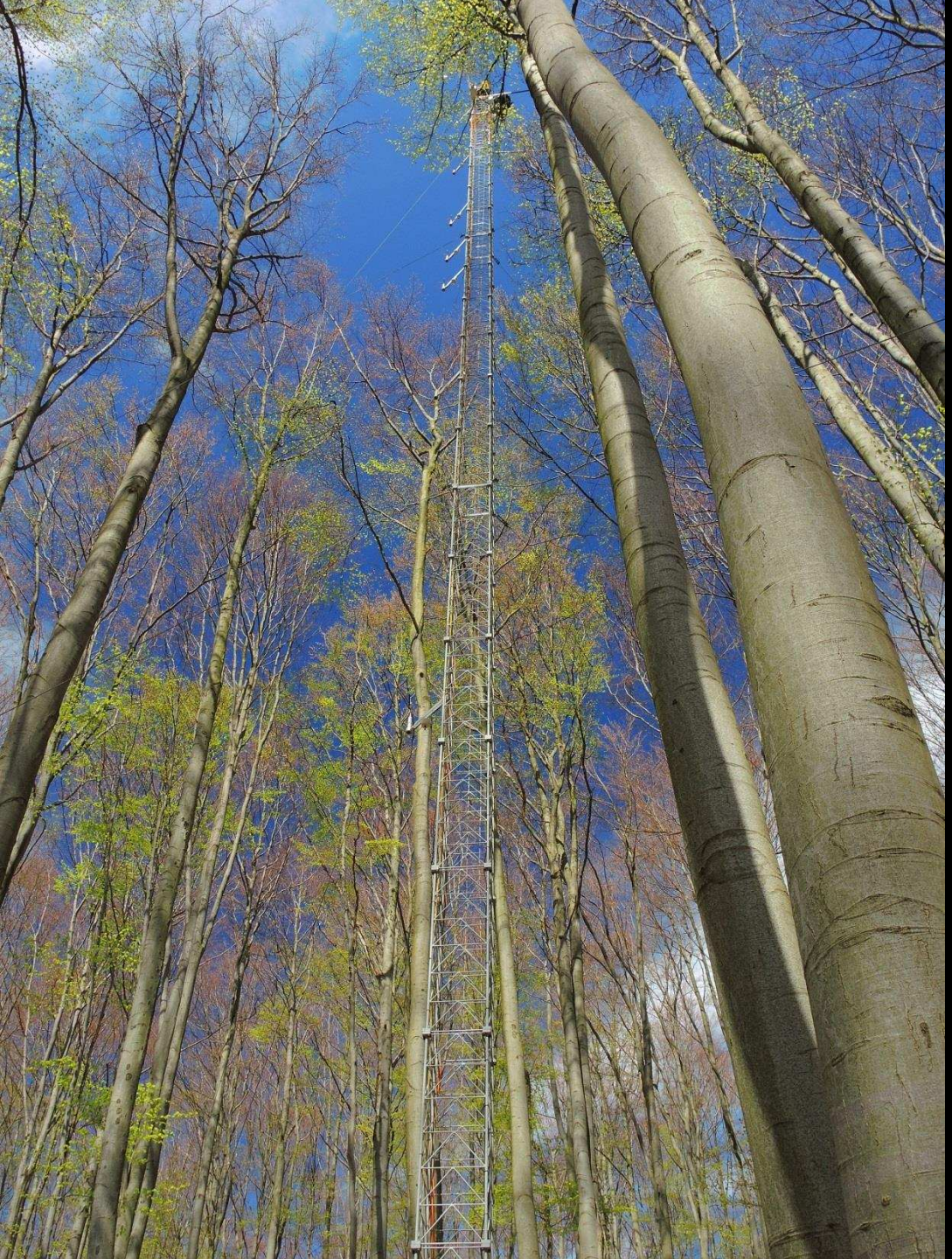
We are looking for: student with interest to help us

We offer: work in our team

work with unique datasets and equipment

Ph.D study (Bioclimatology, MENDELU)





Thank you for your attention

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