Pannonian Basin Experiment (PannEx)

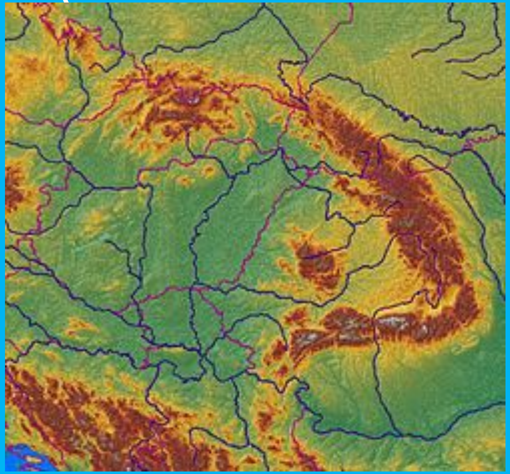
TOWARD TO BECOME AN RHP

GEWEX GHP MEETING, 16 OCTOBER, KATHMANDU

Pannonian (Carpathian) basin

Highest peak of the Carpathian Mountains: Gerlachovský štít 2655 m (Slovakia)

Alps: Mont Blanc (4810)



Short History

1st WS Osijek, November 2015

2nd WS Budapest, June 2016 WB first draft

3nd WS Cluj, March 2017 WB final

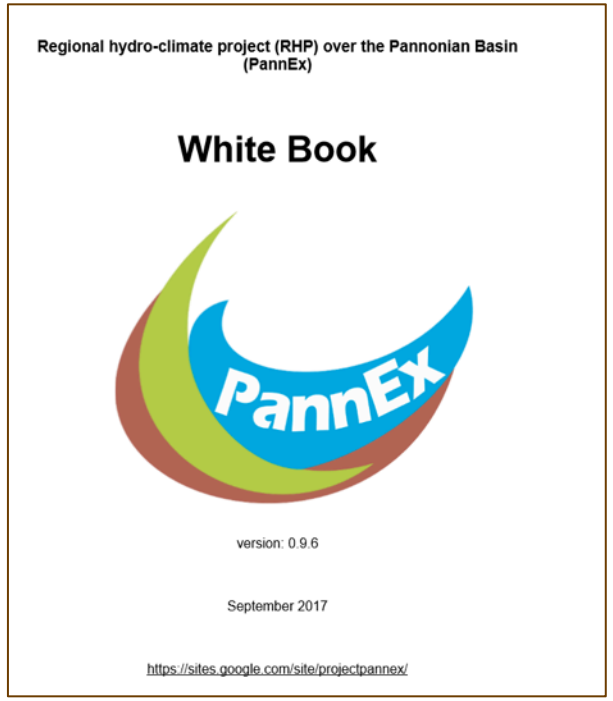
IPC meeting, September 2017 SP first draft

Main activities November 2016 – October 2017

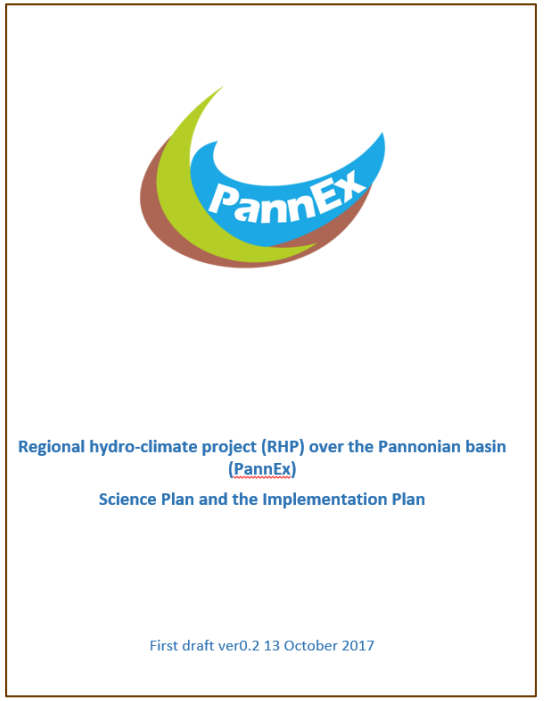
- **3rd PannEx workshop**: 20 -22 March 2017, Cluj-Napoca, Romania
- **PannEx National Seminars in Hungary** (Bilingual)
  - **17 November 2016**: Adaptation of agronomic activities to weather and climate extremes – related to FQ1 (invited: José Camacho, WMO, Agricultural Meteorology Division)
  - **8 December 2016**: Land Degradation Neutrality – related to FQ1, FQ3 (invited: Jamal Annagylyjova, UNCCD LDN Programme)

Documents available

5 FQS AND 3 CCS, 72 CONTRIBUTOR, UNDER FINALIZATION



SCIENCE AND IMPLEMENTATION PLAN



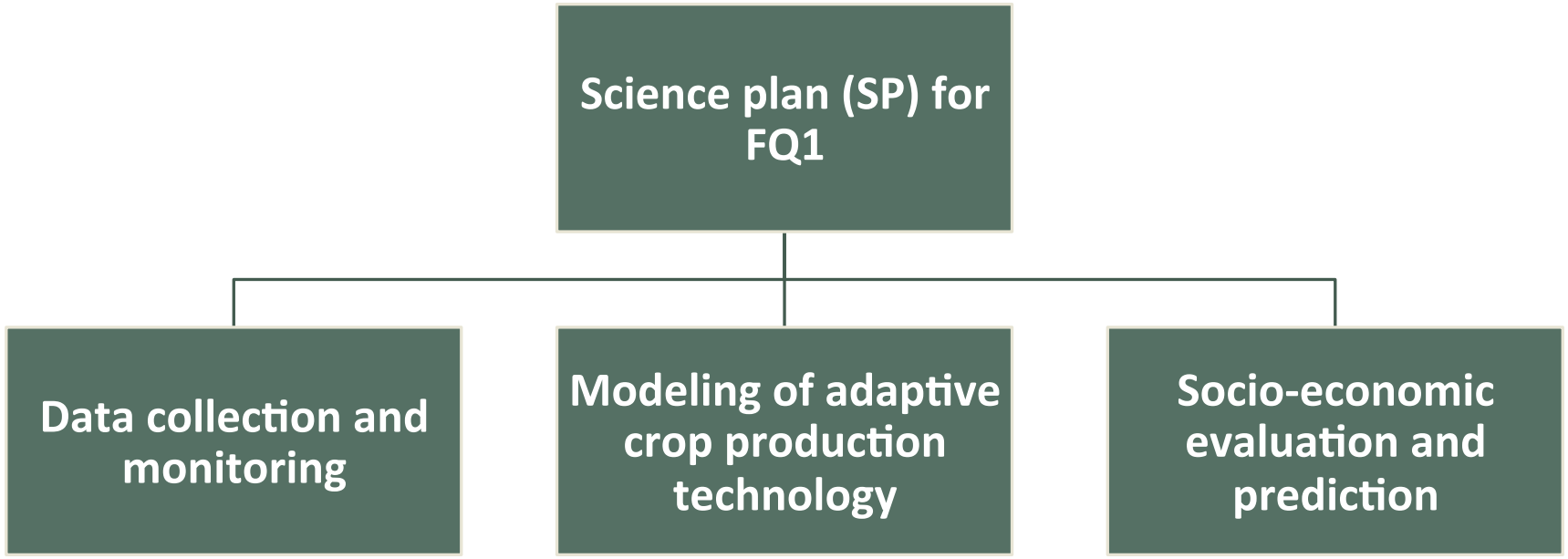
Task Teams

1st PannEx IPC meeting: 25 - 26 September 2017, University of Belgrade, Belgrade, Serbia -First draft of the Science Plan – set up Task Teams

- Agro-climatological and biological systems
- Micrometeorology and agronomical process modelling
- Urban Studies
- Energy Production
- Ecological Services
- Water balance at the basin scale
- Modelling from Climate to Flash Floods
- Outreach and Education
- Special observations and data analysis

Science an Implementation Plan Ver.0.2

FQ1 - Adaptation of agronomic activities to weather and climate extremes



1 Data collection and monitoring

- *Outcome: **Better understand** of agronomic activities and processes, mainly in **crop production, in different and changing agroecological conditions** through field experiments and analysis of field data and historical data.*

Data collecting is the basis and the first step for every decision making processes in agricultural production

Great importance: to start collecting historical data and monitoring all relevant actual experimental data (mainly crops, soil and meteorological data) with the methods agreed upon by the countries of the Pannonian region

Observational networks with observation points (monitoring location) is a critical part of any study and need to be developed respecting the scientific rules

As recommendation: need to established long-term experiments or "reused" existing (by which we can test novel hypothesis)

Collecting data need to answer a specific questions about crops and soil in interactions with weather and climate conditions

multidisciplinary approach is imperative

Collected data will be available to all members of PannEx community and free sharing for any future scientific activities

2 Modeling of adaptive crop production technology

- *Outcome: **Creating a model for calculating soil suitability for crops production** which will be used as a decision making support model.*

Developing best adaptive technology solution in crop production according prediction of climate/weather variability, trends and extremes

Creation of a model which can be used as decision support tool for calculating the soil suitability for producing some of the most important crops and by implementing of geostatistical method can be used for detecting problematic areas in agricultural land of Pannonian region

Creating maps of soil suitability for adaptive cropping systems for Pannonian region

Created model must be modular with countless possibilities and variations (easily adding new indicator of soil suitability with adaptability for different ecosystems)

Model output data would be further used for visualization, because raw data, or basic statistics alone, cannot indicate the actual conditions on certain part of the land

For the needs of visualization, the best method is kriging that provides us an opportunity to monitor spatio-temporal changes at various scales

3 Socio-economic evaluation and prediction

- *Outcome: **Creating economic models for calculating and prediction of demographic processes** in rural areas and socio-economic changes as a strategy to adapt to climate change.*

Most of Pannonian region is the rural area where lives about half of the population and thus draws attention to the dimension of the problem, which has its own demographic, social, economic, infrastructural, agricultural and environmental component

Rural area of Pannonian region for decades faces with deagrarization and depopulation

Rural areas of Pannonian region are characterized by negative demographic, economic and general development trends

It is extremely difficult to thoroughly assess the impact of climate change on agricultural production, consumption, prices and trade, and also estimation of cost of renovation without a detailed analysis of agricultural supply and demand as a model of projections

Mitigation of negative demographic processes in rural areas, emphasizes the importance of improving urban-rural links including better connectivity in the transport, economic, cultural and all other respects with the strengthening of the capacity to adapt to climate change, but also a dynamic socio-economic changes and new development trends

For the needs of visualization, the best method is kriging that provides us an opportunity to monitor spatio-temporal changes at various scales

Improve global data collection, analysis and projection / modeling of socio-economic effect of climate changes

Every proposed measures and policy with investments will not solve all of the negative consequences of climate change, but not taking any changes and measures of rural policy with insufficient financial positioning will affect the continuation and worsening of the consequences of climate change

FQ2: Understanding air quality under different weather and climate conditions

Three key science questions:

- Urban-scale processes including measurements and models
- Scale-dependent meteorological and transport processes, air quality-planning
- Surface and boundary layer processes

Organisation of Scientific Implementation Plan

Science questions Issues	Urban scale processes	Air quality, surface effects, (deposition, source and sink) scale dependent transport	PBL processes, turbulent exchange, surface processes , budgets, SVAT
Measuring / **data set**	Meteorological and air quality monitoring stations, UHI intensity	Standard meteorological, aerosynoptic and background air quality measurements and datasets	Surface energy budget components, trace gas fluxes, PBL structure
	Emission sources, land use / heat sources		
Experiments	UHI measurements and monitoring, Urban climate experiment	Comparison of air quality measurements at both sides of the borders, information exchange and harmonisation among the countries. Comparison and testing of the trans-boundary air pollution transport models	PBL measurements for comparison of mesoscale models
	Air quality measurements for local chemical transport and source-receptor model comparison		Energy-budget and deposition measurements over different surface types (water, short and tall vegetation)
Modelling	Nested urban SVAT, (SURFEX, ISBA, etc.)	Comparison of air pollution forecasts, ensemble model approach, areal deposition (O_3, SO_2, N-loading), aerosol formation and processes, airborne pollen, fog.	1D PBL model comparisons. Optimisation of NWP model parameterizations for Pannonian Basin, new SVAT model parameterisations (vineyard, suburban regions, etc.)
	Source-receptor model		
	3D model system with scale dependent grid resolutions (WRF-Chem, CMAQ, MISKAM)		
Outcome	Urban planning, Heat waves, Human health effects (UHI, fine aerosol particles)	Quantification of i) transboundary pollution transport, ii) eutrophication, iii) O_3 and N loads for regional planning	Regional scale surface layer datasets (energy budget components, evaporation, wind profiles) and optimisation of PBL parameterisations.

Training centers for measurements and modelling

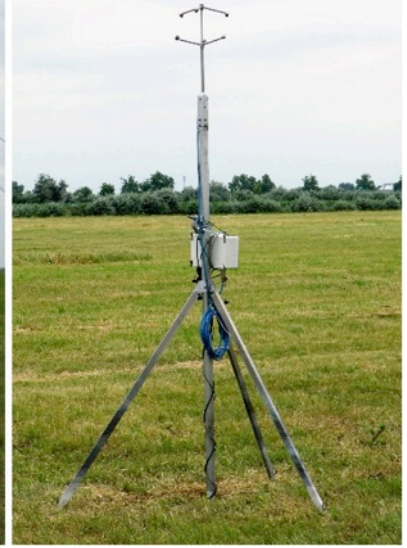
Budapest: Air pollution, nucleation – BpArt platform

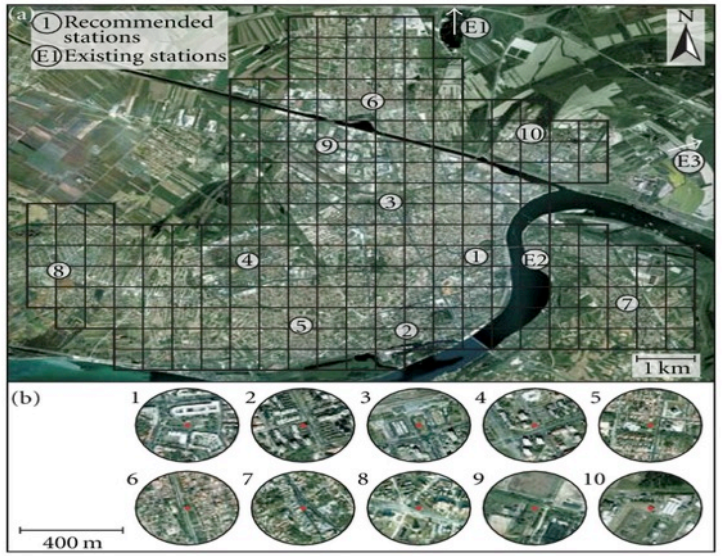
Szeged: Upper air Observatory + surface energy budget measurement

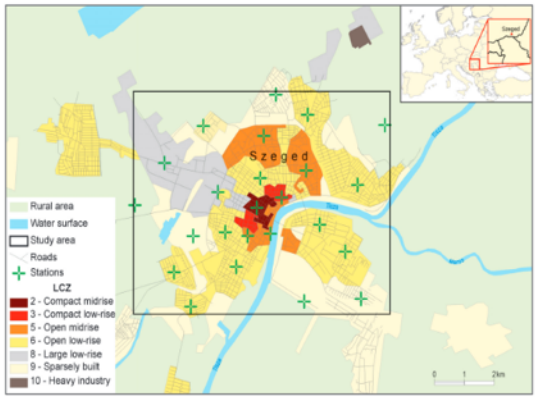
Szeged – Novi Sad: Urban climate

Novi Sad: SVAT modelling, agronomical aspects

Osiek, Zagreb, Cluj, … ?







continuous training in the research fields defined

FQ3. Toward a sustainable development

Topics and proposed outcomes:

Topic 1: Preserving ecological services

*Outcome: Better understanding of the degree of **climate change threat for natural habitats,** identification of the key stands of currently existing habitats that are particularly important and exploration of possibilities that can provide mitigation options by restoring habitats with special emphasis on water-relate issues.*

Topic 2: Hydropower potential evolution

*Outcome: **Evaluation of the current and future climate change impact** on the hydropower potential in the region from which adequate **adaptation measures c**an be developed and potential **future risks** can be reduced.*

FQ3. Toward a sustainable development (cont.)

Topic 3: Wind and solar energy potential

Outcome: Comprehensive analysis of ***current and future potentials*** *for power production from wind and solar in Pannonian basin.*

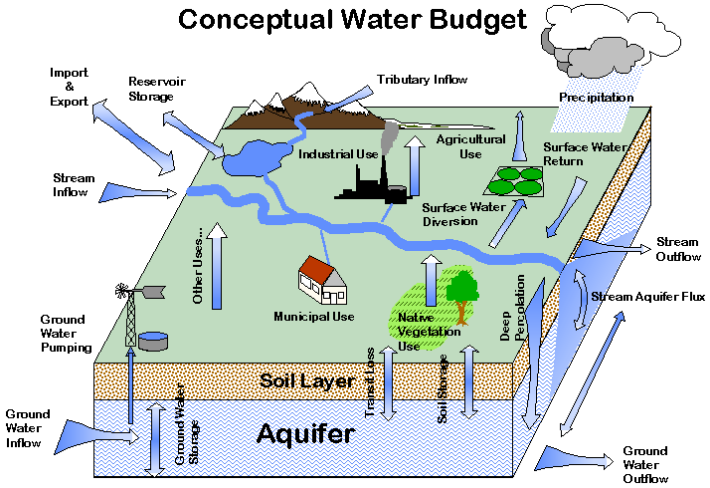
Topic 4: Building the infrastructure for forecasting and coordination of the energy production

Outcome: To build the ***infrastructure for forecasting and coordination*** *of the energy production from* water, wind and sun.

Topic 5: Evolution of the energy needs (cooling and heating) in a warmer climate

Outcome: To estimate evolution of the ***energy needs in terms of cooling and heating demand*** *following potential changes in the future climate in the region.*

FQ4: Water management, droughts and floods



1. Harmonisation of the water balance estimations at Basin scale

$$Pi = Rs,i + Rss,i + ETa,i \pm \Delta Si,$$

Outcome: It is expected to have information about the applicability of different models (stability of parametrizations), information for the future based on stable models, and comparability of model outputs.

Using monthly (seasonal, annual, multi-annual) catchments water balance, water management elements (such as water retention, drought management, runoff control):can be projected more reliably with integrated atmosphere-hydrology (hydrometeorological) fully dinamically-based modelling systems, and can be linked more accurately to natural and/or anthropogenic changes in water cycle.

FQ4: Water management, droughts and floods (cont.)

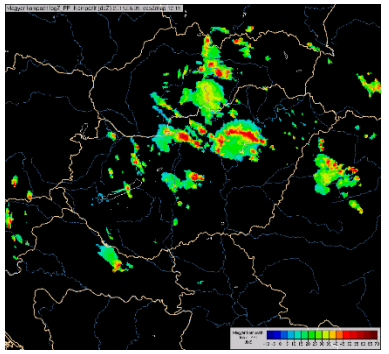
2. Improving drought early warning system in the region

Outcomes: Improved EWS (early warning system) for drought. Hydrometeorological forecasts, ***improved monitoring products with increased resolution and also improved risk assessments*** *will be available and regularly updated. Recent projects finished with final report and possibly also web page and collection of available data, any possible new achievement will be* ***maintained and updated after termination of the different projects***

June 2017 Hungary

FQ4: Water management, droughts and floods (cont.)

3. Possibilities and perspectives in flash flood forecasting



4 June 2016
Bodmer, Hungary

*Outcomes: Further progress is expected in the development of high-resolution numerical models, which could eventually operate with horizontal resolutions of 1km and less within the next 5-10 years.. Nevertheless, better specification of the initial and boundary conditions will also be needed, as well as improvements in the **parameterization of turbulence, microphysical properties and physical-dynamical feedbacks**. Further increase of **observations density** (radars, lidars, windprofilers, surface weather stations) will be also necessary for this purpose.*

FQ5. Education, knowledge transfer and outreach

Topics and proposed outcomes:

Topic 1: Education

Outcome: Evaluation the study programs on Meteorology and Hydrology, development of higher education in Meteorology and Hydrology and improvement of cooperation among higher education providers in the field of Meteorology and Hydrology in the PannEx area by encouraging ***teaching staff and students exchanges under the framework of PannEx project****.*

Topic 2: Knowledge transfer

Outcome: Knowledge transfer will focus on actions to improve the connections between the PannEx scientific and education communities in the PannEx area.

FQ5. Education, knowledge transfer and outreach (cont.)

Topics and proposed outcomes:

Topic 3: Outreach

Outcome: to develop the connections between the PannEx scientific and education community and society in the PannEx area.

Outreach of scientific results to the community and decision makers is of great importance in order to adopt the best adaptation strategies in the area under study. Under these circumstances, we have been identified few activities focused mainly in three directions:

- ✓ Outreach to scientific community;
- ✓ Outreach to public authorities and decision makers;
- ✓ Outreach to large community

CC1: Data and knowledge rescue and consolidation

Special observations and data analysis

*Outcomes: **List of national networks and data sets** (meteorological, hydrological, agro-meteorological, etc.) for the region; Internal agreement on **data policy**; Have a complete **list of research/singular infrastructures** in the basin; List of recent projects and existing methods related to water cycle in the region; List of potential pilot areas; Good quality harmonized **historical climatological dataset** for the region*

Follow up of CarpatClim – DanubeClim project with the same methodology, JRC support

CC2: Process Modelling

General approach: ***Defining the transversal key processes that affect most FQs,*** **establishing a general working framework, increasing the understanding and improving representation in applications.**

Topic 1: Quantifying surface energy and water budgets

Outcome: Provide accurate estimations from observational systems of the terms of the water and energy budgets at the surface for their use in FQ applications.

Topic 2: Atmospheric Chemistry

Outcome: Monitor and model pollutant concentrations, including background levels, urban emissions and agronomical fertilizers and pesticides, and explore the transport processes and the interaction with the different parts of the basin Earth system.

CC2: Process Modelling (cont.)

Topic 3: Land-surface interactions

Outcome: To analyze the processes intervening in the surface-atmosphere interaction and to check with high quality data in the Pannonian Basin the current land-surface schemes and proceed to improvements if possible.

Topic 4: Precipitation systems

Outcome: To improve the characterization of the main types of precipitating systems in the Pannonian Basin through observation and modelling.

Topic 5: Crop modelling

Outcome: Monitoring the response of the cultures to varying environment conditions in the Pannonian Basin.

Topic 6: Hydrological monitoring

Outcome: Understanding and quantifying water processes and uses in the Pannonian Basin, especially concerning the anthropic part.

CC3: Development and validation of modelling tools

Topic 1: Limited Area Modelling (LAM)
Numerical Weather Prediction (NWP)

*Outcome: To **provide modelling tools** as a method for the general and processes based studies, and vice-versa, **to use PannEx special observations** for the NWP model **validation**.*

Topic 2: Regional seasonal forecasts

Outcome: New insights into potential usage of seasonal forecasts for various human activities. Improvement in the determining the limitations of the seasonal products over the Pannonian Basin.

CC3: Development and validation of modelling tools (cont.)

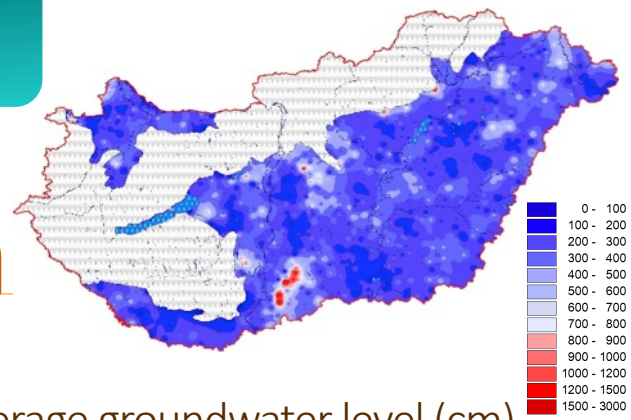
Topic 3: Regional climate models (RCM)

*Outcome: **Reduction of model systematic errors** over the Pannonian basin. Description of the uncertainties of climate projections systems on all time-scales over the Pannonian basin and an objective **method for quantification of climate projection uncertainties**.*

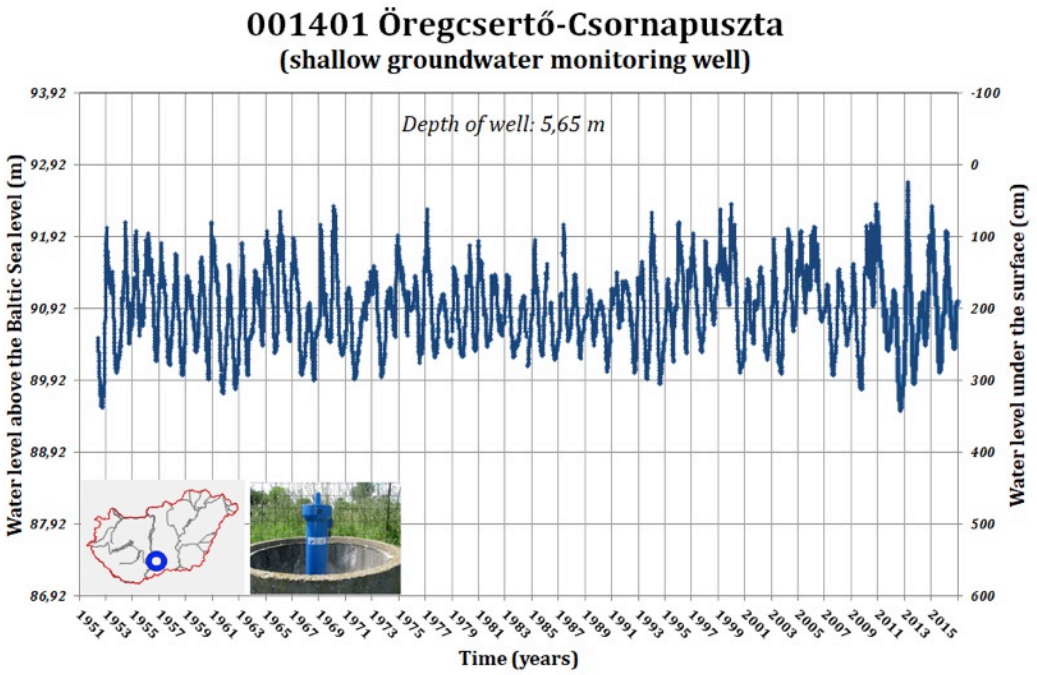
Topic 4: Urban Weather and Climate Modelling

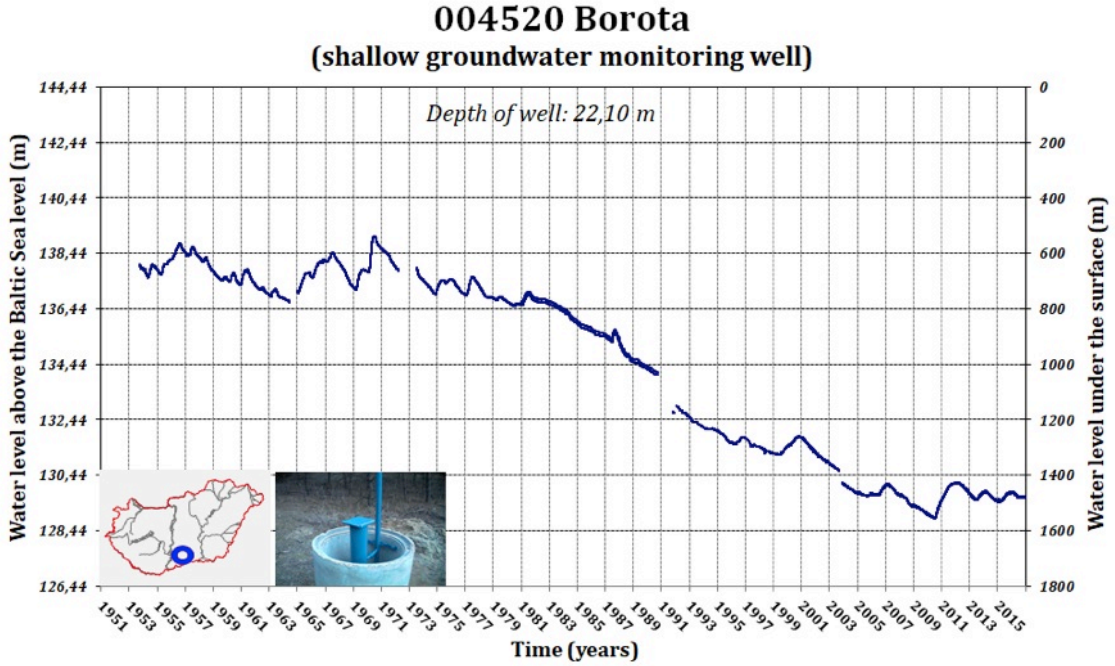
*Outcome: **To provide urban-scale modelling tools** as a method for the urban processes based studies, and vice-versa, to use PannEx special observations for the urban models' **validation.***

Groundwater level on the Pannonian Plain



Average groundwater level (cm) under the surface 1981-2010





Source: Szalai,J.: Directorate General of Water Management

Funds?

Bilateral calls responded by the PannEx community

Ongoing bilateral project: “First micrometeorological research within the Croatian-Hungarian collaboration (FIMO-CROHUN)”, partners: Eötvös Loránd University (Meteorological Department), Budapest, Hungary and University of Zagreb (Geophysical Department), Zagreb, Croatia, time frame: 2017-2018

Future plans

- The finalized White Book will be uploaded to the PannEx webpage and will be advertised on the PannEx mailing list and other interested parties after the English correction is ready.
- Setting the task teams to fulfil the proposed activities outlined in the SP
- Preparation of the **PannEx session** for Annual Meeting of the EMS, Budapest, Hungary, 3-7 September 2018.
- Searching for funding options

Thank you for your kind attention