Universitatea Babeș-Bolyai,
Cluj-Napoca

Facultatea de Geografie

Global Energy and Water Cycle
Exchanges Project

Climate System of the Pannonian Basin (PannEx)

3rd Workshop, 20-22 March 2017, Cluj-Napoca, Romania

2017

ABSTRACT BOOK

CLIMATE SYSTEM OF THE PANNONIAN BASIN (PannEx)

3rd Workshop

March 20-22, 2017

CLUJ-NAPOCA, ROMANIA

Universitatea Babeș-Bolyai,
Cluj-Napoca

Facultatea de Geografie

Global Energy and Water Cycle
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Climate System of the Pannonian Basin (PannEx)

3rd Workshop, 20-22 March 2017, Cluj-Napoca, Romania

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PROGRAM

Climate system of the Pannonian Basin

3rd workshop

Day 1: Monday, 20 March, 2017

Opening ceremony

Chairwoman: Adina-Eliza Croitoru, Babeș-Bolyai University

9.00-9.15: Dănuț Petrea, Dean of Faculty of Geography, Babeș-Bolyai University: *Welcome speech*

9.15-9.30: Daniel David, Vice-rector for Research, Competitiveness - Excellence, and Scientific Publications in Babeș-Bolyai University – *Welcome speech*

9.30-9.50: Jan Polcher, Representative of GEWEX: *Water for the food baskets of the world, a grand challenge for WCRP*

9.50-10.10: Joan Cuxart, Representative of GEWEX: *SOG meeting, specifically GHP and the assessment received on Pannex*

10.10-10.30: Monika Lakatos, President of the PannEx Initiative and PannEx Community - *PannEx: Progress from the first workshop up to now and the tasks ahead*

Coffee break: 10.30-11.00

Session 1: Agriculture response to climate changes and weather extremes

Chairman: Daniel Jug, University of Osijek

11.00-11.15: Andrej Ceglar, Stefan Niemeyer - *Assessing the impact of climate variability on crop production in Europe*

11.15-11.30: Boris Đurđević, Irena Jug, Danijel Jug, Srđan Šeremešić, Vesna Vukadinović - *Comparison of biochar and sugar factory waste lime influence on soil respiration in an acid soil*

11.30-11.45: Ákos Tarnawa, Katalin M. Kassai, Márton Jolánkai: *Influence of precipitation and temperature on wheat *Triticum aestivum* L. protein production*

11.45-12.00: Danijel Jug, Irena Jug, Boris Đurđević, Bojana Brozović, Bojan Stipešević, Vesna Vukadinović: *Adaptation of cropping systems in relation to unfavorable weather conditions and climate changes*

12.00 -12.30: Scientific Discussions on PannEx Flagship Question 1 conducted by Danijel Jug

12.30-13.00: Scientific Discussions on PannEx Cross-Cut 1 conducted by Zita Bihari

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13.00 – 14.30: Lunch break

Session 2: Extreme weather and climate events as a risk to sustainable development

Chairman: Vladimir Đurđević, University of Belgrade

14.30-14.45: Julia Keller, Paolo Ruti, Estelle de Coning, Michel Rixen - *Forecasting high-impact events on timescales from minutes to seasons – research activities promoted by the World Weather Research Programme of WMO*

14.45-15.00: Lucian Sfica, Adina Croitoru, Iulian Iordache, Adrian Piticar - *Synoptic conditions for cold waves and cold spells occurrence in Romania*

15.00-15.15: Dejan Stojanovic, Milena Kresoja, Tom Levanič, Bratislav Matović, Vladimir Đurđević, Saša Orlović - *Prediction of Forest Growth through utilization of Climate Data into Time-series Model*

Session 3: Water-related risks for society security under climate changing conditions

Chairwoman: Monika Lakatos, Hungarian Meteorological Service

15.15-15.30: Svitlana Krakovska, Liudmyla Palamarchuk, Anastasiia Chyhareva, Natalia Gnatiuk, Tetiana Shpytal - *Some hydrothermal characteristics of the Pannonian region under the current climate change*

15.30-15.45: Sandor Szalai - *Improvement of hydrological modelling by model harmonisation*

15.45 -16.15: Scientific Discussions on PannEx Flagship Question 3 conducted by Vladimir Durdevic

16.15-16.45: Coffee break

16.45-17.15: Scientific Discussions on PannEx Flagship Question 4 conducted by Monika Lakatos

17.15-18.15: Poster session (Room 43)

17.15-18.15: IPC internal meeting (Room 45)

18.30-20.00: Cluj-Napoca City tour

Day 2: Tuesday, 21 March 2017

Session 4: Monitoring and estimation of climate change with special regards to extreme weather events (1)

Chairman: Ivan Güttler, Meteorological and Hydrological Service of Croatia

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9.00-9.15: Jaap Schellekens - *The earth2observe water resources reanalysis and its application at the local scale*

9.15-9.30: Bianca Muntean - *A cloud-based collaborative environment for rapid prototyping of innovative Earth Observation products and services to enhance climate resilience of our society and economy*

9.30-9.45: Roxana Bojariu Sorin Dascălu, Mădălina Gothard, Alexandru Dumitrescu, Marius-Victor Birasn, Liliana Velea, Roxana Cică - *Climate variability and change impact on droughts in the Danube Basin*

9.45-10.00: Livia Labudova, Maroš Turňa - *Drought Monitoring in Slovakia*

10.00-10.15: Ivan Güttler - *Regional climate modelling: experience from DHMZ*

Coffee break: 10.15-10.45

Session 4: Monitoring and estimation of climate change with special regards to extreme weather events (2)

Chairman: Judit Bartholy, Eötvös Loránd University

10.45-11.00: Judit Bartholy, R. Pongrácz, I. Pieczka, K. Szabóné André - *New climate scenarios for the Pannonian Basin*

11.00-11.15: Amanda Imola, Szabó Ferenc Ács, Hajnalka Breuer - *The Fine-tuning of Feddema's Climate Classification Method: Relationship between Environmental Features and the Mesoscale Climate of the Carpathian Basin*

11.15-11.30: Svitlana Krakovska, Anastasiia Chyhareva, Sorin Cheval, Natalia Gnatiuk - *Shifts of season duration in the Pannonia region in the period 1961-2010*

11.30-11.45: Sorin Cheval, Alexandru Dumitrescu, Mihai Adamescu, Constantin Cazacu - *Observed climate change hotspots in the Carpathian region (1961-2010)*

11.45-12.00: Gabor HALUPKA, Sándor SZALAI - *Meteorological factors in water management of urban parks*

12.00 -12.30: Scientific Discussions on PannEx Flagship Question 2 conducted by Tamás Weidinger

12.30-14.00: Lunch break

Session 5: Impact and vulnerability assessments of climate changes and extreme weather events on different sectors (1)

Chairman: Tamás Weidinger, Eötvös Loránd University

14.00-14.15: Adrian Șarpe, Izabella Voda – *Small watershed hydrological models – lag time comparison*

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14.15-14.30: Tamás Weidinger, Árpád Bordás, Zsolt Bottyán, Zoltán Bozóki, Rodamilans Joan Cuxart, András Zénó Gyöngyösi, Gyula Horváth, Zoltán Istenes, János Józsa, Zoltán Nagy, Péter Salavec, Gemma Simó, Zoltán Attila Szabó, Péter Torma, Ágoston Tordai, Burkhard Wrenger - *PABLS'13 and '15: boundary layer measurement campaigns in Szeged*

14.30-14.45: Maja Telisman Prtenjak, Marko Karoglan, Željko Večenaj, Silvio Simon, Zeljka Kordej-De Villa, Branko Grisogono, Andreina Belusic, Antun Marki, Visnjica Vucetic, Damir Pocakal, Jasminka Karoglan-Kontic, Ivana Tomaz, Mirela Osrecak, Zeljko Andabaka, Ivana Vladimira Petric, Renata Leder, Ivan Prsa, Tomislav Plavska, Maja Vehovec, Ivana Rasic Bakaric - *VITiculture and CLimate Change in Croatia (VITCLIC)*

14.45-15.00: Helga Toth, Balazs Szintai - *Drought Monitoring and Change based on Surface model at the Hungarian Meteorological Service*

15.00-15.15: Bojan Cvetkovic, S. Nickovic, G. Peijanovic, S. Petkovic, J. Nikolic, A. Vukovic, M. Vujadinovic, V.Djurdjevic - *Improvements in water cycle numerical modelling*

15.15 – 15.45: Coffee break

Session 5: Impact and vulnerability assessments of climate changes and extreme weather events on different sectors (2)

Chairman: Sorin Cheval, University of Bucharest

15.45-16.00: Joan Cuxart, Blazenska Matjagic - *Mesoscale topographically-generated Low-Level Jets in the Pannonian Basin*

16.00-16.15: M.S. Beldean-Galea, Iv. Haiduc, A.E. Croitoru, F. Moldovan, I. Holobacă - *Carbon dioxide versus meteorological variables in urban area. Case study Cluj-Napoca City*

16.15-16.40: Scientific Discussions on PannEx Flagship Question 5 conducted by Adina Croitoru

16.40-17.05: Scientific Discussions on PannEx Cross-Cut 2 conducted by Joan Cuxart

17.05-17.30: Scientific Discussions on PannEx Cross-Cut 3 conducted by Ivan Güttler

17.30-18.30: IPC internal meeting

19.00: Official dinner (Grand Hotel Napoca)

Day 3: Wednesday, 22 March 2017

Session 6: Future actions

Chairman: Joan Cuxart, Univeristy of Balearic Islands

9.00-9.30: Open discussion on Science Questions

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9.30-10.00: Wrap up of Science Question discussions by IPC members

10.00-10.30: Coffee break

Session 7: Future actions

Chairman: Adina Croitoru, Babeș-Bolyai University

10.30-11.00: Possible sources of funding and the setting of a strategy for applying to the different calls

11.00-11.30: Discussions on PannEx logo, next workshop date and place

12.00: End of 3rd PannEx Workshop

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ORAL PRESENTATIONS

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WATER FOR THE FOOD BASKETS OF THE WORLD, A GRAND CHALLENGE FOR WCRP

Jan Polcher

Representative of GEWEX
Contact: jan.polcher@lmd.jussieu.fr

The World Climate Research Program (WCRP) has chosen to highlight the water resources of the food baskets of the world as one of its grand challenge for climate research. It is of tremendous importance for society to understand the water cycle of these highly anthropogenized regions and ensure that even under a changing climate they can continue to feed a growing world population. The GEWEX program is leading this grand challenge for the WCRP.

The increased greenhouse gases will modify rainfall patterns in many ways: distribution, amount, intensity, frequency, duration and type. It is a challenge for the scientific community to predict these changes with confidence, in particular at the spatial scales of the major agricultural areas of the world and some progress is urgently needed. The changes in rainfall characteristics will affect many land surface processes such as infiltration and recharge of ground water and thus the water available for plant evaporation. These changes will also bring more intense and longer droughts or heavier floods, extremes which will affect agriculture and are the focus of another grand challenge of the WCRP. At the same time the evaporative demand of the atmosphere will be higher in a warmer climate and could also negatively affect crops by increasing the frequency and severity of soil moisture stress situations.

One of the major challenges over the agricultural regions of the world is that water is regulated in order to ensure reliable irrigation of crops, domestic water supply and hydro-power generation throughout the year. These infrastructures have successfully allowed to manage the natural fluctuations of climate of the past. GEWEX and the WCRP have not yet studies the combined effect of the climate change and the human management of the resource. Human activities have modified the natural water cycle by deciding how much of the precipitation, as snow or rain, infiltrates, runs-off to the oceans or is evaporated by plants. These interventions have modified the way energy is partitioned at the surface, affected the structure of the lower layers of the atmosphere and probably displaced the location of initiation of rain events. Thus the sensitivity of the regions to climate change has also been modified by humans but this has not yet been taken into account in climate studies. The exploration of these feedbacks will need to be carried out at high resolution as land surfaces are by nature patchy and no large scale feedback is expected. We need to understand the stresses which climate change will put on human infrastructures and see to which point they will be able to cope with the future changes in the water cycle. It is also essential to determine for the food baskets of the world which water consumption levels will be sustainable in a changing climate.

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SSG MEETING, SPECIFICALLY GHP AND THE ASSESSMENT RECEIVED ON PANNEX

Joan Cuxart

Representative of GEWEX
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The 29th meeting of the GEWEX Scientific Steering Group took place in Sanya (Hainan, China) between 6 and 9 February 2017. The GEWEX chairs led the review of the status of current and planned activities, as well as the strategic steps to be taken in the coming years. The meeting was attended by the members of the SSG itself, the GEWEX panel chairs, some invited participants of relevant organizations (ESA, NASA, NOAA, WWRP) and members of the Earth Science community in China. The organizer was Professor Xin Li, of the Cold and Arid Regions Environmental and Engineering Research Institute (Lanzhou, China).

The co-chairs of the different panels reported to the SSG on the status of their activities and received suggestions for further advancement and improvement and requests of action concerning activities which were not working as expected. The invited institutions and the Chinese scientific community informed of their actions and interests related to the GEWEX aims, and some steps were taken towards establishing a more intense collaboration with them.

GHP reported on the just ended, mature, initiating and planned RHPs and CCs. The initiating and planned actions received most of the SSG attention. The projects in the initiating phase shall demonstrate progress to proceed to fully running actions, otherwise they might be reconsidered. The planned projects, such as PannEx, are considered with outmost interest, because they may host and develop many of the core ideas of GEWEX and this motivates the community very positively, such as in the new Grand Challenge "Food baskets of the world".

In this talk, the current status and foreseen actions of GEWEX in general, and of GHP in particular, will be briefly described, focusing on what is the possible role of PannEX amongst them, for a time span covering the next 10 to 15 years.

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PANNEX: PROGRESS FROM THE FIRST WORKSHOP UP TO NOW AND THE TASKS AHEAD

Monika Lakatos

Hungarian Meteorological Service, Budapest, Hungary

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The initiation workshop of the PannEx was organized by The GEWEX Hydroclimatology Panel (GHP), the Croatian Meteorological and Hydrological Service and the University of Osijek at Osijek in November 2015. The main scientific issues: the five flagship questions and three crosscuts subjects were identified on the first workshop. The five flagship questions address the agriculture, air quality, sustainable development, water management and education related to these issues. The three crosscut issues are dedicated to data and knowledge rescue, process modelling, and developing and validating the modelling tools. One and a half year passed since then. The flagships and crosscuts are flashed in a white book written by many authors from the region. The first version of the white book were discussed on the 2nd PannEx workshop in Budapest June, 2016. The PannEx were introduced on the 1st Baltic earth conference to make bridges between regional hydroclimatology projects (RHPs). The PannEx activities were presented on the GHP meeting in October. National Seminars were organized in Budapest in the topic of the first flagship question: Adaptation of agronomic activities to the weather and climate extremes and with the title: Land Degradation Neutrality which was related to both science questions on agriculture and the sustainable development.

To become a full-working regional hydroclimatology project a detailed science plan have to derive based on the white book and we have to agree on the implementation plan including the detailed coordination mechanism, tasks and deadlines, the data management strategy and the human resources. The potential funding possibilities have to follow continuously. The 3rd workshop provides a good opportunity to finalize the white book and to discuss the first draft of the science plan and to make the community stronger.

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ASSESSING THE IMPACT OF CLIMATE VARIABILITY ON CROP PRODUCTION IN EUROPE

Andrej Ceglar, Stefan Niemeyer

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Agriculture in Europe is strongly influenced by changes in climate variability and extremes. The present climatic trends indicate that the northern areas may primarily have a positive effect through increases in productivity; while in southern areas the disadvantages will predominate resulting in lower harvestable yields, higher inter-annual yield variability and reduction of agricultural areas. In this study we aim to present ongoing activities in the Food Security Unit of the Joint Research Centre (JRC) with relation to monitoring and forecasting the agricultural production and closely related areas of the impact of climate change on crop yields in Europe. The Mars Crop Yield Forecasting System (MCYFS) has been developed for this purpose, which is an integrated analysis tool based on satellite observations of Earth, meteorological observations and forecasts, agro-meteorological and bio-physical modelling, and statistical analyses. Several case studies using this tool are presented, related to seasonal forecast activities and climate change impact assessment.

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COMPARISON OF BIOCHAR AND SUGAR FACTORY WASTE LIME INFLUENCE ON SOIL RESPIRATION IN AN ACID SOIL

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Biochar is the product obtained through the pyrolysis process of waste biomass which has long residence time in soil, even hundreds of years. It is used in agriculture as soil conditioner and can have positive effects on several physical, chemical and biological soil properties. Also, biochar has one more important characteristic and that is sequestration of carbon in the soil. Some research show that by switching from the traditional method of disposal of organic matter to biochar production, it is theoretically possible to stabilize about 0.7 Gt of CO₂ on the global level. However, currently mostly used soil conditioner of acid soils is sugar factory waste lime, which is a by-product in the production of sugar and contains 30% Ca. The aim of this research was to determine the differences in effects that these two soil conditioners have on soil respiration levels. The research was carried out on stationary field trials at two locations on acid soils in Osijek-Baranja, and Virovitica-Podravina County, Croatia. Experimental design was a split-plot with four repetitions and the crop used was corn. Biochar was the main factor which was compared to sugar factory waste lime as the most widely used soil conditioner of acid soils in Croatia. The 5, 10 and 15 t ha⁻¹ of biochar were applied on the plots and dose of sugar factory waste lime was calculated for each field trial location. The amount of CO₂ released was estimated based on the 24h soil-CO₂ burst test method. Soil respiration at location Virovitica-Podravina was significantly higher than the soil respiration on location Osijek-Baranja. The highest values of soil respiration were measured on treatment with liming, indicating a good microbial activity, but also an increase of CO₂ emissions. Since the studied soils contain very little organic matter, increase in microbial activity over time can lead to the additional decline in organic matter content as well as soil fertility. Application of biochar in the highest dose has no statistically significant effect on soil respiration increase, which confirms that biochar was stable in soil and achieved carbon sequestration. One-third of greenhouse gas emissions come from agriculture and at the same time agriculture must adapt to the climate change. So, we can conclude that biochar can positively effect both problems through reducing agriculture's carbon footprint and through its positive effect on several soil properties that can mitigate negative effects of climate change.

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INFLUENCE OF PRECIPITATION AND TEMPERATURE ON WHEAT TRITICUM AESTIVUM L. PROTEIN PRODUCTION

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Meteorological conditions of a certain crop year, especially the amount and distribution of precipitation and the actual temperature highly influence grain yield and yield quality of winter wheat *Triticum aestivum* L. Weather conditions are evaluated and labelled favourable or non-favourable in relation with the optimum requirements of the crops' phenophases. Regarding precipitation, the most vulnerable periods during growth and development of winter wheat are the phenophases of heading and flowering. In case of temperature, two critical periods can be detected. One is the vernalisation, and the other is the ripening stage. Crop yield and grain quality can also be influenced by agronomic applications. Plant nutrition in general and N topdressing in particular should be considered as the most effective treatments within the technologies of winter wheat production. The amount of nitrogen and the timing and distribution of the application have an impact on wheat quality, especially on the protein production of the crop.

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ADAPTATION OF CROPPING SYSTEMS IN RELATION TO UNFAVORABLE WEATHER CONDITIONS AND CLIMATE CHANGES

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Crops (plants), during its whole evolution, grow and develop by adapting to ever-changing environmental conditions. In present time this variations and changes are aggravated because of the impact of human activities and can be more seriously and dramatically than in whole period of agriculture. As the climate change become theoretical and practical problem in almost every aspect of human life, agricultural production try to find the best (or optimal) pathways to adapt and prevail actual or potential problems, especially in crop production. Production levels of two most important crop types in Pannonian basin, maize and wheat (and increasingly important soybean), are strongly influenced on weather conditions. Every variation of average values of most important weather parameters in crop production (precipitation and temperature) can directly or even indirectly lead to the decrease of crop productivity. Cropping systems defines which way of production can achieve optimal crop productivity in ways and in levels in which crops can be adapt to environmental changes (mostly to weather and climate aberrations). Impact of weather and climate change shaping cropping systems and farm management on many different ways and have many aspects, e.g.: sowing different crops or varieties, introduction tolerant crops (cultivars), changing type and timing of field operations, irrigation, implementation of reduced or conservation soil tillage systems, intercropping and multi cropping (cover, catch and cash crops), crop rotation. Temporal and spatial changes during crop growth have not yet been well known. On theoretical and practical basis cropping systems will go through significant changes probably with expansion of cropland on vertical and horizontal level. Choosing of the "best cropping system" or "best solutions" is a process which need to be elaborating according site-specific methods and crop-specific responses to mitigate climate threats. In this process, application of conservation agriculture principles has a unique and specific role which can make a difference from successful and sustainable crop production in compare with traditional principles.

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FORECASTING HIGH-IMPACT EVENTS ON TIMESCALES FROM MINUTES TO SEASONS – RESEARCH ACTIVITIES PROMOTED BY THE WORLD WEATHER RESEARCH PROGRAMME OF WMO

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The WMO World Weather Research Programme (WWRP) promotes international and interdisciplinary research for more accurate and reliable forecasts from minutes to seasons, expanding the frontiers of weather science to enhance society's resilience to high-impact weather and the value of weather information to users. WWRP aims at Seamless Prediction by increasing convergence between weather, climate and environmental approaches. The presentation will introduce two of the three WWRP core projects, which might be particularly relevant for PannEx. It will give an overview on current and planned activities of those projects, available data bases and methods, and will show potential links for possible collaboration options in the framework of PannEx.

The High-Impact Weather Project (HIWeather) focuses on five hazards, of which urban heat and air quality, and urban flooding are two. HIWeather activities aim to improve the understanding of predictability and processes of such events, advance coupled modelling capabilities and evaluation. In particular, the project also addresses the communication of forecasts and warnings, tailored to the user's needs, taking into account their vulnerability and risks.

The Sub-seasonal to Seasonal Project (S2S, under the co-leadership of WWRP and WCRP) seeks to improve forecast skill and understanding on the subseasonal to seasonal timescale, with specific attention to the risk of extreme weather such as droughts, floods and heatwaves. This project fosters research through a data base of sub-seasonal to seasonal forecasts, and promotes the uptake of the application products by operational centers and decision makers.

Some of the activities proposed in the PannEx flagship questions, in particular on agronomic activities, air quality and water management, and the cross cutting modelling activities are well aligned with the scopes of the two projects, and establishing links and collaborations could be of mutual benefit. “

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SYNOPTIC CONDITIONS FOR COLD WAVES AND COLD SPELLS OCCURENCE IN ROMANIA

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Despite the actual warming trend observed worldwide, cold waves represent one of the major climate hazards in the temperate region. In our study we analyzed synoptic conditions for cold outbreaks occurrence in Romania over a 55-yr period (1961-2015). We have used observation data recorded in 27 weather stations in Romania, and 76 cold waves and cold spells were identified. The intensity threshold was the value of the 95th percentile of daily maximum temperature, while the duration threshold was chosen at minimum 3 consecutive days.

The synoptic conditions have been analyzed by using HYSPLIT technique, the NOAA Climate Prediction Reanalysis Archive, and the Catalogue of Atmospheric Circulation Types in Europe resulted from 733 COST action. Also, indices of continental and hemispherical climate teleconnections have been employed. The methodology used to classify synoptic conditions is based on K-mean clustering of backward trajectories, followed by obtaining the composite maps for the 3 major synoptic types generating cold waves in Romania.

These types have been classified according to the origin of the air masses as it follows: North Atlantic (1), Arctic (2), and East European/Siberian (3). General climate features of each synoptic types is described for the region of Romania using ROCADA data base. The role of the Carpathians for regional differences in the propagation of cold waves represents one of the main topics of this presentation.

Acknowledgments This research was developed under the framework of the research grant *Extreme weather events related to air temperature and precipitation in Romania* (project code: PN-II-RU-TE-2014-4-0736), funded by the Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI) in Romania.

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PREDICTION OF FOREST GROWTH THROUGH UTILIZATION OF CLIMATE DATA INTO TIME-SERIES MODEL

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Dendrochronology is a scientific discipline that deals with the dating of historical events allowing the release of records about natural environmental processes and human induced changes including past temperatures, precipitation, forest fires, landslides, insect outbreaks, etc. Tree-rings, central object within Dendrochronology, may be well used also for comprehensive climate / growth studies. Impact of extreme climate events on forests in Serbia is well documented (increased forests mortality, increased frequency of forest fires, intensive and frequent pest attacks, etc.). Also, several climate impact studies were published regarding future of forests in the 21st century. What was missing are prediction regarding near-future, or real-time predictions. We utilized tree-ring data from oak stand from north part of Serbia together with temperature and precipitation data from CARPATCLIM database within framework of time-series model. Particularly, we used Autoregressive Integrated Moving Average Model joined with mean temperature and precipitation for the period April-August. Model parameters were obtained for the period 1961-2000 and then tested on the last 10 years of climate data (20 % of sample, period 2001-2010). Calculated mean absolute error, as well as mean square error between modeled and measured tree-ring data were below 5%. Developed model may provide excellent base for near real-time prediction of forest growth and their response to extreme climate conditions. Implementations of climate data from different emission scenarios in this model may be promising. Key words: tree-rings, temperature, precipitation, autoregressive model, real-time predictions

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SOME HYDROTHERMAL CHARACTERISTICS OF THE PANNONIAN REGION UNDER THE CURRENT CLIMATE CHANGE

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Climate change is impacting on agriculture and food security already and becoming a significant threat and challenge for further sustainable development of all nations. Agriculture, as like as forestry and other biological systems, is strongly dependent on heat and water availability. To unite both characteristics, so called hydrothermal characteristics are used in climatology to determine different types of hydrothermal regime and consequently types of climate. In order to investigate how current climate change impacts on local hydrothermal regime in the Pannonian region, we analysed changes in the following characteristics: distribution of annual precipitation sums, mean 2-m air temperature of the warmest month, annual potential evapotranspiration (PET), annual moisture deficit and moisturising factor on the 0.25 x 0.25 grid.

All estimations were performed based on the data from the European gridded dataset E-Obs. To identify the changes we compared periods 1961-1990 (WMO climatic norm) with 1981-2010 (current climate) and where appropriate with the period 1986-2015 (the most recent). The following results were obtained. The general patterns of annual precipitation sums are similar for both periods with less than 500 mm per year at the central lowland and above 1000 mm per year at the boundaries of the Pannonian region. Notwithstanding that annual sum of precipitation generally increased in the last period in the central more dry part of the region, amount of the increase was less than 10% or 50mm. At the same time, due to intense rise of air temperature and particularly in the warmest month (over 1oC), annual PET has increased dramatically from above 650 mm in the standard period to above 750 mm in the modern period. Therefore, moisture deficit, as difference between precipitation and PET, became much severe (over minus 400 mm) and moisturising factor, as a ratio of the same characteristics, decreased pointing out that the central part of the region has turned from semi-humid to semi-arid type of climate.

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IMPROVEMENT OF HYDROLOGICAL MODELLING BY MODEL HARMONISATION

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The White Book of the PannEx contains gaps on different areas. One of the most important task is the runoff modelling in the Danube catchment. For this purpose, countries use different models according to their geographical and historical conditions. One possible way to improve the streamflow estimations is to harmonize the national runoff models. One possible project proposal will be shown in the presentation.

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THE EARTH2OBSERVE WATER RESOURCES REANALYSIS AND IT'S APPLICATION AT THE LOCAL SCALE

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The overall objective of the EU FP7 project earth2Observe is to integrate available earth observations, in-situ datasets and models to construct a consistent global water resources reanalysis dataset of sufficient length. Furthermore, the resulting datasets will be downscaled for application in case-studies at regional and local levels and optimized based on European and local needs for water management and decision making. An updated version of the WATCH-ERA Interim (WFDEI) global forcing dataset has been made available and a total of ten global land surface and global hydrological models have been run with this forcing to construct a first version of the water resource reanalysis; a multi model ensemble. Key to the project is the applicability of the global for basin scale studies. Here, the datasets and models will be validated and improved based on end-user defined performance criteria on the basis of case studies covering most continents and climate conditions and with different degrees of data richness. First work in Australia demonstrates that a global model can benefit significantly from the assimilation of EO based soil moisture data.

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A CLOUD-BASED COLLABORATIVE ENVIRONMENT FOR RAPID PROTOTYPING OF INNOVATIVE EARTH OBSERVATION PRODUCTS AND SERVICES TO ENHANCE CLIMATE RESILIENCE OF OUR SOCIETY AND ECONOMY

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The Earth Observation ClimLab (EO ClimLab), implemented by European Space Agency is a collaborative research e-environment enabling the rapid development and prototyping of new Earth Observation (EO)-based products aiming to support adaptation and mitigation to climate change across multi-disciplinary societal and business themes (e.g. agriculture, health, risk management, infrastructure maintenance, education, outreach).

The project will have a duration of 18 months, with partners from 3 different countries: Romania, Czech Republic and Poland. The partners from Romania are: ARIES Transilvania (Cluj-Napoca), Indeco Soft (Baia Mare) and AROBS Transilvania Software (Cluj-Napoca).

The purpose of the project is to popularize the use of information provided by satellites in order to create apps in Romania, Poland and Czech Republic, the final objective being the identifying of the most promising apps in order to support them and to be put to use. Mostly, it's purpose is to develop commercial apps which will use the data provided by satellites.

EO ClimLab will be included in local ecosystems with several goals:

- To create local dynamics, involving universities, local authorities, companies, around climatic resilience challenges;
- To promote and democratize the use of space data for climate resilience solutions by the installation of DAP platforms based on open source tools able to interconnect Space and local data;
- To propose support to entrepreneurs after the development of new ideas with the contribution from incubators and accelerators.

The EO ClimLab can be seen as kind of "Fablab" environment providing developers with the data, tools and knowledge needed to develop new products and services to enhance climate resilience.

The EO ClimLab can be operated by different organisations (e.g. incubators, techno park, local authorities, universities), which will have access to the EO ClimLab package described above including physical and virtual infrastructure and support.

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CLIMATE VARIABILITY AND CHANGE IMPACT ON DROUGHTS IN THE DANUBE BASIN

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The aim of this study is the assessment of observed drought variability and change occurring in the Danube basin. We have used gridded data consisting of monthly temperature, precipitation and potential evapotranspiration from the CRU. These data cover the time interval 1901-2015. In addition, we have analyzed the WFDEI meteorological forcing data based on ERA INTERIM reanalysis which are available for the interval 1979-2012 and the model results for the historical period (1951-2005) which have been made accessible thanks to the EURO-CORDEX initiative. The impact of climate variability and change on drought is assessed by using the Palmer Drought Severity Index (PDSI). The principal component analysis of PDSI reveals two patterns of variability: (1) a basin-wide one in which the PDSI shows a linear downward tendency thus indicating a trend towards drought especially in the warm season; (2) a contrasting configuration with opposite signs between low and mid Danube basin. Model results suggests that the basin-wide signal in the PDSI could be linked with the climate change.

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DROUGHT MONITORING IN SLOVAKIA

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Due to the global climate change, the drought begins to be more serious and important theme of discussions. This phenomenon has an influence on the agricultural production, and consequently on the production of food for increasing world population. Due to the importance of drought monitoring, we decided to run its testing version in the first season 2015 and monitored area covered the Danubian Lowland and the East Slovakian Lowland. Four drought indices (SPI, SPEI, Z-index and CMI) were weekly updated and drought/humidity development was described. Except of that, we tried to illustrate the tendency of each index in next 7 days. The forecast was based on the European model ECMWF. In new season 2016, we enlarged the monitored area, slightly modified a methodology and prepared new appearance of drought monitoring. At the moment, it covers the territory of the whole country. The monitoring is station based and the data from 44 climatologic stations with available daily operational data access are used. The mountainous stations were excluded as the monitoring should be used primarily for agricultural purposes. The assessed period is from 1981 till the present and the reference period for the SPI and the SPEI was fixed on 1981 – 2010. The monitoring is updated weekly each Monday from March to September at the official webpage of SHMI (<http://www.shmu.sk/sk/?page=>) and it consists of the assessment of the situation during the past seven days as well as the expected changes in drought indices in the next seven days. The drought indices are visualised in figures, which are available after click on the station mark in the interactive map with figure preview. The colour of the mark represents drought intensity according to the SPEI at the end of week. Beside graphical visualisation, we provide also text summarizing weather in the last week with explanation, how it influenced the water balance in Slovakia and which changes are expected in the next week as well. During the workshop, we would like to introduce you our approach to drought monitoring with the slight modification of the SPI and the SPEI methodology, which seems to be useful for operational monitoring.

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REGIONAL CLIMATE MODELLING: EXPERIENCE FROM DHMZ

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In this talk a presentation of regional climate modelling activities at the Meteorological and Hydrological Service of Croatia (DHMZ) will be given. Experiences from the EURO-CORDEX and CORDEX-FPS initiatives will be discussed. Finally, a set of PannEx targeted regional climate models' simulations at the <10 km horizontal resolutions will be suggested.

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NEW CLIMATE SCENARIOS FOR THE PANNONIAN BASIN

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Many studies concluded that the Pannonian Basin is one of the most exposed and vulnerable regions of Europe from the climate change point of view. Some of the new regional climate scenarios using the new RCP scenarios of IPCC are already completed, and others covering a whole range of possible future conditions will be available within the next few years. At the Eötvös Loránd University, the regional climate model RegCM is used to produce such new climate scenarios for the Pannonian Region using a moderate (RCP4.5) and a high (RCP8.5) anthropogenic impact estimation.

Besides the projected changes of the mean climate conditions (mainly temperature and precipitation), extreme climate events associated with temperature (especially heat waves) and precipitation (with special focus on droughts and excessive, intense precipitation) are also analysed in this presentation.

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THE FINE-TUNING OF FEDDEMA'S CLIMATE CLASSIFICATION METHOD: RELATIONSHIP BETWEEN ENVIRONMENTAL FEATURES AND THE MESOSCALE CLIMATE OF THE CARPATHIAN BASIN

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Feddema's climate classification method is an up-to-date method for characterizing climate at different scales. In preliminary research this method has been used for characterizing the climate of the Carpathian Basin using the CarpatClim dataset. The results show that climate heterogeneity obtained by Feddema is much larger than the climate heterogeneity obtained by Köppen and also that the application of Feddema's method in the subregions can show heterogeneous climate types due to its fine tuning. The aim of the study is to fine-tune the Feddema's method to apply it in three sub-regions for climate classification purposes.

The Carpathian Basin possesses a particular climate, and as such, it is a suitable location for the investigation of the connection between the meso- γ scale (2-20 km) heterogeneity of climate and the variability of topography, soil and vegetation. The subregions were chosen in a way that facilitates the verification procedure based on relationship analysis between the above mentioned features. In further researches, this method can be applied to analyse the climate change of the region, though additional multidisciplinary studies are necessary to understand the changes of environmental features in the region.

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SHIFTS OF SEASON DURATION IN THE PANNONIA REGION IN THE PERIOD 1961-201

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Season duration is one of the most important climatic characteristics of any region and among the most requested information by many economic sectors such as agriculture, forestry, energy, tourism and recreation, etc. Shifts in season duration represent the regional climate changes and depend on complex of many hydrometeorological factors. Therefore, the goal of the presented research was to estimate shifts of main seasons' duration over the Pannonian region in a modern period (1981-2010) vs. a standard WMO period (1961-1990).

Multi-year daily mean of air temperature, represented its averaged annual course, was obtained by E-OBS dataset with resolution 25x25 km for both periods in every grid point. Number of days with temperature above thresholds of 0°C, 5°C, 10°C and 15°C in the annual course was assumed as warm, frost-resistant vegetation, active vegetation and summer seasons' durations respectively. Warm season ($t > 0^{\circ}\text{C}$) in the Pannonian region lasts for over 300 days and exceeds 320 days over the most territory for both periods. The most significant changes in the modern period were found at the south-south-western part of the region, where warm season became as long as all the year (366 days). Duration of frost-resistant ($t > 5^{\circ}\text{C}$) and active ($t > 10^{\circ}\text{C}$) vegetation seasons have not changed significantly and for both periods they were around 190 and 240 days respectively. Shifts were plus/minus 2 days in both cases. Summer season duration ($t > 15^{\circ}\text{C}$) in the region was above 130 days in the standard and above 140 days in the modern periods. Consequently the prevailing shift of the summer season duration was 8-10 days in the Pannonian region with maximum over 20 days in the Romanian Carpathians. As a conclusion, the maximum shifts in seasons' durations have been obtained for summer season in the Pannonian region. Other studied seasons did not change significantly in their durations.

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OBSERVED CLIMATE CHANGE HOTSPOTS IN THE CARPATHIAN REGION (1961-2010)

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Climate variability and change is currently a topic of global interest, often present in prime time news and firmly included in the political agenda, as the impacts on environment and society can be observed in different corners of the world. The increased frequency of extreme weather events may be linked to the climate change context, and phenomena like mountain glacier melting, sea level rising or lower water resources are also attributed to warmer and drier climate conditions. In their turn, the ecosystems are highly sensitive to climatic factors and, at the same time, early indicators of change, e.g. the tropical ecosystems will store less carbon in a warmer climate. The global dimension of the climate change is beyond question, but drastic differentiations related to the trend and intensity of the changes may occur at regional and local scales. In this context, climate change hotspots may be defined as areas where one or more climate variables shows a steep decreasing or increasing trend along a certain period.

The Carpathian Mountains are considered a biodiversity hotspot, occupied by many relatively undisturbed ecosystems, and still rich in semi-natural, traditional landscapes. Whereas previous research provided robust scientific evidences about the general trends of the climatic elements, this study reports on observed climate change hotspots (1961-2010) relevant for ecological investigations in the Carpathian mountain region, as identified from temperature and precipitation at seasonal and annual scale, based on the output data of the CARPATCLIM project. The hotspots were identified and analyzed both for individual variables and aggregated using Standard Euclidean Distance, and the outputs emphasize clear thermal differences between the Carpathian Mountain chain and the surrounding areas, as the warming is more intense over the lowlands than at high altitudes. Besides, the southern part of the domain has become drier, while the northern part is slightly wetter in the last decades.

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METEOROLOGICAL FACTORS IN WATER MANAGEMENT OF URBAN PARKS

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Water management of the urban parks is a particular research section within the frame of urban geology, with increasing social importance. Natural and anthropogenic factors affect on these green sites, giving a special scientific importance of the research. Behavior of such a 'composite' system is expected to be very complex. Beside it, social relevance of urban parks is also arising, since ability of tolerance of extreme heat events is highly supported by the green areas. General meteorological factors (like precipitation, temperature, irradiation, wind) are affecting different way on this partly artificial, partly natural environment comparing e.g. a natural meadow, just because of complexity of the urban environment. Points mentioned above were the base to introduce a new research project in the Geological and Geophysical Institute of Hungary ('MFGI'). The project is focusing on water management of the urban parks. Field studies have been started in 4 parks of Budapest, in July, 2016.

The chosen parks are as follows: Honvéd square (Pest [E-side of the Danube], downtown); Derkovits square (Pest, suburb, garden area); Nagy Imre square (Buda [W-side of the Danube], downtown); Vérhalom square (Buda, garden area). Soil temperature and soil moisture measurements are being in progress at four different locations in every park, weekly frequency. Precipitation has been also detected. Observation points were selected to describe effect of different microclimatic circumstances on soils of the parks. One point represents a permanent shiny, another one a permanent shady area of the park. The remaining two observation points represent two special places: one is the southern borderline of the park facing the northern frontage of the surrounding houses; while the other one is on the opposite side, facing to the southern frontage of the houses.

The first results clearly show, that • soil temperature in downtown parks are generally higher than in a park taking place in the suburb, which indicates a living heat island effect in Budapest; • soil temperature and moisture data at the 4 observation points of the same park definitely differ, which highlights parallel, yet definitely different natural processes within a given park; • soil moisture higher in downtown parks, because of permanent irrigation during the summer. Also, irrigation can play a special role, as cooling factor for the soils of a given park; • this way irrigation appears to be as a unique human factor, which locally affects on effect of climate change, as a regional/global impact. Our long-term objective is to understand behavior of urban parks under special conditions (e.g. during heat island effects) by getting multidisciplinary information from well-defined positions. This can be essential to perform a more sustainable water management of an urban park in the future.

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SMALL WATERSHED HYDROLOGICAL MODELS - LAG TIME COMPARISON

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In the framework of hydrological cycle the process of mass transfer of rainfall water into runoff is characterized by the drain lag time defined as duration between net rain nucleus moment and the peak flow moment. Here it is used as benchmark for a comparative analysis of two different approaches of rainfall-runoff process. In the rational method lag time of smaller than 10km² ungauged hydrological basins is calculated following an iterative algorithm. USDA-SCS is the second method and the so called Curve Number (CN) occur in the lag time formula. Based on the soil and land cover maps the Mures river basin CN map was composed and an area weighted average value for each of 51 analyzed watershed was extracted. Rational method computed lag times were in the range of 16 to 93 minutes and the SCS ones were between 9 and 173 minutes. Squared correlation coefficient of these series were 0.5389, showing the need of corrections in CN determination method for Mures river basin. In order to start defining these adjustments, corresponding CN values were calculated from rational method lag times and a comparative analysis of variables involved in both formulas was performed. Other correlations between direct and inverse calculated CN were also examined. The other possible interpretation of this lag times series poor correlation is the rational method of the roughness coefficients estimation confidence. Because of its complexity, an inverse calculus of these coefficients was performed here in a simplified non-iterative version only. If a consistent correction will be found, the hydrological basis of the design procedures (dams, dikes, bridges) and of the water resources management (hydropower, irrigation), will be significantly improved because of a straight and less subjective SCS lag time equation, thus further studies are expected.

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PABLS'13 AND '15: BOUNDARY LAYER MEASUREMENT CAMPAIGNS IN SZEGED

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The PABLS (Pannonian Atmospheric Boundary Layer Experiment Szeged) programs were organized within wide range of Hungarian and international cooperation in the winter of 2013 (20th November – 1st December) and in the summer of 2015 (16th June – 8th September). The main goals were i) description of Planetary Boundary Layer structure (PBL) development especially in the transition periods, ii) profile (temperature, humidity, wind) measurements near surface and in the PBL using remote sensing instruments (Wind Profiler, SODAR, Radiometer), tethered balloon, UAV, quadcopters and of course radiosondes, iii) soil and surface energy budget component measurements. The surface energy budget closure uncertainty (sum of the sensible and latent heat fluxes ($H + LE$) divided by sum of available energy (net radiation minus heat flux into the soil ($R_n - G$)) were higher than 90% in both experiments, so the dataset is suitable for the NWP evaluation purposes. Comparison of i) different sonic anemometers (METEK-USA1 and Campbell-CSAT3 with 10 Hz frequency) and ii) eddy covariance software packages (LI-COR TM EddyPro® 6.0 and TurbulenzKnecht-3.11 from University of Bayreuth) for calculation of 1, 5 and 30-minute turbulence characteristics were provided. Practically there were no differences between the momentum fluxes (below 10%) from two sonic anemometers; the differences between the sensible heat fluxes were 20 W m⁻² in most cases. Of course, the CSAT3 anemometer, with EC150 gas analyzer was more precise.

Higher sensible and latent heat fluxes ($H + LE$) came from LI-COR TM EddyPro® 6.0 software using CSAT3 – EC150 instrumentation (less than 15 W m⁻² on daily average). Instrumentation of Upper Air Observatory in Szeged with Wind Profiler, radiometer, ceilometer, disdrometer, GNSS receiver and the planned improvements (soil temperature and -moisture profile, self-calibrated soil heat flux plates, wind, temperature and relative humidity gradients, sonic anemometer, short wave and long wave radiation budget components) give us an opportunity to describe the „Szeged Column” from the surface up to the top of PBL. The Szeged HMS Observatory has an important role of being reference station i) for the development of new parameterization schemes, ii) to provide data sets for NWP model comparison and calibration and iii) to give a platform for the experimental work and measuring campaigns.

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VITICULTURE AND CLIMATE CHANGE IN CROATIA (VITCLIC)

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In Croatia is observed the increasing trend in mean annual air temperature and the large variability in the measured extreme precipitation from prominent drought to severe flooding. Climatological studies based on regional climate models show the intensification of the extreme values of temperature and precipitation over Europe in the future climate. These changes in temperature and precipitation have a great impact on viticulture, considering that of all living organisms, plants react first to the change of surface temperature. Due to climate change, changes in temperature will affect: (i) differently all developmental stages of vines in certain wine-growing areas in Croatia (i.e. their phenological characteristics) and (ii) differently on different varieties. At the same time, the temperature increase changes convective activity (storms) and thus the occurrence of hail that are estimated as the second biggest cause of material damage in Croatia. The trend of increasing average duration of hailfall was also observed on the basis of measurements obtained in the low land of Croatia.

Due to mentioned, this project has several goals. Based on meteorological and climatological datasets and wine and grapevine archive data, the current situation and a monitoring system of key phenological phases of the vine due to climate change will be analyzed and established. Furthermore, the aim is to link the ripening and quality of grapes with agro-climatic indices and determine the relationship between hail parameters and the degree of damages in grapevines. The purpose is also to enable: (i) detailed agronomic and economic evaluation for preserving Croatian autochthonous grapevine varieties, (ii) determination of climate changes through agro-climatic indices in different future periods and (iii) an estimation of the increase or decrease in certain weather types which favor convective developments (and hail).

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DROUGHT MONITORING BASED ON SURFACE MODEL AT THE HUNGARIAN METEOROLOGICAL SERVICE

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Land Surface Model is applied at the Hungarian Meteorological Service (HMS) to monitor the above ground biomass, surface fluxes (carbon and water) and the associated root-zone soil moisture at the regional scale (spatial resolution of 8 km x 8 km) in quasi real time. In this system the Surfex model is used, which applies the ISBA-A-gs photosynthesis scheme to describe the evolution of vegetation. Surfex is forced using the outputs of the ALADIN numerical weather prediction model run operationally at HMS. The radiation information are coming from LandSAF satellite products. Surfex model is capable to run it with assimilation of satellite observation. First, Surfex is run in open-loop (i.e. no assimilation) mode for period 2008-2016. Secondly the Extend Kalman Filter (EKF) method is used to assimilate LAI Spot/Vegetation (till May 2014) and PROBA-V (from June 2014) and SWI ASCAT/Metop satellite measurements. Anomalies, drought indicators and indices are calculated based on the outputs of the model simulations. Both system are able to capture temporal and spatial evolutions of the drought events well. The advantage of using a model based drought monitoring system is demonstrated by its more physically consistent manner.

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IMPROVEMENTS IN WATER CYCLE NUMERICAL MODELLING

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Existence of water in climate system significantly changes energy budget and consequently all components of the system and living environment. Some of the major deficiencies in numerical modeling of water related processes, with high priority for weather forecast and climate simulations, identified during the last years, are cloud formation caused by large uncertainty of aerosols concentration and impact of extreme precipitation on land water flow.

After fully coupling dynamical hydrology model HYPROM with numerical weather prediction model (NWPM), further research in SEEVCCC has divided in two paths for improvement of specific numerical modules: (1) better representation of cloud formation important over synoptic scales, and (2) prediction of land water flow in cases of extreme precipitation.

Euro-Mediterranean region is under great influence of Saharan long-range dust transport because of cloud formation caused by existence of fine mineral dust particles. Prognostic concentration of dust aerosols and processes related to cloud formation are included in NWPM. Latest tests were done for one-month case during April 2016 over Cyprus, where LIDAR and drone measurements were available. The model results coincide evidently with observations, producing ice nuclei with good timing and at altitudes as observed. These latest results, together with other published test cases, justify the importance of prognostic mineral dust implementation in process of cloud formation. Absence of this module in NWPMs, especially in severe long-range dust transport from desert areas, underestimate high clouds cover which is of great importance for energy budget in weather and climate simulations.

On the other end of scale range are processes of extreme precipitation and water treatment over land. HYPROM has demonstrated its numerical stability and success in simulation of land flow and river discharge fully coupled with NWPM. But, in case of precipitation deficiency related to biased weather forecast, it is forced with radar observations and has performed as significant upgrade of now-casting system. In some tests related to extreme flood cases (for example flood in Western Serbia in May 2014, caused by synoptic circulation, flash food in January 2015 in Southern Serbia, caused by convective precipitation, etc.) HYPROM in now-casting mode has successfully predicted extreme river discharge, most importantly its timing, and proved to be reliable candidate for implementation in operational flood warning system.

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MESOSCALE TOPOGRAPHICALLY-GENERATED LOW-LEVEL JETS IN THE PANNONIAN BASIN

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ECMWF analysis fields are inspected under conditions of very weak synoptic pressure gradients for different seasons of the year, some of them using the new improved horizontal resolution of 9 km. The main low-level structures generated under clear skies are identified, including nocturnal slope flows from the Dynarides reaching the low lands of the basin, flows along the Tisza valley, and basin-wide circulations depending on the pressure patterns surrounding the basin. The link of these structures to basin-wide low stratus will be highlighted. Furthermore, focus will be put on the vertical structure of the mesoscale low-level jets and their corresponding horizontal extension. The goodness of these numerical fields will be checked against the available data.

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CARBON DIOXIDE VERSUS METEOROLOGICAL VARIABLES IN URBAN AREA. CASE STUDY CLUJ-NAPOCA CITY

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Carbon dioxide is one of the most important greenhouse gas possible linked to climate change of which concentration increased significantly in the last decades. The main sources of carbon dioxide in urban area are the burning of fossil fuels as well as the anthropic activities.

In this paper a close relationship between CO₂ concentrations and meteorological variables in Cluj-Napoca city was proposed in order to establish the atmospheric conditions linked to high CO₂ values.

A detailed 1-year campaign was carried out in two selected urban measurement points and in one reference point situated outside of urban areas aiming to establish the contribution of anthropic activities at CO₂ level.

Three meteorological variables were considered: wind speed, air temperature, and relative humidity. Finally, daily and yearly variation of CO₂ concentration in Cluj-Napoca city were obtained.

Measurements of carbon dioxide concentration carried out in the city showed a daily variation which depend to the photosynthesis with a maxim in the morning and a minimum in the afternoon. The annual trend showed two peaks one of them in winter, and other in April due to missing or low amount of rainfall, which generated the increase of CO₂ level. With increasing rainfall amount, diminishing CO₂ concentration was detected. Air temperature is correlated with the variation of CO₂ level, resulting in a coefficient higher than 0.6.

Both air humidity and wind speed regression coefficients were generally very low, suggesting a low probability that variation in carbon dioxide concentration to be influenced by one of these weather elements.

However, there are singular situations for which the correlation coefficients approaching the threshold of 0.6. Thus, for the relative humidity the highest regression coefficient (0.52) was registered in June 2009 while for wind speed the highest coefficient (0.56) was found in May 2009. Regression between the concentration of carbon dioxide and air temperature reveals two important aspects: the threshold (0.6) of correlation coefficient was exceeded in each month of winter, as well as in late spring and early summer (May and June); the lowest correlation coefficient was observed in August, when observations were performed under heat waves conditions, while the highest values were observed in May and January (higher than 0.8).

The results of the study suggest that a conclusion regarding the correlations between carbon dioxide concentration and meteorological variables are difficult to be established using short time measurement data.

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POSTER PRESENTATIONS

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VERIFICATION OF INITIAL AND BOUNDARY OZONE CONCENTRATIONS BY GEOS-CHEM GLOBAL CHEMICAL TRANSPORT MODEL FOR REGIONAL SCALE AIR-QUALITY MODEL SYSTEM

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Our recent study of global chemical transport model GEOS-Chem (Goddard Earth Observing System – Chemical) (<http://acmg.seas.harvard.edu/>) focused on the chemical and meteorological relationships between ozone and NO_x initial and boundary concentration fields. Our GEOS-Chem model yielded the initial and boundary files for CMAQ – SMOKE – WRF air-quality model system, which produced ozone concentration forecasts for the Carpathian Basin. The settings of the model were GEOS-5, 2×2.5 horizontal grid, 47 model vertical levels, SOA aerosols, "NO_x-O_x-HC-Aer-Br" chemistry and LINOZ stratospheric ozone chemistry from the tropopause to the top of the atmosphere. The number of tracers were 66. Meteorological data (GEOS-5), emission inventories from HEMCO (aerosol, anthropogenic and biofuel, aircraft and ship, biomass burning emissions, etc.), oxidant (O₃, OH) concentration, and scale factors which had been scale emissions before, were included in the GEOS-Chem data. For our CMAQ model system we had to pre-process the output NetCDF files of the GEOS-Chem. Linked with global models, regional models improve the grid-external sources and provide their own estimates of grid-internal sources. In a nutshell, to link regional and global models, there are 5 steps to take: i.) Horizontal Interpolation – Since most regional models use a curvilinear grid, this is the simplest step (e.g. nearest neighbor with automatic conversion of CMAQ coordinates). ii.) Vertical Interpolation – Many regional models use a pure sigma-pressure coordinates, which are different from the hybrid eta-sigma GEOS-Chem coordinates (e.g. pressure vertical interpolation). iii.) Tracer translation – GEOS-Chem uses explicit and lumped chemical species (gas and particle), which require one-to-one, many-to-one, and one-to-many mapping to regional model tracers (e.g. gas-phase translations for CB05 and SAPRC07). iv.) Unit conversions – Translated tracers must be converted to regional model units to ensure compatibility (converting units dynamically). v.) Meta Data – Regional model meta-data must be provided to ensure compatibility (e.g. adds CMAQ meta-data to outputs automatically). We used PseudoNetCDF python software package to construct time-invariant boundaries. We analyzed the results of two different types of weather situations (anticyclonic and cyclonic respectively). We studied the differences of the measured and modelled ozone and NO_x concentration from a) GEOS-Chem and b) from CMAQ – SMOKE – WRF air quality model system. Daily maximum ozone concentrations (measured and modelled) were fairly similar, but the daily minimum values (in the early morning and night time) were overestimated by the model, thus lesser daily schedules were yielded.

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**POTENTIAL IMPACT OF CLIMATE CHANGE ON HOVERFLIES SPECIES
(DIPTERA:SYRPHIDAE) SPECIES GEOGRAPHICAL RANGE (EUROPE)**

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Hoverflies are the second most important pollinators group of flowering plants and thus essential for terrestrial ecosystems sustainability. Here, we examined potential climate change impact on hoverflies species habitat suitability. Eleven hoverfly species of the genus *Pipiza* were studied and potential range shifts were analyzed with WorldClim scenarios by using Maxent for species distribution modelling. The predicted impact on climate change-induced shifts show for six species (*Pipiza austriaca*, *Pipiza carbonaria*, *Pipiza fasciata*, *Pipiza luteibarba*, *Pipiza laurusi*, *Pipiza luteitarsis*) and four tested future scenarios potential habitat suitability expansion and for 5 species and four tested scenarios (*Pipiza festiva*, *Pipiza lugubris*, *Pipiza noctiluca*, *Pipiza notata*, *Pipiza quadrimaculata*) potential habitat suitability contraction. *Pipiza carbonaria* habitat suitability will significantly expand in size (56.8%) though species will potentially lose 4.7% of its current suitable area. Also, species *Pipiza fasciata*, *Pipiza laurusi*, *Pipiza luteibarba* will expand their range, between 30 and 40 %. Even though for species with larger suitable area in future scenarios, successful range shifts will potentially depend largely on availability to colonize new (sometimes isolated) area and presence of suitable habitats within those areas Suitable area will dramatically shrink in size for species *Pipiza lugubris* (45.8%), *Pipiza notata* (76.9%) and *Pipiza quadrimaculata* (62.8%) . In general hoverfly species from *Pipiza* genus are identified as low dispersal, microhabitat dependent species positively correlated with landscape heterogeneity and forest availability. Thus, *Pipiza* species are one of the most vulnerable within hoverfly family and require further investigation, especially under climate change framework.

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THE URBAN BOUNDARY LAYER 2016 CAMPAIGN

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In the last century the urbanization accelerated and reached enormous magnitude. Not only the large cities but also the smaller ones can modify properties of the urban atmospheric environment compared to the natural surroundings. The changings are caused by the artificial building-up, as well as by the emission of heat, moisture and pollution related to human activities. Compared to the rural area temperature increase is the most important. This effect causes the so called urban heat island. During the Urban Path project (<http://en.urban-path.hu>) a unique monitoring network system was installed in Szeged with the idea to describe effects and map the horizontal structure of the urban heat island. The goal of the URBOL campaign (performed in August 2016) was to extend Urban Path data with vertical profile measurements.

The measurements were performed using an electrically powered multicopter remotely piloted system. The multicopter was equipped with its own sensor package (standard temperature, relative humidity and air pressure sensors) and with GRAW radiosonde. Profile measurements were done in Szeged downtown urban canyon as well as at the Szeged Airport (located 4 km from the city downtown in the suburb area). Meteorological parameters were measured from the ground up to 50 meters above the ground level, vertical lifting speed was about 1 m/s. Night time operation was supported by the suitable illumination which allows the identification of the multicopter's orientation. All flights were supervised by a safety pilot. The aim of our study is to represent preliminary results of the diurnal evolution of the urban boundary layer.

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FUTURE CHANGES IN HEAT WAVES INDICES IN ROMANIA

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Heat waves, defined as prolonged periods of unusual high temperatures, are some of the most threatening natural hazard. Many recent studies on climate change which examined extreme temperatures showed that heat waves have become more frequent and intense and of a longer duration. Analysis of climate models projections under different scenarios showed that these changes will continue in future even at higher rates. Scientific information on changes in heat waves in Romania is very limited. Few studies which analyzed changes in heat waves are based only on historical observational data and showed alarming changes in the last decades. Therefore, investigations of future changes in heat waves are of a high importance. In this study we detected and analyzed changes in heat waves in Romania based on daily output of three regional climate models (RACMO22E, REMO2009, and WRF331F). Heat waves data series were derived from daily maximum and minimum temperature data sets extracted from models output for four representative weather stations in Romania over the period 2020-2100. HWs detection was made based on the 90th percentile calculated on a 15-day window centered on each calendar day of extended summer period (May-Sept). The percentile threshold calculation was based on observational data of 1981-2010 baseline period recommended by World Meteorological Organization. A set of 10 indices were calculated based on two heat waves definitions (at least three consecutive days when maximum air temperature exceeds 90th percentile, and at least three consecutive days when minimum air temperature exceeds 90th percentile) and on five variables established based on number, duration, and intensity of heat waves events. The main results indicated a strong increase in all heat waves indices in Romania under RCP 4.5 scenario according to all models used in this study. These changes can have a deep impact on human health, socioeconomic sector, and environment.

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ASSESSMENT OF THE ATMOSPHERIC BLOCKING PROCESSES IN EUROPE AFFECTING ON DROUGHT FORMATION IN UKRAINE

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The drought in Ukraine dominates in spring and summer time. It is known that most intensive droughts occur as a result of blocking processes in regional atmospheric circulation. Analysis of distribution blocking areas using the Lejenas-Okland index during the historical strong spring-summer droughts in Ukraine (1948-1986) showed that the center of blocking usually located over north border of country and the main blocking longitudes are 30-35E.

The conditions of regional atmospheric circulation for the periods with drought were considered using proposed index ECBI (European Continental Blocking Index), which is determined by a ratio of the current and climatic pentad values of zonal wind component (u) at the level 300 hPa. Zonal wind component, averaged over the region restricted by coordinates 10-60 E and 40-60 N, therefore index ECBI maybe use for evaluation of blocking state over all mid-latitudes of Europe. The period of 1980-2010 was taken as a basic one. Positive values of the ECBI indicate to blocking of zonal flow, the negative ones correspond to enhancing of zonal wind. Values of the ECBI close to $|1|$ specify the extreme cases. Analysis of ECBI showed that drought in Ukraine frequently related to the processes of blocking in spring and autumn, when the ECBI usually is positive. Before the spring drought is typical the prevalence of blocking processes in a preceding winter season, usually in December, February and March. In summer months with a drought more frequently observed zonal type of circulation (ECBI is negative), that indicates on peripheral character of weather processes.

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INFLUENCE OF ATMOSPHERIC CIRCULATION AND DROUGHT ON THE CEREAL CROP YIELDS IN UKRAINE

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Ukraine is one of the leading producers and exporters of cereals in Europe. But the territory of Ukraine almost every year is exposed the droughts of different intensity and duration. The aim of the study is to develop the regression model for the winter wheat and spring barley yields in main agro-climatic areas of Ukraine. As the predictors were used three parameters: author's the European continental blocking index (ECBI), which considers the features of regional atmospheric circulation in the growing season; the Vegetation Conditions Index (VCI) and introduced the Wet Vegetation Index (WVI), which are based on satellite vegetation indices NDVI and NDWI respectively. The ECBI reflects the conditions of zonal flow at the level 300 hPa respectively to the climatic norm. When $ECBI > 0$, the blocking of the zonal flow is fixed, if $ECBI < 0$, the zonal flow is stronger than normal. The VCI reflects the current meteorological conditions. The value of $VCI > 80\%$ correspond to favorable conditions of growth, while the $VCI < 35\%$ indicate drought of varying intensity. Similarly to the VCI, high values of the WVI ($> 80\%$) correspond to healthy and juicy vegetation and WVI value less than 50% indicate to the dry and wilted plants. Analysis shown that the significant crop losses (10-43% from the trend) were observed mainly in years with a spring-summer drought such as 1996, 2003 and 2007.

Modelling the yields was made on the basis of constructing a linear regression equation, where the predicted values is the mean absolute (c/ha) or relative crop yields (relative to trend). The ECBI, VCI and WVI were chosen for periods, in which their values have the maximum of correlation closeness between crop yields and corresponding parameter in the spring or early summer time. The average absolute error of forecast ranges about 3-5 c/ha for winter wheat and 3.5 c/ha for spring barley. Obtained equations allow to predict the cereal crop yields with earliness of 1.5-2 months before harvesting.

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CROP RESPONSE TO ENHANCED TEMPERATURE AND CARBON DIOXIDE

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Climate changes influenced on global environment with increasing temperature and atmospheric carbon dioxide concentration. The growth in agricultural productivity is multifaceted and include changes in soil productivity, availability and cost of mineral fertilizers, changes in temperature and precipitation conditions, atmospheric concentrations of CO₂ and other greenhouse gases. There are many processes in plant growth that are affected by interaction of both enhanced temperature and carbon dioxide, in processes that determine carbon balance in the shorter term, from the long time scales of development and growth, which together lead to accumulation of biomass and yield. The reasons to expect progressively increasing CO₂ response of plant carbon balance at higher temperatures are decreased photosynthesis/photorespiration ratio and decreased gross photosynthesis/dark respiration ratio in warmer conditions. The effect of enhanced CO₂ on photosynthetic reactions are more pronounced in high temperature. Temperature is one of the decisive factors in forming an effect on growth and plant productivity by accelerating the flowering and stems elongation during spring and then extend growing season, and it is one of the major factors controlling species distribution. Increasing temperatures mostly associate with elevated CO₂, vapor pressure deficit and drought.

The long-term responses of climate change under higher CO₂ concentration, temperature and precipitation may differ from short-term effects because of the feedbacks involving nutrient cycling. Higher temperature causes faster crop development and thus shorter vegetation period, which in most cases is associated with lower yields. Temperature also impacts the rates of photosynthesis, respiration, and grain filling. Crops with a C₄ photosynthetic pathway (e.g. maize and sugarcane) have higher optimum temperature for photosynthesis than C₃ crops (e.g. wheat). Warming during the day can increase or decrease net photosynthesis, depending on the current temperature, whereas warming at night raises respiration costs without any potential benefit for photosynthesis. High temperature leads to increase in the saturation vapor pressure of air. At a constant relative humidity warming raises the vapor pressure deficit between air and the leaf, which is defined as the simple difference between the saturation vapor pressure and the actual vapor pressure of the air. Plants respond to very high vapor pressure deficit by closing their stomata, but at the cost of reduced photosynthesis rates. Warming increases the possibility of heat stress during the critical reproductive period, which can lead to sterility and lower yields. Higher concentration of CO₂ has a fertilization effect in C₃ species such as wheat and most fruit and vegetable crops, given that photorespiratory costs in the C₃ photosynthesis pathway are alleviated by higher CO₂. Higher CO₂ concentration also reducing stomatal conductance, thereby increasing water-use efficiency in both C₃ and C₄ crops. The effects of climate change on agricultural yields vary by region and by crop. With climate change, the growing period will reduce and the planting date also needs to change for higher crop production. Climate change can decrease the crop rotation period. Farmers may have to adapt by growing more tolerant species considering sowing dates, crop densities, fertilization levels when planting crops etc.

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THE FACTORS OF FORMING MINIMUM RUNOFF OF SMALL RIVERS TRANSCARPATHIA

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In territory the Transcarpathian water-balance station, that located in the village Mizhhirya (48° 31' north latitude, 23°30' East longitude), analyzed of data of 20 hydrometric gauges and investigated spatial - temporal patterns of the minimum runoff of the warm period. To take into account the impact on the minimal runoff intrazonal and azonal factors a study the correlation between low-flow runoff and catchments area, height and forest cover of watershed. The dependence between of the minimal runoff and catchments areas were not found that to be associated with a small range of catchments areas studied. For the considered territory of one of the main factors that influences the runoff is average height, as with the change of altitude changes as weather factors (rainfall, temperature, etc.), and the factors underlying surface (type of vegetation, soils, total territory of forest cover, slopes gradient). The dependence of the average minimum module runoff from watersheds average height is quite clear and defined two groups. In the first group points when changing position high altitude from 800 to 1000 meters above sea level, the average minimum flow module increases from 0.005 to 0.02 m³ /(s•km²), while in the second group, in the same height range the minimum module of runoff increases much more slowly, from 0,005 to 0,009 m³ /(s• km²). If we trace the dependence of the average minimum module of runoff from the forest cover of the watershed, it can be noted that the points are located as two streams, the one branch consists of rivers that originate in the valleys, and the other - with basin Rika river and others. For rivers that originate in the valleys, the degree of forest cover varies from 12 to 35%, and the average value of the minimum module of runoff increases tenfold - from 0.0025 to 0.025 m³ /(s• km²); the forest cover of tributaries of Rika river varies from 28 to 95%, and the average minimum modulus increases only 0.005 to 0.0075 m³ /(s• km²). It is thus possible to conclude that the value of the minimum flow is largely determined not by forest cover, but by few other factors. The distinctive feature of the watersheds of rivers that originate on the slopes Valley Borzhava is its top part with marks higher than 1,000 meters. On the lower part of catchments areas the forest is cut down and was organized pastures and only average part of the slope to remaining with forested. Mountain Ridge Borzhava is a barrier to air masses that bring moisture from the Atlantic. Therefore the bulk of rain unloaded on the windward side. The snow cover in the Valley is established usually in November - December. During winter blizzards are marked active transfer of part of snow from the windward slope on the leeward.. In the upper reaches of river Pylypec and stream Ploschanka formed elements of Alpine landscape in the form of cars, where every year as a result of blizzard and avalanche is formed snow patch, which melting ends in July - August. Other watersheds are forested up to the watershed line, and the forest is absent only where it artificially destroyed. The presence of forest on the highest marks prevents of snowstorm transportation of snow and increased accumulation of snow in some places.

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**DETERMINING THE GENETIC COMPONENTS OF UNDERGROUND
RUNOFF IN LOW-FLOW PERIOD ON OBSERVATIONAL DATA ON
SMALL CATCHMENTS OF TRANSCARPATHIAN WATER-BALANCE
STATION (UKRAINE)**

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Existing methods of determining the underground flow in the river is indirect in the sense that underground inflow in river basins in the regional studies cannot be measured by direct measurements, as is the relatively surface runoff. This situation gave rise to the diversity of approaches to address the proposed tasks, resulting in a significant number of ways to assess underground inflow into the river. Virtually the only sufficiently objective assessment by regional underground flow in the river is a method of genetic separation of river runoff. The most effective is this way for the small mountain catchments where at large slopes and high permeability loose cover, surface water pass quickly in to receiving waters, and a steady transition to underground recharges taking place is already within days after cessation of rainfall. In this study, was performed the breaking of summer runoff hydrographs on the genetic components to identify their quantitative ratios depending on soil and plant, geological and climatic characteristics. To analyze used the materials of long-term observations of the Transcarpathian of water-balance station.. The most informative method in terms of assessing genetic components of alimentation of bed runoff - is runoff hydrographs breaking in years of low water content when the surface component is small. Analysis of long-term observations revealed that on the Transcarpathian water-balance station such conditions of forming runoff is provided in 1961, 1963, 1964 and 1973, respectively. According to the daily depth of runoff for all hydrometric gauges were built hydrographs of runoff for summer period - from May to October. The runoff hydrographs genetic braking was carried by method of chop-in. The supply of underground runoff channel consists of two genetic components that unrelated to precipitation of analyzed genetic period - depth of runoff that goes from the previous (spring) hydrological period and depth of runoff that is formed by the gravitational unloading deep Analysis of runoff hydrographs for the entire period of observation showed that the most dynamic component alimentation of underground runoff in long-term period is the redistribution of moisture from the previous season. In some years, with big stocks snow and lingering spring, this component can exceed a layer of surface runoff warm period. On the other hand, in some years, in late spring period the degree of moisture in watershed close to critical. In those years the alimentation of underground channel flow carried out only by unloading the deep aquifers. However, as shown by analysis, the correlation between genetic components can vary significantly depending on local factors even within a relatively small area.

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ENDANGERED AREAS IN THE PANNONIAN REGION REGARDING DRY AND WET CONDITIONS

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According to the meteorological measurements the frequency of extreme precipitation events increased in last decades in the Pannonian region. We were looking for parameters that can quantify the extremity of precipitation. The ratio of the standard deviation (D) and the expected value (E) of the annual or seasonal precipitation can characterize the extremity.

For example if D is great, it means that extreme sum can occur, while E is small, it means that low precipitation sum is expected in the given point. In this case the risk of drought is great and consequently the vulnerability is high. On the base of the CarpatClim dataset we categorize the region regarding dry and wet conditions.

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AGRONOMIC PESTS INSECTS RESPONDING TO INCREASING TEMPERATURE AND CO₂

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Climate change is recognized to have direct impact on the entire agroecosystem through increasing global temperature and CO₂ level and will probably lead to increased numbers of agricultural insect pests. Temperature is probably the most important abiotic factor for insect pest population since they are poikilotherms and their growth and development is under direct influence of changes in the environment temperature. It has direct impact on agronomic pest population acting on insect behaviour, survival, development, reproduction and distribution. Current prediction is stating that global mean annual temperature will increase for 1°C by 2025 which can have significant effect on temperature depended insects. Increased temperatures affects insects populations on several ways: by accelerated development and increased number of generations, more successful overwintering in warm winters, by changing relationship between pest and host plant, population size and through changes in crop management which is consequence of adaptation and mitigation to climate change.

Most of the insects pests in agriculture produce one generation annually and some insects take several years to complete their life cycle. Pests of agricultural crops in relation to the other insects are readily adaptable to changes in the environment. This makes them capable of surviving in extreme conditions in the agroecosystem and quickly occupy new suitable areas for development with the ability to achieve high levels of population density. Some pest insects are „stop and go“ opportunists looking at temperature. These insects will develop rapidly in the period with favorable temperatures, resulting in a greater number of generations annually. On the other side, some species will produce more generations due to extreme temperature in some years and it may become common with gradual warming. Effects of temperature increase on overwintering pests in temperate regions are considered to be the main effect. In some cases, lower winter mortality can lead to an increase in insect population. Also, increase in soil temperature can cause shorter embryonic development and diapausing period of eggs which favors eggs hatching and faster larval development that result in earlier emergence of adults. Stated may lead to an increase in the population of certain species of insects. In contrary, milder winter in some species can decrease population development.

With increasing average temperatures populations of insects can spread more northwards and migratory species may arrive in certain areas earlier. Indirect influence of temperature increase on insects refers to change in crop management as a result of adaptation to climate change. With the shift of some crops in new, suitable arable areas, their pests will also migrate and expand. The introduction of new crops for adaptation to climate change will lead to the appearances of new pests. Altering crops and crop rotations causes changes in insects pest – host plant relation. Higher temperatures with higher CO₂ concentration are causing changes in the quality of the food source for insects. Enhanced CO₂ level leads to accelerated rate of photosynthesis in plants resulting in increasing proportion of carbohydrate in relation to nitrogen content in plants. It is expected that herbivorous insects will consume plant parts more intensely to make up the needs for

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the nitrogen. Furthermore, the nitrogen-based compounds (phytochemicals) in plants operates normally as toxins and as a repellent for insects attack. In the lack of nitrogen components in relation to the carbon, plants become more susceptible to insects pest attack, which enables them better nutrition and increased population number.

Despite various claims, entomologists predict an increase in the number of pests as a result of climate change. Certain insect species will react differently to the effects of climate change depending on their intensity in individual years. Predicting the potential distribution of the agricultural insects pest plays a key role in determining the impact of climate change on agroecosystem and the combination of farming strategies. Implementation of continuous monitoring is required for effective control of pest population as well as models developing to help predict the incidence of certain pests and thus contribute to better prevention and pest management.

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TYPICAL PBL HEIGHT DIURNAL COURSE FORMS DURING THE SUMMER IN THE CARPATHIAN BASIN

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Examination of planetary boundary layer (PBL) is an up-to-date research area in meteorology. Most of the studies are based on measurements, a much smaller part uses computer simulation techniques. In this study, diurnal PBL height course simulations are made by using WRF (Weather Research Forecasting) mesoscale model with Yonsei University PBL scheme.

Numerical simulations are performed for each day in the summer period (June, July and August months) above Pannonian Basin. In the first step, PBL height diurnal course forms are classified according to synoptic scale circulation patterns. The results suggest that the forms obtained can be grouped into four classes. The highest PBL height values are typical for anticyclonic weather type, then the land-surface effects are also strongest. In the second step, more process oriented, cause-effect analysis will be performed to separate the atmospheric and land-surface effects and to quantify the main Pannonian Basin specific relationships.

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ANALYSIS OF LARGE-SCALE CIRCULATION PATTERNS AFFECTING THE PANNONIAN CLIMATE

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Atmospheric low-frequency variabilities have substantial impacts on climate variables such as air temperature and precipitation. Therefore, assessing their effects is essential to improve global and regional climate model simulations for the 21st century. The North Atlantic Oscillation (NAO) is one of the best-known atmospheric teleconnection patterns affecting the Pannonian Region. Besides NAO, we aim to analyze other interannual-to-decadal teleconnection patterns, which might have significant impacts on the Pannonian Region, namely, the East Atlantic/West Russia pattern, the Scandinavian pattern, the Mediterranean Oscillation, and the North Sea Caspian Pattern. For this purpose the ERA-20C atmospheric reanalysis dataset and multivariate statistical methods are used. The indices of each teleconnection pattern and their correlations with temperature and precipitation are calculated for a past reference period. Then, we aim to calculate the same indices of the relevant teleconnection patterns for the historical and future simulations of Coupled Model Intercomparison Project Phase 5 (CMIP5) models and compare them against each other using statistical methods. Our ultimate goal is to examine all available CMIP5 models and evaluate their abilities to reproduce the selected teleconnection systems. Thus, climate predictions for the 21st century for the Pannonian Region may be improved using the best-performing models among all CMIP5 model simulations.

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HYDROLOGICAL PROJECTIONS FOR A SMALL CATCHMENT USING HYDROLOGICAL MODELLING DRIVEN BY REGIONAL CLIMATE MODEL RESULTS

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Both water management and agricultural adaptation strategies are strongly recommended to rely on physically-based hydro-climatological model results. As an example the hydrological consequences of climate change is analyzed for the Upper-Tisza sub-catchment covering about 9700 km² in the Northeastern Carpathians. For this purpose, the DIWA (DIstributed Watershed) physically-based hydrological model is used, which is driven by the outputs of RegCM4 regional climate model. First, calibration and validation of DIWA are completed for the target catchment using historical meteorological (CARPATCLIM) and runoff data.

After that, characteristics of extreme hydrological events in past and future (using new RCP scenarios) time periods for 30 years are assessed. Finally, statistical analysis based comparison of observed-past, modelled-past and modelled-future runoff data is evaluated for the Upper-Tisza sub-catchment. The results can be used to provide recommendations for decision makers in order to adapt to the climate change induced hydrological hazards.

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IMPORTANCE OF ULTRAFINE AEROSOL IN URBAN ENVIRONMENTS

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Ultrafine (UF) atmospheric aerosol particles (with an equivalent diameter <100 nm) are usually present in large number concentrations (daily medians up to 10^4 – 10^5 cm $^{-3}$) and abundances (70–90% of all aerosol particles) in cities. They are emitted directly from high-temperature sources or they are formed in the air by atmospheric nucleation. Inhalation of UF particles can represent an excess health risk relative to coarse or fine particles of the same or similar chemical composition. The specific effects are mainly associated with the large number of insoluble particles deposited in the respiratory system, their large total surface area and their very small size. As the atmospheric residence time for most of these particles is limited to a few hours, they can identify their major emission and formation sources. Long time series of UF concentrations make it feasible to model the dispersion patterns in cities.

Budapest platform for Aerosol Research and Training (BpART, URL: <http://salma.web.elte.hu/BpArt>) is a research station to serve and advance the research of atmospheric aerosols through complex surface-based and satellite-born measurements, as well as to promote the education and training of PhD students and young researchers. This possibility can be well utilized for the regional perspectives as well. The research work to be performed within the frame of the research facility is also connected to the COST program entitled Chemical On-Line cOmpoSition and Source Apportionment of fine aerosol (COLOSSAL, COST OC-2016-1-20692, chair: María Cruz Minguillón, Spain, duration: 2017–20).

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TRENDS IN MAXIMUM FLOW VARIATION OF RIVERS IN THE EASTERN PART OF ROMANIA

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The analysis of maximum flow of rivers is essential for flood risk assessment and management. This work aims to identify the trends in maximum discharges variability of rivers located in the eastern part of Romania, a region heavily affected by damaging floods in the last decades. The watersheds of the considered rivers are spread over different landforms (mountains, hills, and plains) and overlay areas varying from less than 50 km² to over 6000 km². They have mostly a quasi-natural flow regime. The work is mainly based on the statistical processing (frequency and trend analysis) of monthly and annual maximum discharges data series, recorded between 1971 and 2010 at 19 gauging stations (belonging to the national hydrometric network) controlling the selected catchments.

The results showed statistically significant trends in monthly and annual maximum flow, generally negative, for almost a third of the studied river. For 11 catchments no statistically significant trends were identified annually, but in some months both positive and negative trends were found.

On the whole, a cyclical variation including an alternation of periods with high annual maximum discharges (1970 – 1980 and 2000 – 2010) and low annual maximum discharges (1980 – 2000) was identified. Likewise, a relatively heterogeneous situation concerning the frequency and magnitude of major floods (with peaks higher than relevant probabilistic thresholds of Q1%, Q5%, Q10% and Q30%) was found. However, after 2000, an increasing trend of the annual maximum discharge and of the frequency of large floods has been identified for almost half of the studied rivers. Knowing the trends in maximum discharges could help to better design or adapt the strategies on flood risk mitigation according to the observed changes in flow variation.

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THE ROLE OF ORGANIC AGRICULTURE IN CLIMATE CHANGES MITIGATION

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Organic farming is well organized, recognized and legally regulated. At the world level, 43.7 million hectares are involved in organic farming, of which Europe has part of 26.6%. Basic principles of the system are the preservation of harmony production, where the emphasis is on more resistant nutrients cyclings, with a high degree of sustainability. Measures that lead to this kind of agricultural production are traditionally and scientifically recognized and proven, and as a result may have reduced impact of adverse weather change phenomena. One of the basic measures to maintain soil fertility, protection of plants against pests, and the level of crop yield is crop rotation. Proper rotation of crops in the fields makes possible to provide better soil fertility. The inclusion of legumes in crop rotation can be used for their ability to acquire nitrogen from the atmosphere, are used for their growth and development and obtain important protein components of plant foods for humans and animals, but also leave behind residual nitrogen, which is not subject to rapid leaching into groundwater nor denitrification, which would lead to a faster increase in the concentration of nitrogen compounds in the atmosphere and thus contribute to climate change. Most poacea-crops, on the other hand, used successfully resources that are inaccessible to other plants, and with above ground dense leaves growth and dense fibrous root growth prevents erosion and impact of torrential precipitation for the removal of soil particles, their residues tend to increase the level of organic matter and, consequently, the build-up of humus in soil, which is important both from the standpoint of better retention of nutrients in the soil and also better conservation of water in the soil, which favors not only crops but also microorganisms-synergists of organic agricultural production. Crops from other plant species have their own contribution to maintaining the biological value of soil, build-up of humus, erosion prevention (both by water and by wind), to the conservation of water and better soil biogenity, all of which promotes organic agriculture. The choice of crops is also very important, because organic farming promotes traditional crops well adapted to all the stresses of a landscape, regardless whether they are biological, edaphic or atmospheric. Of course, the consequences of not using the latest varieties and hybrids may be lower yield, but, in adverse situations with any precipitation and temperature regime changes, traditional domesticated crops provide more stable returns. The use of cover crops can further expand the crop rotation and improve the sustainability of organic production, because the planting additional plants, for soil and environmental benefits they provide, will alleviate whichever benefits the main culture could not provide for an increase in soil fertility, soil protection from degradation, accumulation of humus, soil and biological value of higher water conservation. Furthermore, we should not ignore the component of development of rural areas through organic agriculture, because, in addition to environmental protection, improvement and protection of soil and water quality, through increased involvement in agricultural production, association of producers, higher level of training, direct contact with end users of their products, builds up and social awareness, which can help community to overcome problems brought by the adverse weather patterns.