



Pannonian Basin Experiment (PannEx)

GHP PANEL MEETING, 24 – 26 OCTOBER 2018

SANTIAGO, CHILE

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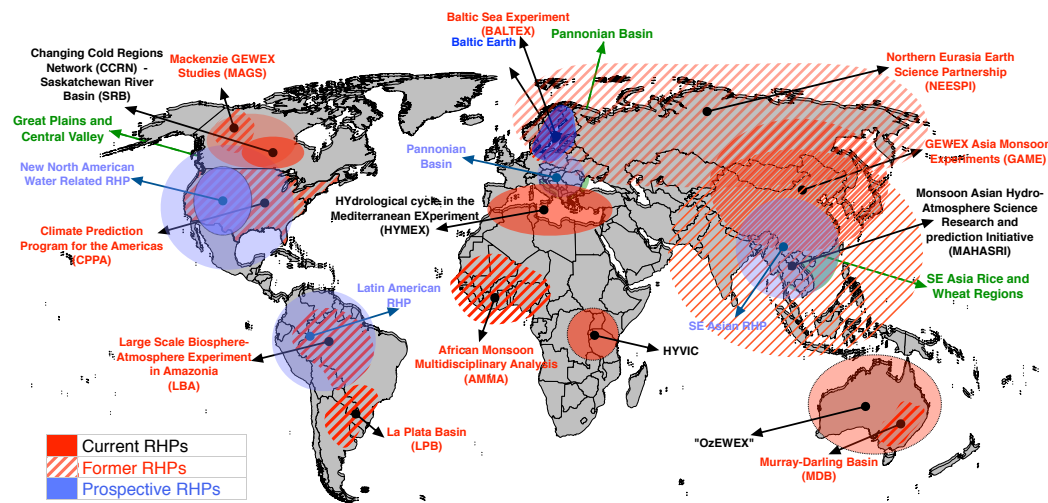
Pannonian (Carpathian) basin

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





WCRP Grand Challenges-WATER FOR FOOD BASKETS



How will a warming world affect the available fresh water resources globally? (Focus on the geophysical processes and the anthropogenic influences on these processes)

How does this translate specifically to the food basket regions of the world?



ICSU
International Council for Science

Boram Lee, 2nd PannEx WS
Budapest



Recent drought on the Danube, dry conditions on the upper catchment, October 2018



source: MTI//Máthé Zoltán, 16th of October

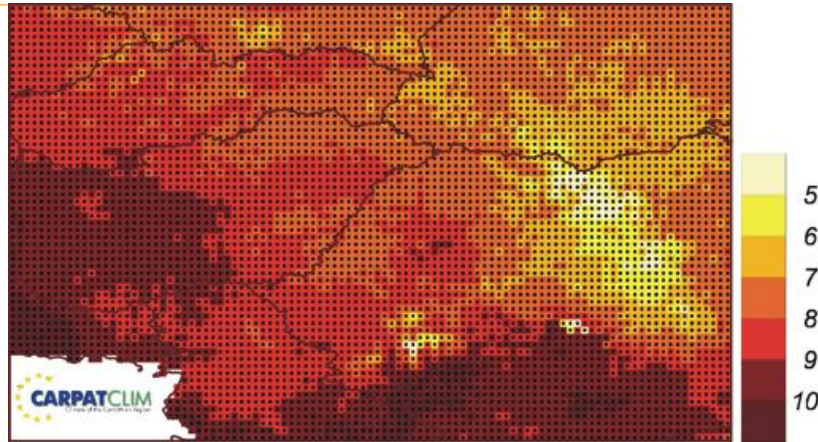


source: Huszti István / Index

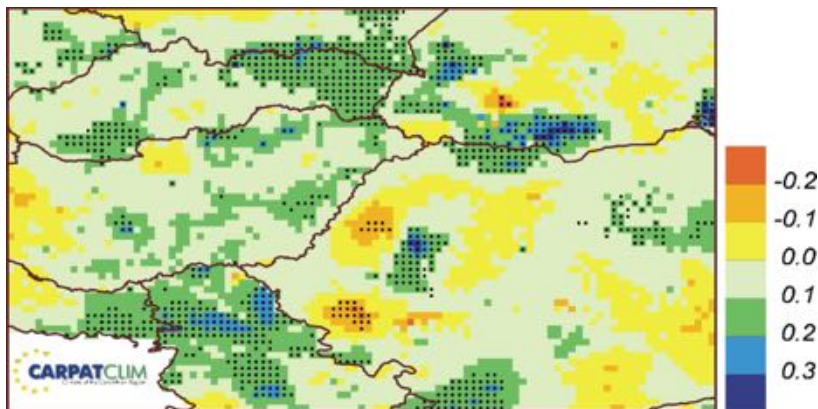
DriDanube project – covering PannEx area- Drought User Service



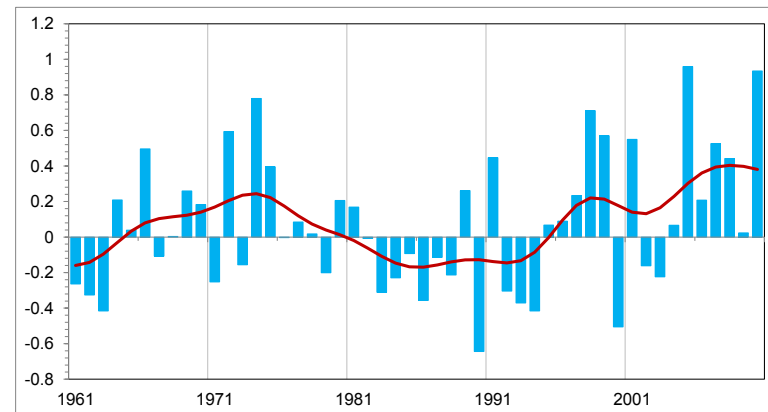
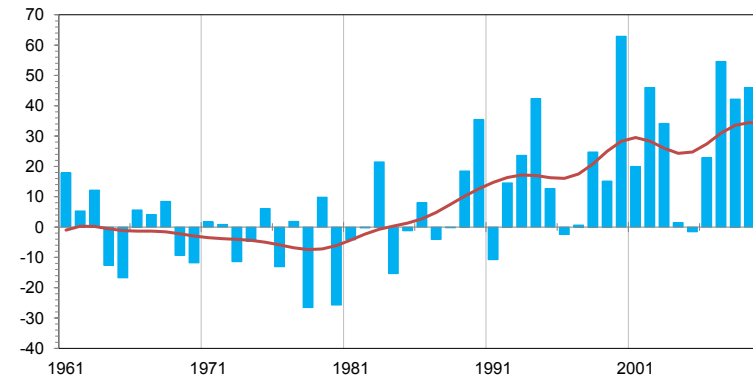
Changing in climate extremes in the Carpathian region, 1961-2010- CarpatClim dataset



Warm days



Simple daily intensity



Short History of PannEx



1st WS Osijek,
11/2015

2nd WS
Budapest, June
2016 WB first
draft

3rd WS Cluj,
March 2017 WB
final

1st IPC meeting
09/2017 SP first
draft

2nd IPC meeting
extended
06/2018
Ljubljana

4th WS Budapest
04/09/2018

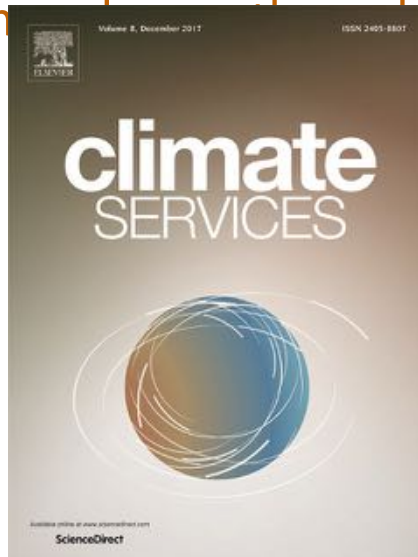


Recent publication-available online 26 May 2018

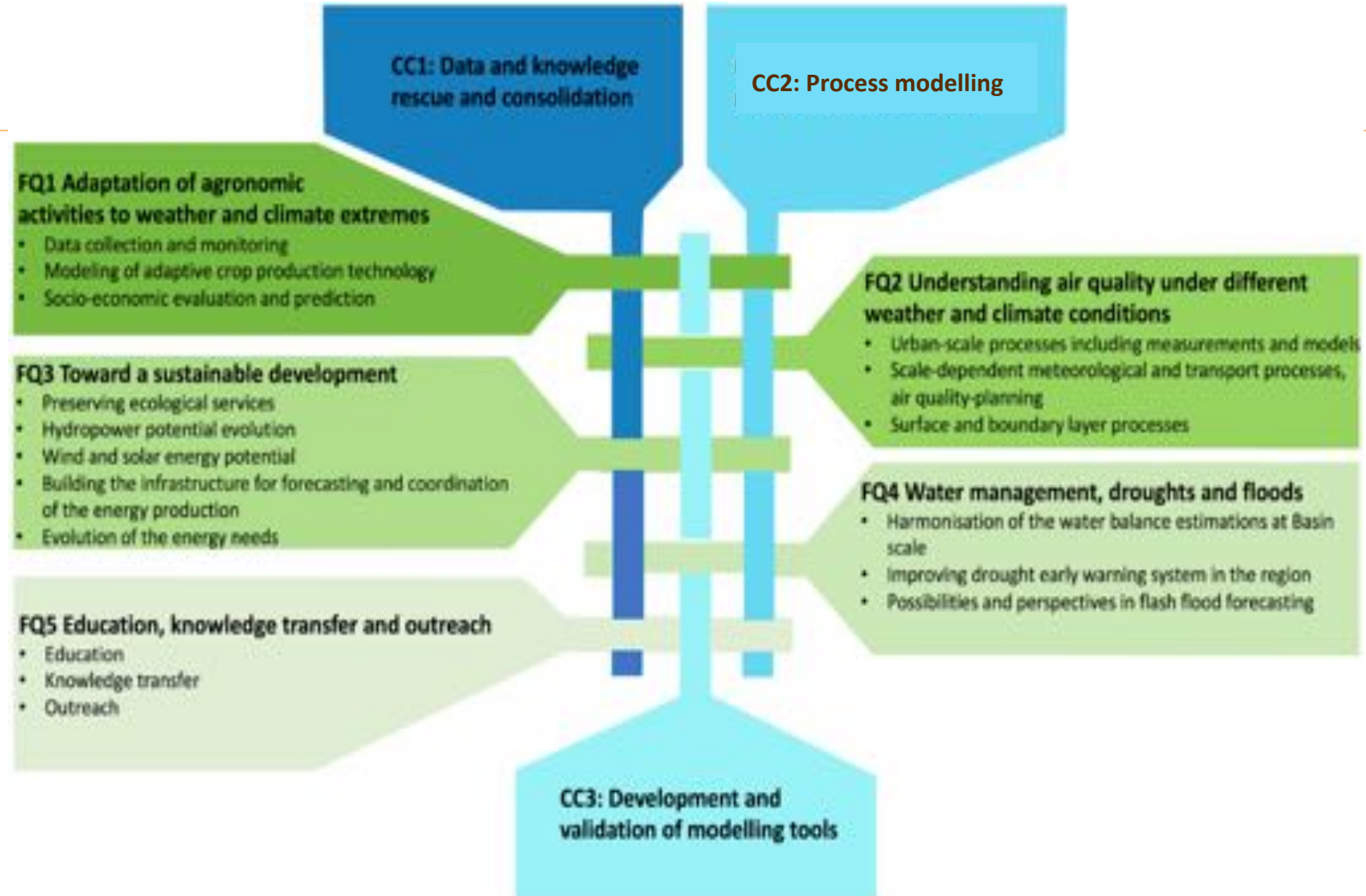
Andrej Ceglar, Adina-Eliza Croitoru, Joan Cuxart, Vladimir Djurdjevic, Ivan Güttler, Branka Ivančan-Picek, Danijel Jug, Mónika Lakatos, Tamás Weidinger: PannEx: the Pannonian Basin Experiment

<https://www.sciencedirect.com/science/article/pii/S2405880718300165>

WCRP shared the new paper out online "so fast that it fell off the shelves"

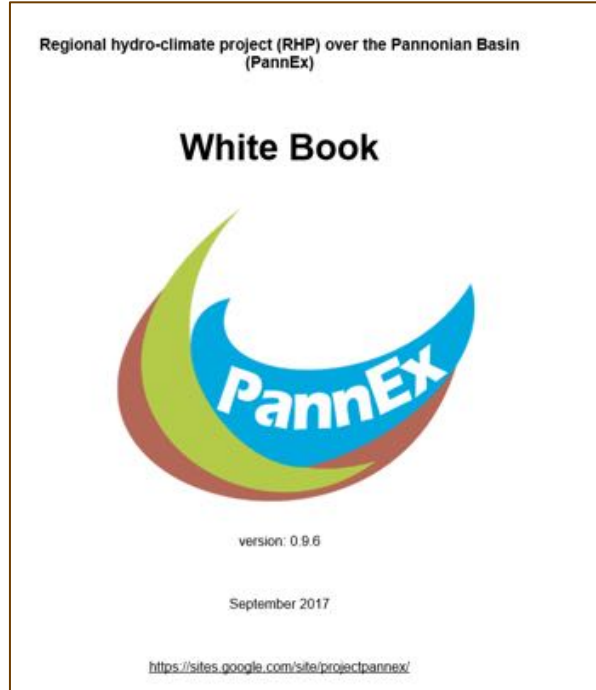


FQs and Cross Cuts within PannEx

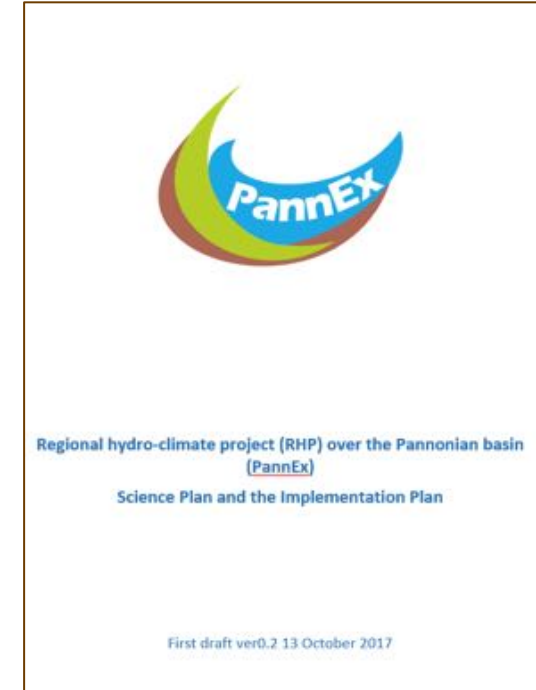


Documents available

5 FQS AND 3 CCS, 72 CONTRIBUTOR,
FINALIZED



SCIENCE AND IMPLEMENTATION PLAN



<https://sites.google.com/site/projectpannex/>

White book is
uploaded to the
PannEx page

Here's an update on [PannEx](#) for the week of 15 October - 21 October.

Insights for your Page

[See All Insights](#)

METRIC	LAST WEEK	PREVIOUS WEEK	TREND
Page Visits	24	0	↑
Weekly Total Reach	129	0	↑
People Engaged	30	0	↑
Total Page Likes	33	31	↑6.5%

Task Teams

- ❑ Agro-climatological and biological systems
- ❑ Micrometeorology and agronomical process modelling
- ❑ Air quality and urban studies
- ❑ Energy Production
- ❑ Ecological Services
- ❑ Water balance at the basin scale
- ❑ Modelling from climate to flash floods
- ❑ Special observations and data analysis
- ❑ Outreach and Education

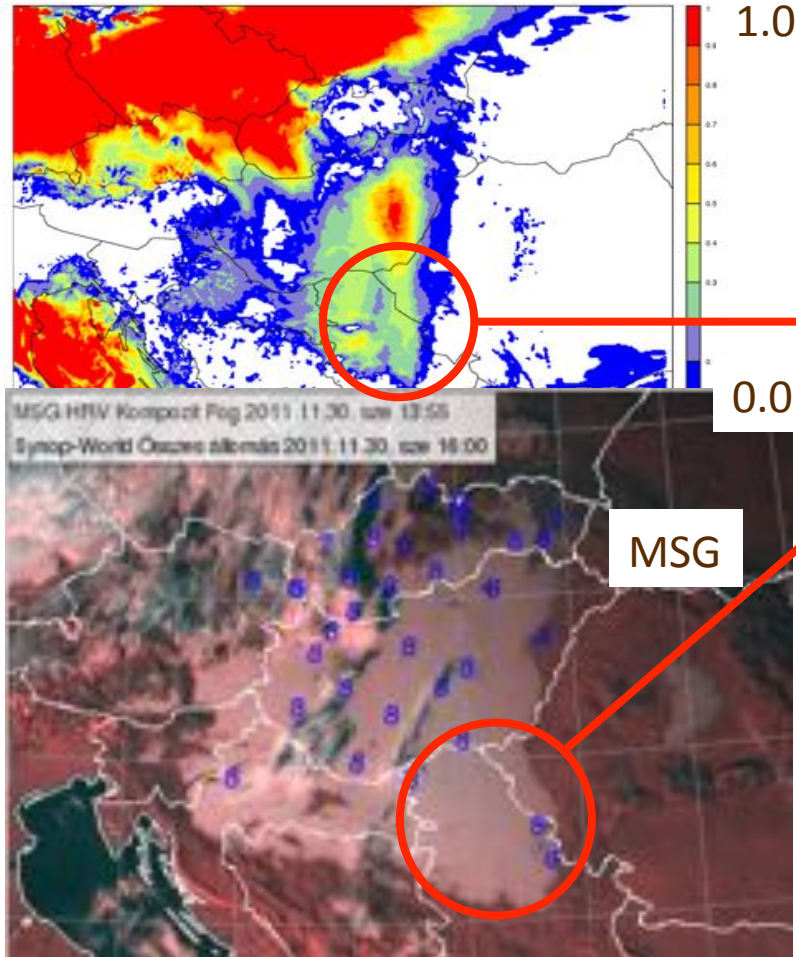
Task Team: Modelling from climate to flash floods— Status of NWP part

Proposed activities:

- Intercomparison of NWP models (ALADIN/AROME, COSMO, WRF, and also ECMWF/IFS) for typical weather situations of the Pannonian Basin where models face difficulties
- E.g.: winter anticyclonic cases, summer convective precipitation
- Start with case studies (periods perhaps later)
- Using data from local measurement campaigns (e.g. PABLS)
- Short term (in 1-2 years): networking, identifying case studies, defining methodology
- Medium term: (in 3-4 years): running common case studies, identifying model errors, sensitivity studies, recommendations for improvement, try to apply for funding

Possible candidate for case study: winter anticyclonic low cloud case

AROME, +14h low cloud forecast



Operational NWP models tend to underestimate low clouds during winter anticyclones in the Pannonian Basin

Some past and recent activities

ESA call: BLACK SEA AND DANUBE REGIONAL INITIATIVE

ESA Open Invitation to Tender AO9487

Open Date: 06/08/2018, 1st of October (13:00).

- research activities to advance the use of ESA and non-ESA EO missions towards the achievement of major scientific challenges identified for the next decade at the Black Sea from Space Workshop and by the **PannEx community**.
- **Danube+ Drought Early Warning**
- 200,000 eur, at least two partners, 2 years
- Romania and Slovenia are eligible from the PannEx region

Deadline 19 October 2018

2 submissions

EMS Annual Meeting: European Conference for Applied Meteorology and Climatology 2018

OSA2.7:PannEx: The Water and energy cycles in the Pannonian Basin and their interactions with human activities

Abstract: total accepted 27, oral 15, poster 12, two granted

<https://meetingorganizer.copernicus.org/EMS2018/sessionprogramme>

Regular PannEx meeting in ELU

Date and time: 4 September 16h-19h



Some past and recent activities

- **8TH GEWEX OPEN SCIENCE CONFERENCE: EXTREMES AND WATER ON THE EDGE**, MAY 6 - 11, 2018, CANMORE, CANADA: Lakatos, M., Weidinger, T., Horváth, Á., Hoffmann, L., Bihari, Z., Szentimrey, T., Cuxart-Rodamilans, J.: *Computation of PET on daily scale to estimate the surface energy budget components in the region of the PannEx RHP*

Funds

Bilateral calls responded by the PannEx community

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

Submitted:

Partly covers the region: EEA-Norway Grant Call: Common Challenges – Shared Solutions : Project title: ***Coupled meteorological and hydrological modelling and data support for reducing the risk of flash floods, droughts, soil degradation and water pollution***, leader: Institute for Soil Sciences and Agrochemistry Hungary, Norwegian Institute of Bioeconomy Research, NIBIO, Met.NO, OMSZ and Varimax (Hungary); University of Ljubljana, University of Zagreb, Zagreb University of Applied Sciences Latvian University of Agriculture / Latvia, Tallinn University of Technology / Estonia – **Baltic Earth region**

Future plans

- ❑ The most recent task is the **advertising of the task teams** to reach the relevant expert and institutions in the region and to motivate members of the community to contribute to the work of the Task Teams, and to creation of the next iteration of the Science and Implementation Plan (SP).
- ❑ On the 4th PannEx WS we agreed on the place and date of the **next PannEx WS**, the host will be Branislava Lalic University of Novi Sad (Serbia), the proposed date is June 2019.
- ❑ Preparation and sending an official **invitation letter for TT leaders and vice-leaders**
- ❑ Encourage the presenters of the EMS18 to publish conference papers in 'Advances in Science and Research – Contributions in Applied Meteorology and Climatology', submission deadline 15 January 2019
- ❑ suggest PannEx - HyMeX and Baltic Earth communities for a joined RHP session on the conference EMS 2019 Copenhagen
- ❑ Searching for funding options

Computation of PET on daily scale to estimate
the surface energy budget components in the
region of the PannEx RHP

8TH GEWEX OPEN SCIENCE CONFERENCE:
EXTREMES AND WATER ON THE EDGE, MAY 6 -
11, 2018, CANMORE, CANADA



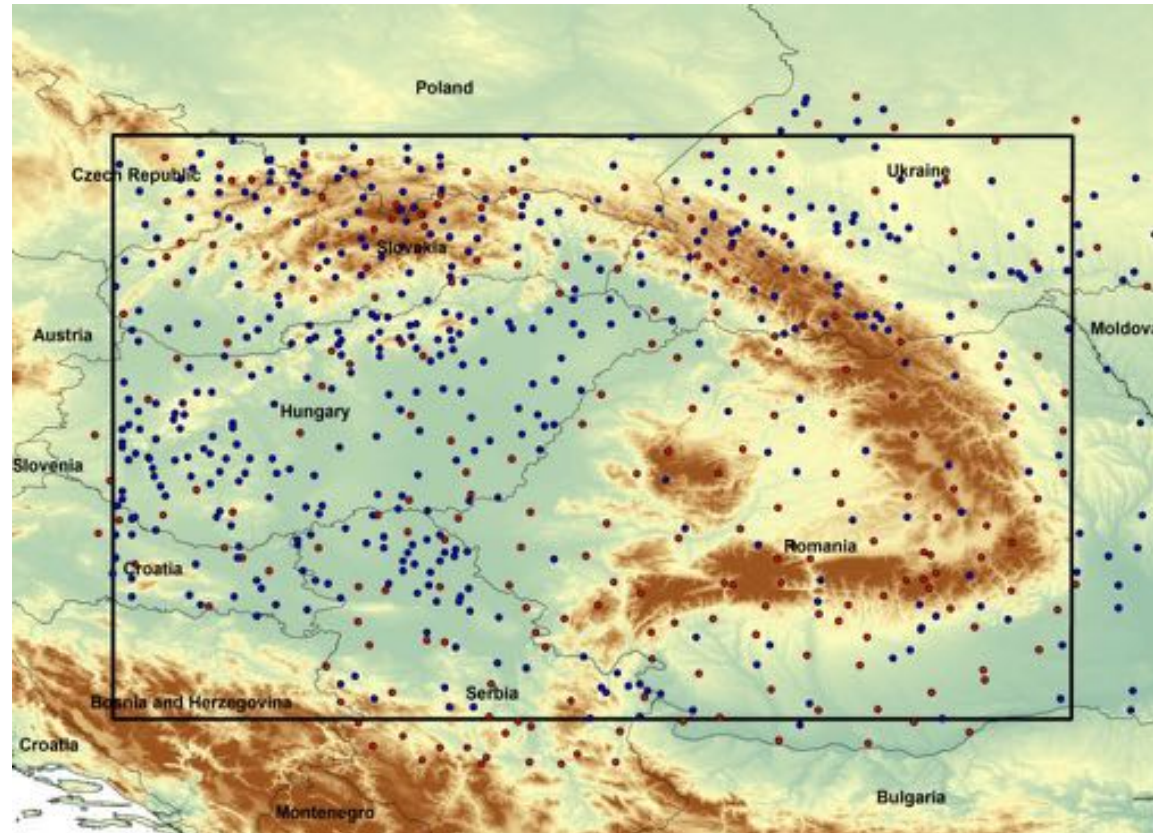
¹LAKATOS, M., ²WEIDINGER, T., ¹HORVÁTH, Á., ¹HOFFMANN, L., ¹BIHARI, Z.,
¹SZENTIMREY, T., ³CUXART-RODAMILANS, J.

¹HUNGARIAN METEOROLOGICAL SERVICE, ²DEPARTMENT OF METEOROLOGY,
EÖTVÖS LORÁND UNIVERSITY, ³UNIVERSITY OF THE BALEARIC ISLANDS

CarpatClim data sources

NMHSs in the region

415 climate stations and 904
precipitation stations were
used



3.36 Potential evapotranspiration

Inputs: Mean temperature (T_M , in $^{\circ}\text{C}$, for all 12 months), Latitude (ϕ in radians)

$$\text{PET [mm]} \quad \text{PET}^* = \begin{cases} 0 & T_M < 0^{\circ}\text{C} \\ 16 \left(10 \frac{T_M}{1} \right)^a & 0^{\circ}\text{C} \leq T_M < 26.5^{\circ}\text{C} \\ -416.85 + 32.24(T_M) - 0.43(T_M)^2 & T_M \geq 26.5^{\circ}\text{C} \end{cases}$$

$$\text{Exponential a coefficient} \quad a = 6.75(10^{-7})I^3 - 7.71(10^{-5})I^2 + 0.49239$$

$$\text{Annual Heat Index [}^{\circ}\text{C]} \quad I = \sum_{i=1}^{12} I_i$$

$$\text{Monthly Heat Index [}^{\circ}\text{C]} \quad I_i = \left(\frac{T_{M_i}}{5} \right)^{1.514}$$

$$\text{Adjusted PET [mm]} \quad \text{PET} = \left(\frac{\theta h}{360} \right) \text{PET}^* \quad \theta = \text{days (in that month)}$$

$$\text{Daylight [hours]} \quad h = \frac{2\omega_{ss}}{15}$$

$$\text{Sunset hour angle [degrees]} \quad \omega_{ss} = \arccos(-\tan(\phi)\tan(\delta))$$

$$\text{Solar Declination [radians]} \quad \delta = \left(\frac{\pi}{180} \right) (23.45) \sin \left(\frac{2\pi(284+d_n)}{365} \right)$$

$$\text{Julian day (15}^{\text{th}}) \quad d_n = 1(01 \text{ Jan}), \dots, 365(31 \text{ Dec}) \quad (\text{Use the 15}^{\text{th}} \text{ of each month})$$

Outputs: monthly PET (Carpathians 1961–2010)

Monthly PET in
CarpatClim

Daily PET: Penman-Monteith Reference Evapotranspiration method

17 steps for
calculations from
standard
meteorological data
(CarpatClim grid)

Day of the year,
latitude, longitude,
 T_{\min} , T_{\max} ,

wind speed,

relative humidity

$$ET_o = 0.408 \Delta (R_n - G) + \gamma \frac{900}{T + 273} u_2 (e_s - e_a) / \Delta + \gamma (1 + 0.34 u_2)$$

ET_o = reference evapotranspiration, mm day⁻¹;

R_n = net radiation at the crop surface, MJ m⁻² d⁻¹;

G = soil heat flux density, MJ m⁻² d⁻¹;

T = mean daily air temperature at 2 m height, °C;

u_2 = wind speed at 2 m height, m s⁻¹;

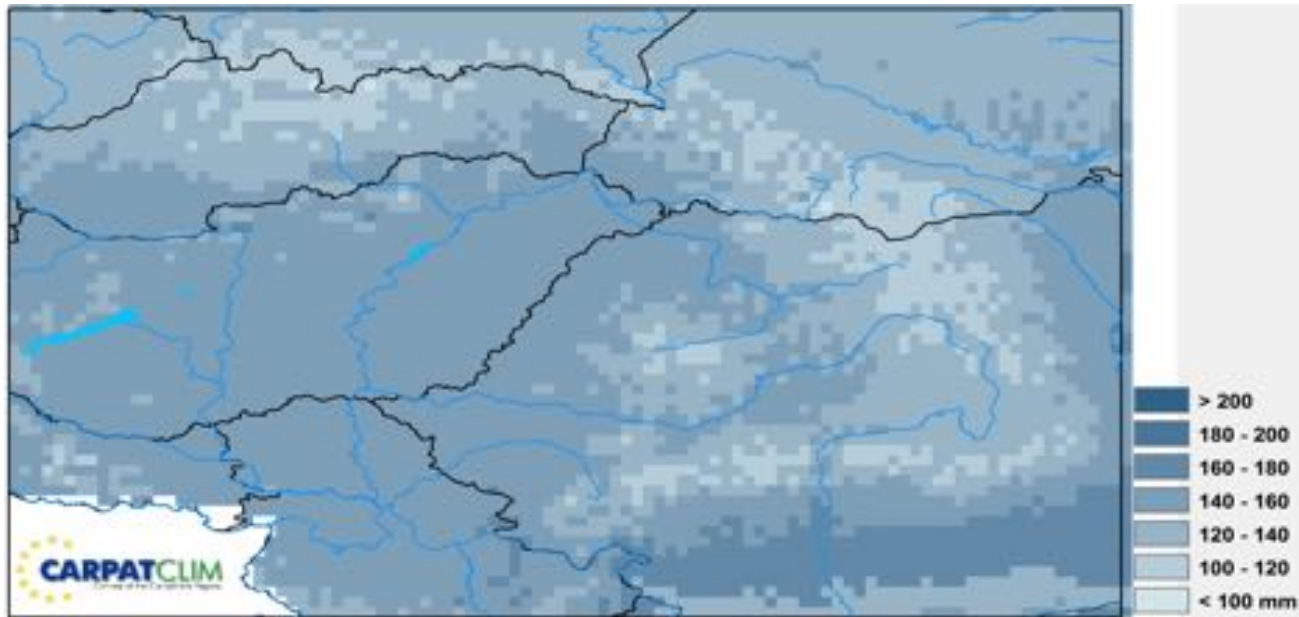
$e_s - e_a$ = saturation vapor pressure deficit, kPa;

Δ = slope of the vapor pressure curve, kPa °C⁻¹;

γ = psychrometric constant, kPa °C⁻¹.

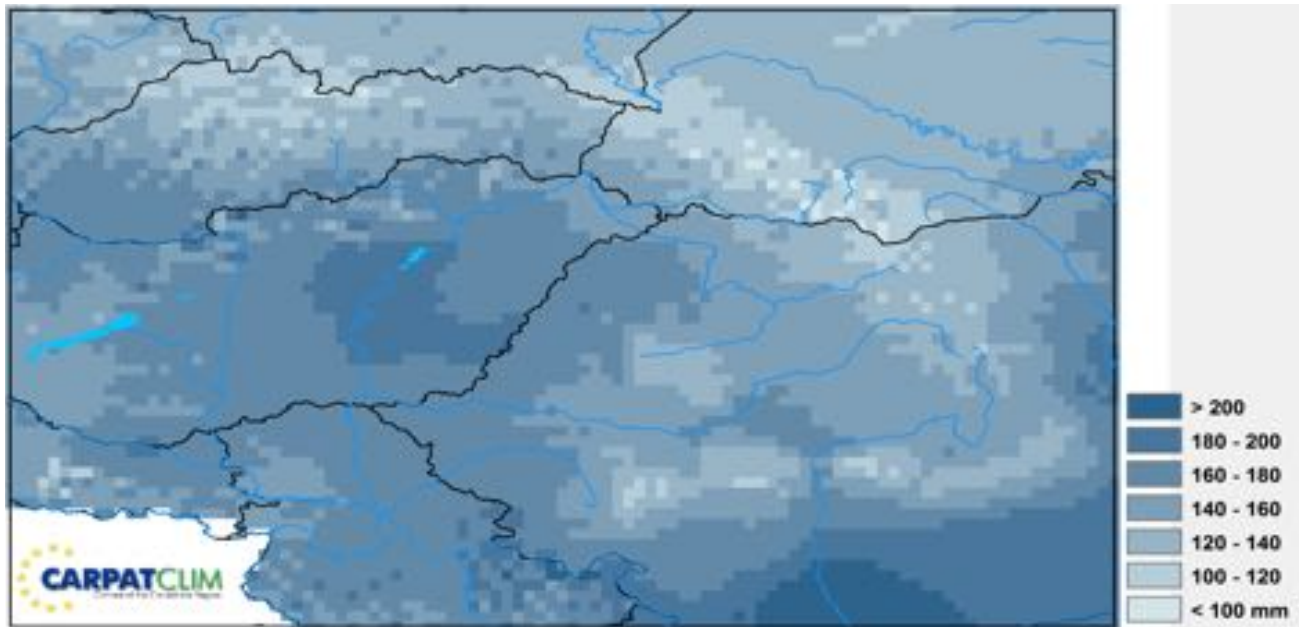
Reference:

Zotarelli, L., Dukes, M. D., Romero, C. C., Migliaccio, K. W., , and Morgan, K. T., 2010: Step by Step Calculation of the Penman-Monteith Evapotranspiration (FAO-56 Method), IFAS Extension, University of Florida, <http://edis.ifas.ufl.edu>



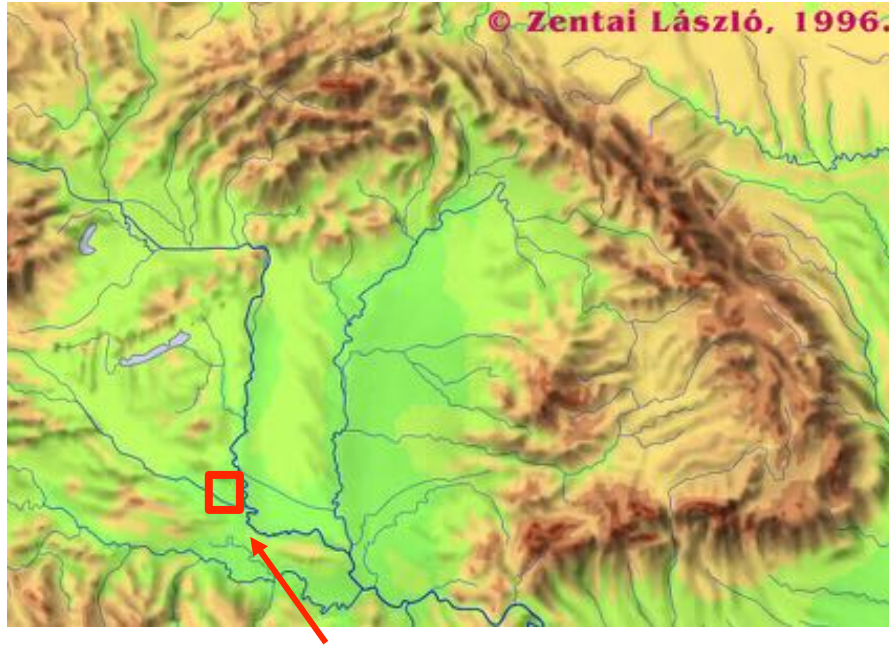
July 2007
Monthly
PET

CarpatClim
monthly PET



derived from
daily (Penman-
Monteith) PET
values

WRF-NOAH coupled model system- Case study for 18.07.2007-22.07.2007 very hot period



Nature Park Kopački rit,
177 km² in Eastern
Croatia, moorland

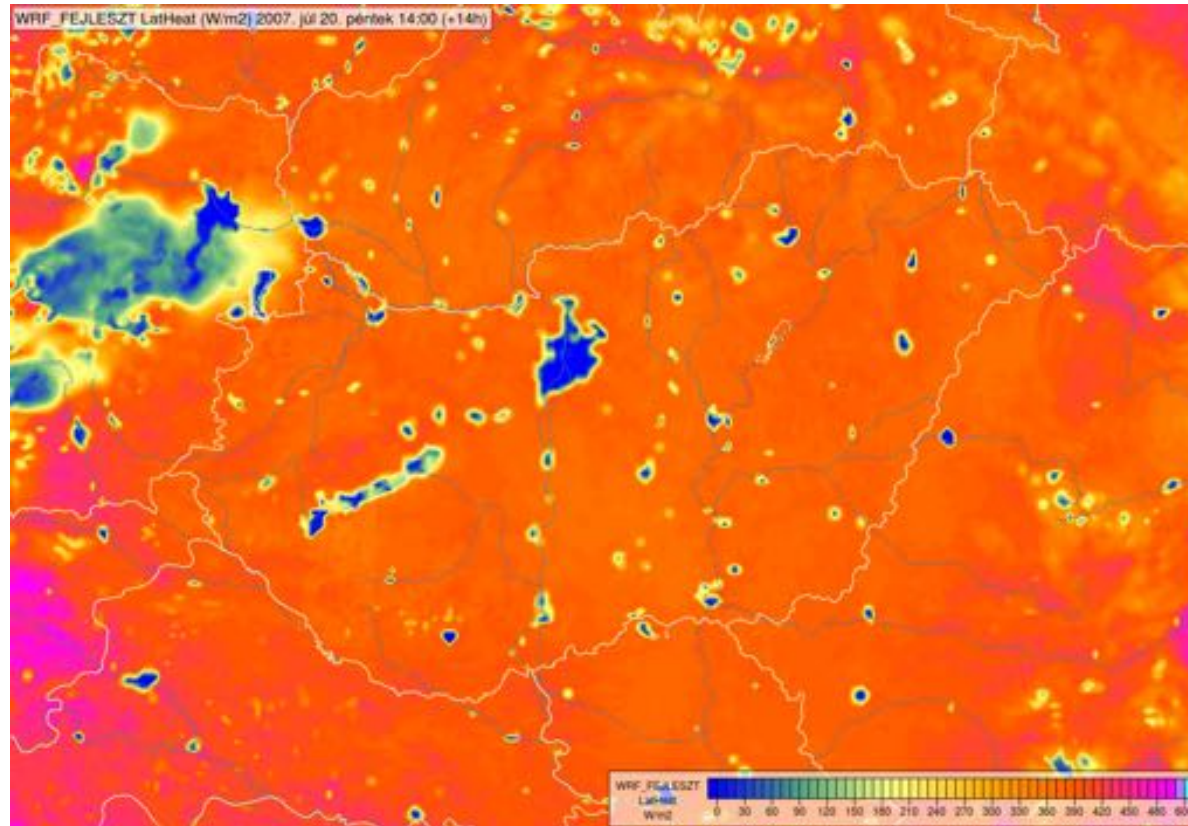
Modell parameters were used:

LH: description = "LATENT HEAT
FLUX AT THE SURFACE" ;

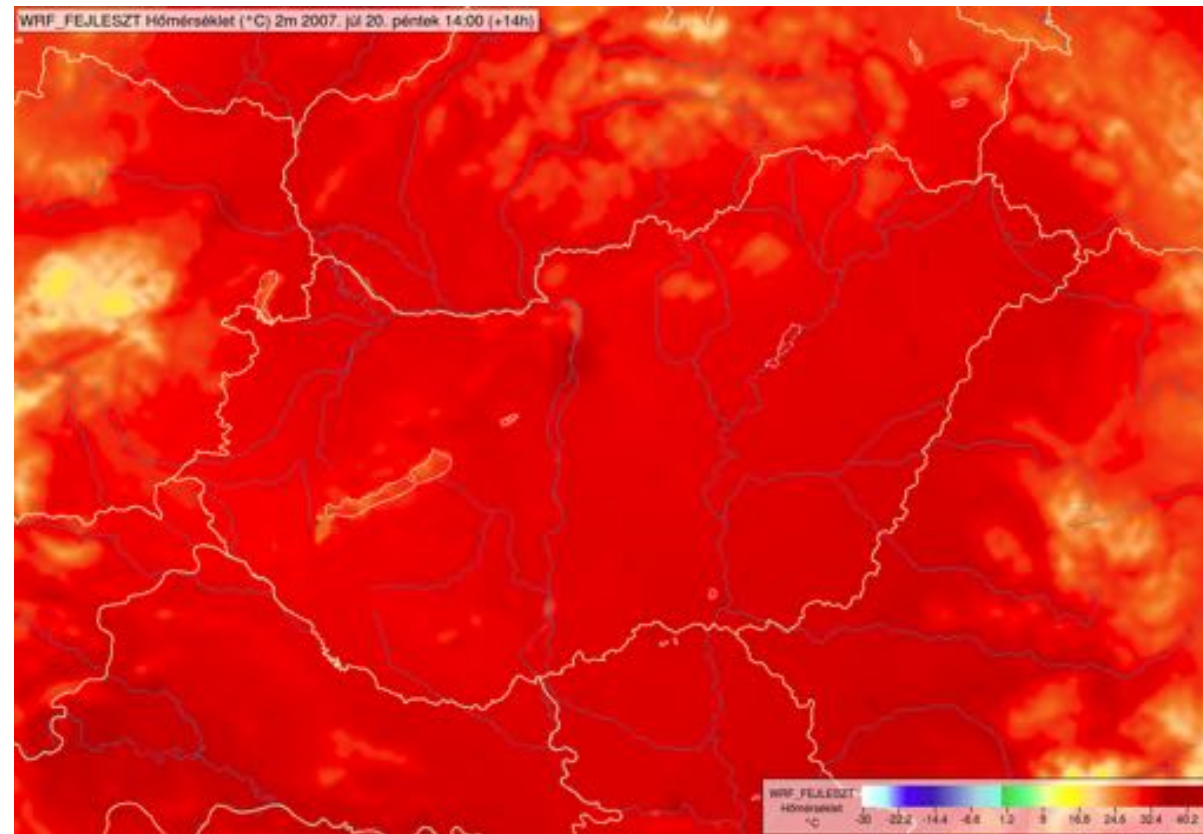
T2:description = „TEMP at 2M”

Hottest day: 20.07.2007

LH 2007-07-20_14:00:00 UTC

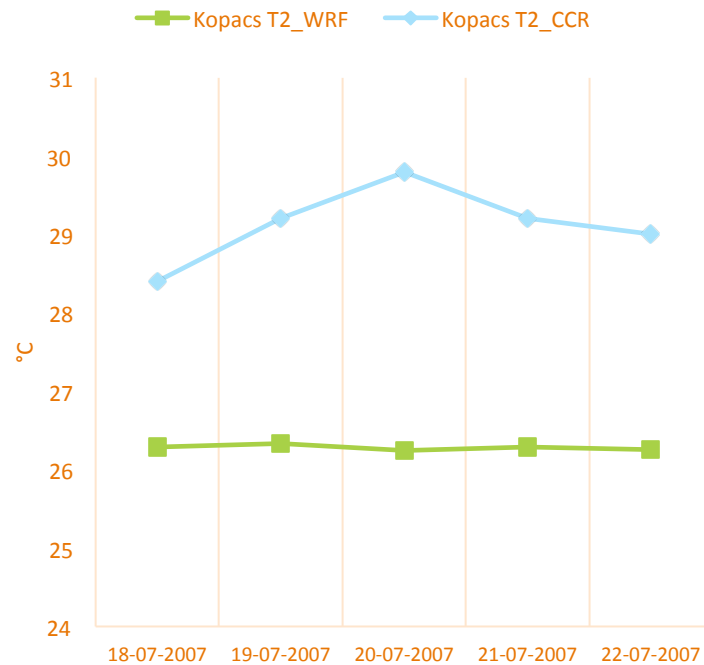


T2 2007-07-20_14:00:00 UTC

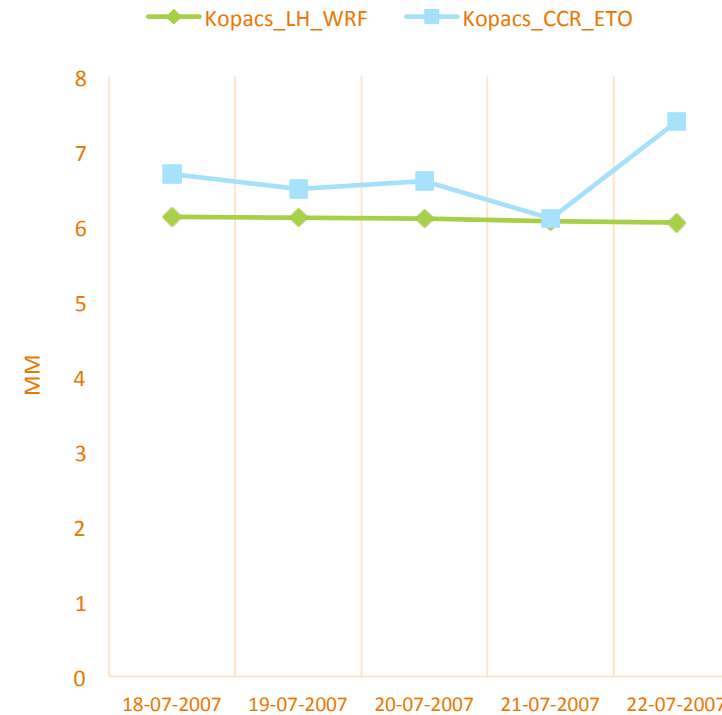


Comparison of the regional average of the modelled (WRF) and measured (CCR: CarpatClim) values for the Kopački rit

**KOPAČKI RIT TEMPERATURE
AT 2M**



KOPAČKI RIT



Conclusion and future plans

- The CarpatClim dataset is an appropriate dataset for studying the radiation and energy budget components on daily scale in the PannEx region
- In this study the CarpatClim is extended with daily PET values for other applications
- to analyse the surface energy budget components based on the WRF-NOAH coupled model system
- To extend the CarpatClim dataset with land-use, albedo and soil moisture data to support the PannEx activities
- To estimation of daily PET with using actual land-cover CarpatClim database



Thank you for your kind attention