

Long term changes of the sub-daily precipitation extremes in the Carpathian basin

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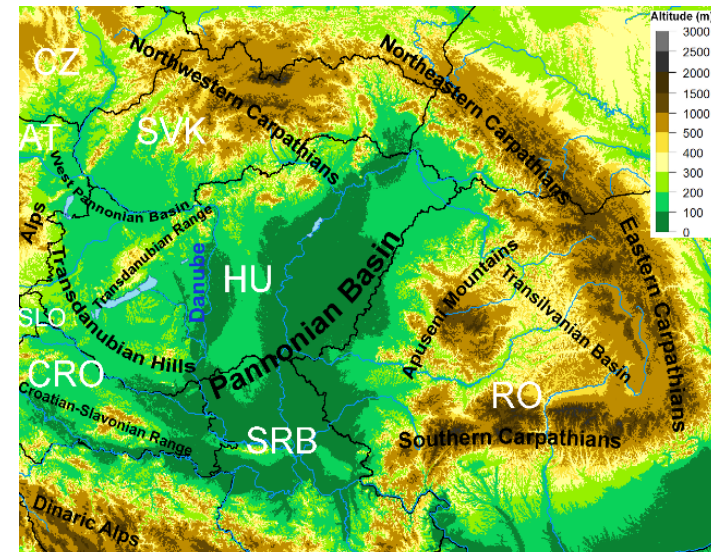
Outline

- Sub-daily precipitation indices for the PannEx region
- Longer series until 1967 analysed or Hungary

GEWEX Global Water and Energy Exchanges Project, WCRP) GHP - PannEx is a Regional Hydroclimate Project (RHP)

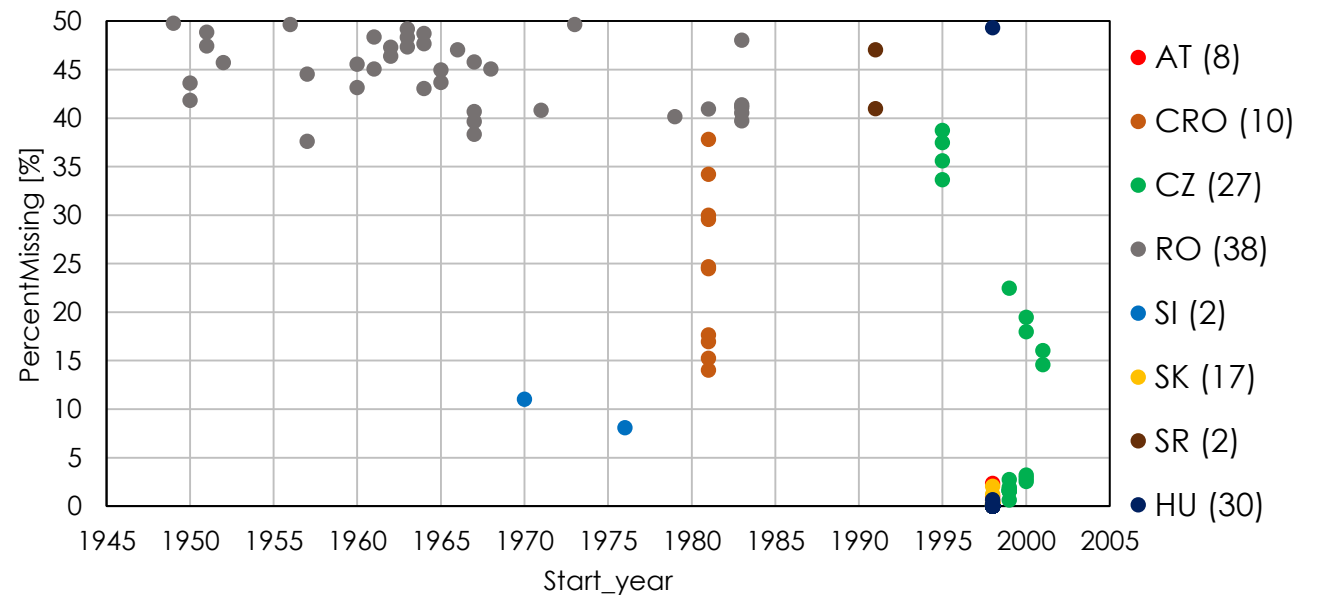
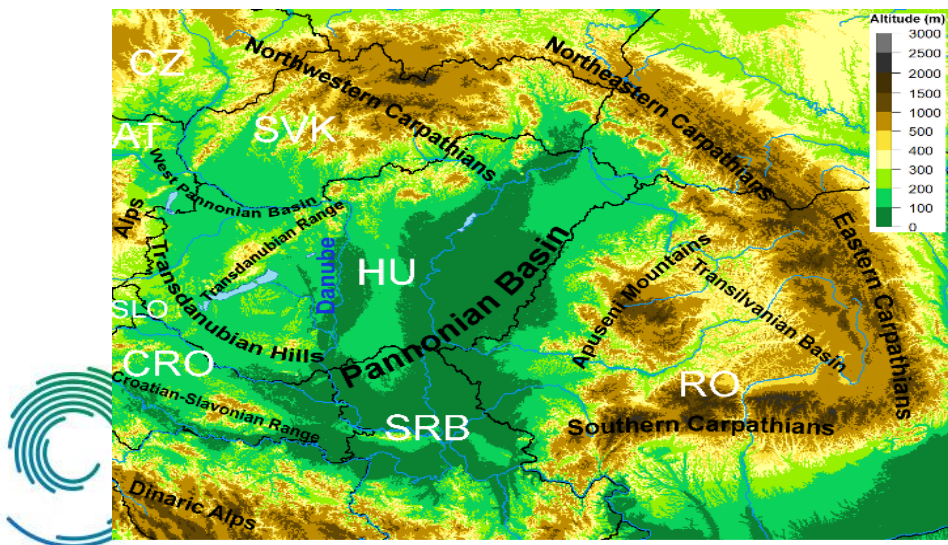
SQ: How can we better understand and predict precipitation variability and changes?

PannEx aims to achieve a better understanding of the Earth System components and their interactions in the Pannonian Basin



Atmosphere Special Issue "Climate Extremes in the Pannonian Basin: Current Approaches and Challenges" - *Analysis of Sub-Daily Precipitation for the PannEx Region*

Lakatos, M.; Szentes, O.; Cindrić Kalin, K.; Nimac, I.; Kozjek, K.; Cheval, S.; Dumitrescu, A.; Iraşoc, A.; Stepanek, P.; Farda, A.; Kajaba, P.; Mikulová, K.; Mihic, D.; Petrovic, P.; Chimani, B.; Pritchard, D. Analysis of Sub-Daily Precipitation for the PannEx Region. Atmosphere 2021, 12, 838. <https://doi.org/10.3390/atmos12070838>



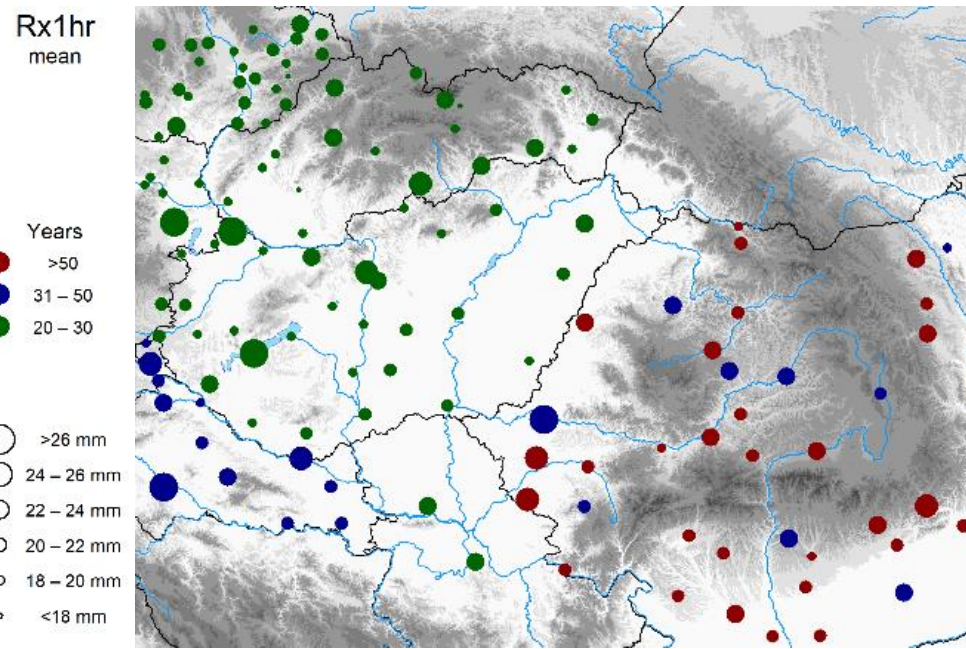
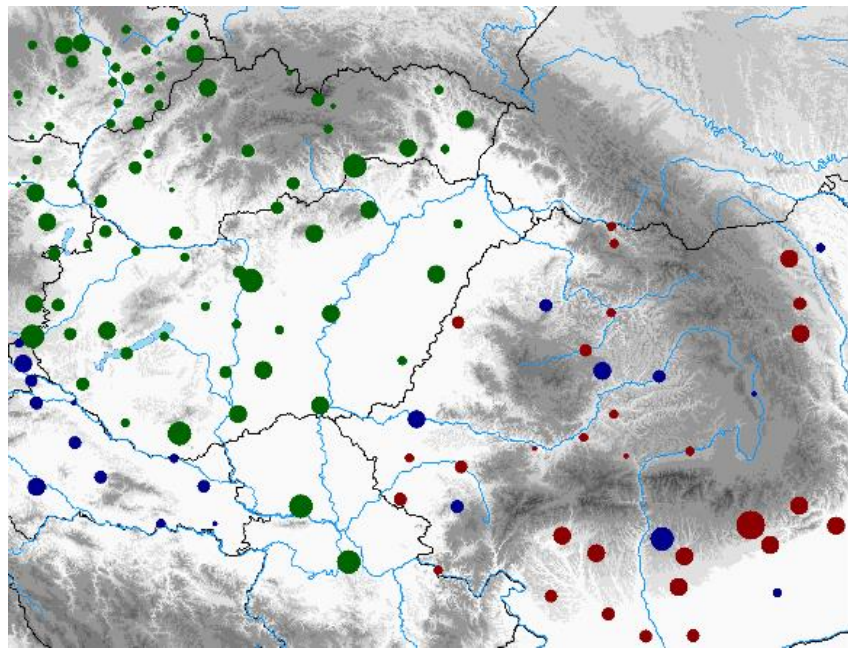
The longest records by country

Sub-daily indices defined in a GEWEX related project- **INTENSE** (INTElligent use of climate models for adaptation to non-Stationary hydrological Extremes)

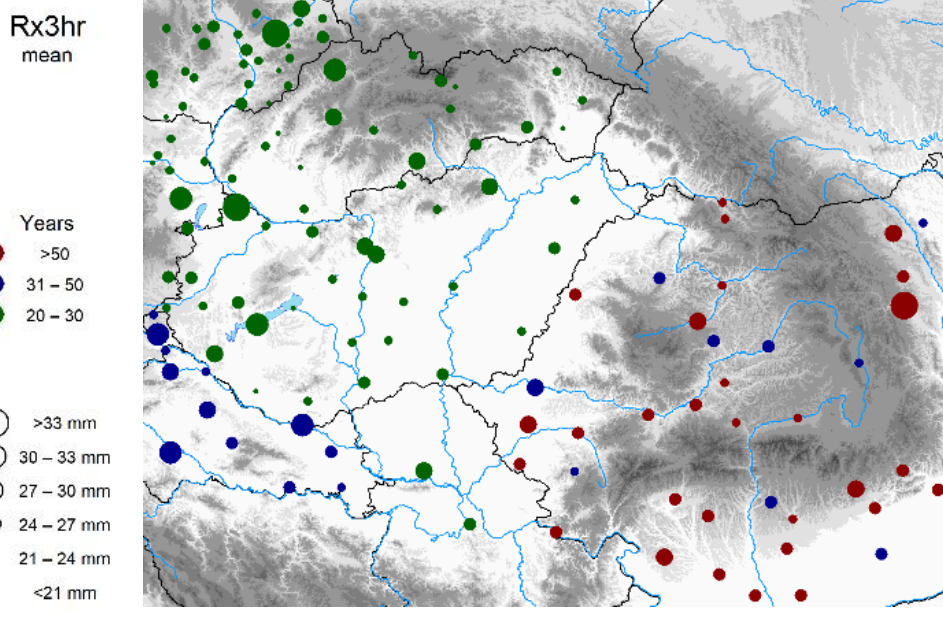
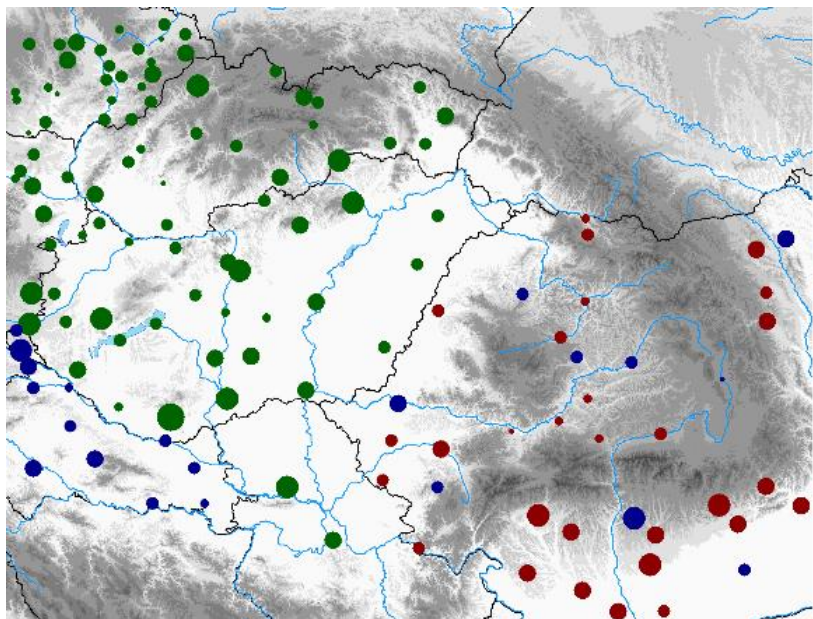
- to construct a new **global** sub-daily precipitation dataset
- **software** is developed for verifying sub-daily precipitation data and to derive a set of **global hydro-climatic indices**
- the derived **indices**, e.g. monthly/annual maxima, **will be freely available** to the wider scientific community

The list of indices used in this study

Indices Group	Abbreviation	Description	Illustrated on maps/graphs
Maxima	Rx1hr	Simple maxima of 1-hour sum	annual mean and the maximum (maps)
Maxima	Rx3hr	Simple maxima of 3-hour sum	annual mean and the maximum (maps)
Maxima	Rx6hr	Simple maxima of 6-hour sum	annual mean and the maximum (maps)
Frequency/Threshold	R3hr20mm	Count of 3hr periods greater than 20mm thresholds	annual count (graphs)
Duration	MxLWS	Maximum length of wet spell. Wet hours are defined as ≥ 0.1 mm)	annual (graphs)
Diurnal Cycle	MoWH	Timing of wettest hour of each wet day	monthly (graphs)
General	SPII1hr	Mean precipitation in wet hours	seasonal mean and change (maps)

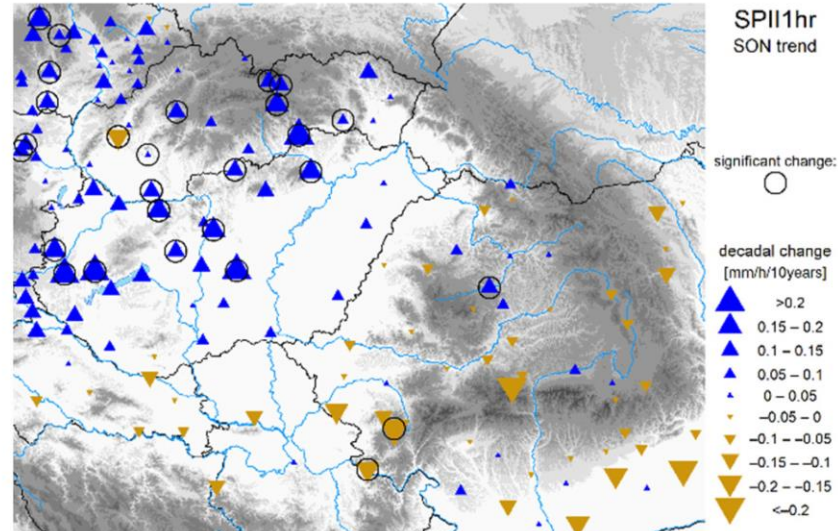
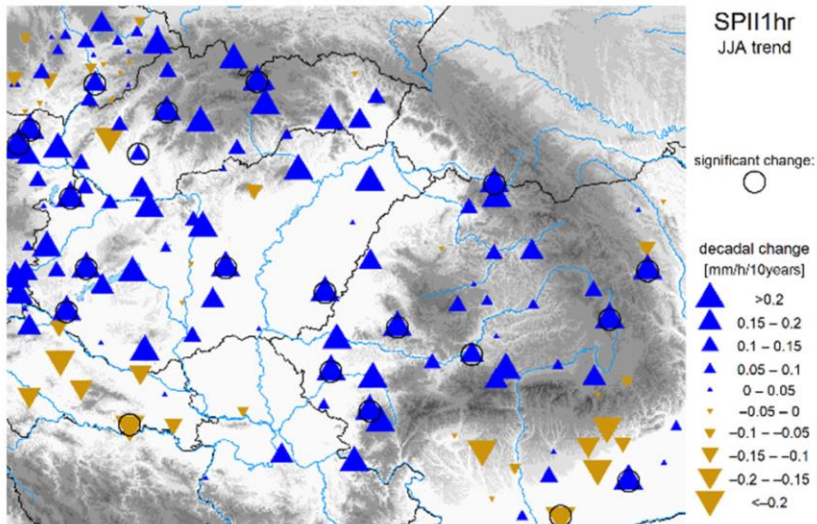
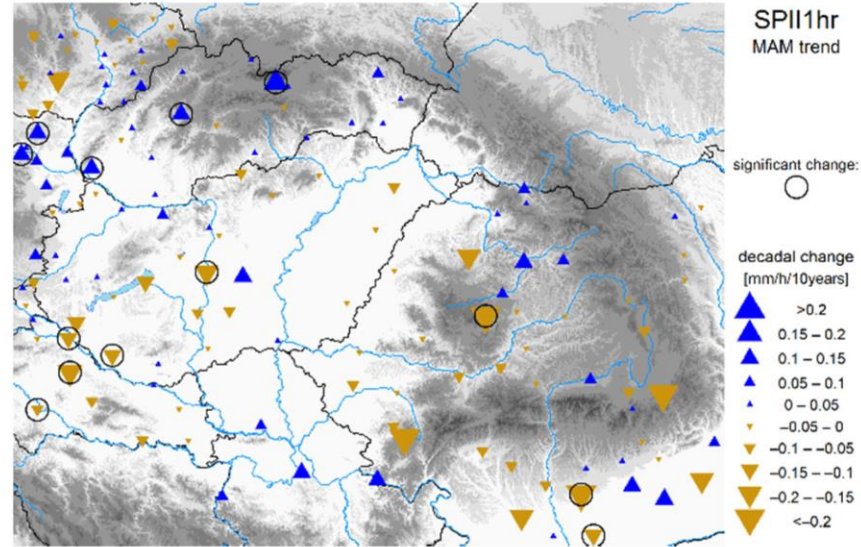
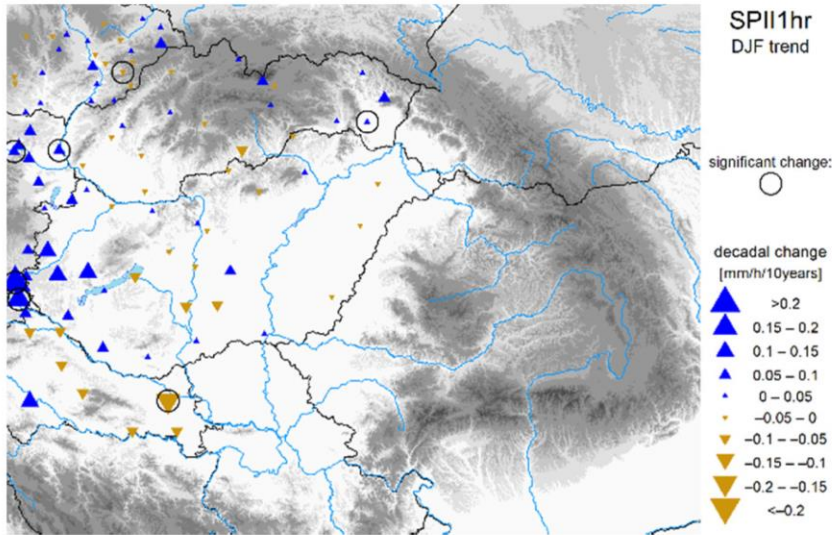


Annual average of 1-hour maxima (Rx1hr) (left) and the maximum 1-hour precipitation (right)



Annual average of 3-hour maxima (Rx3hr) (left) and the maximum 3-hour precipitation (right).

Decadal change of the mean 1 hr precipitation intensity (SPII1hr), 1998-2019

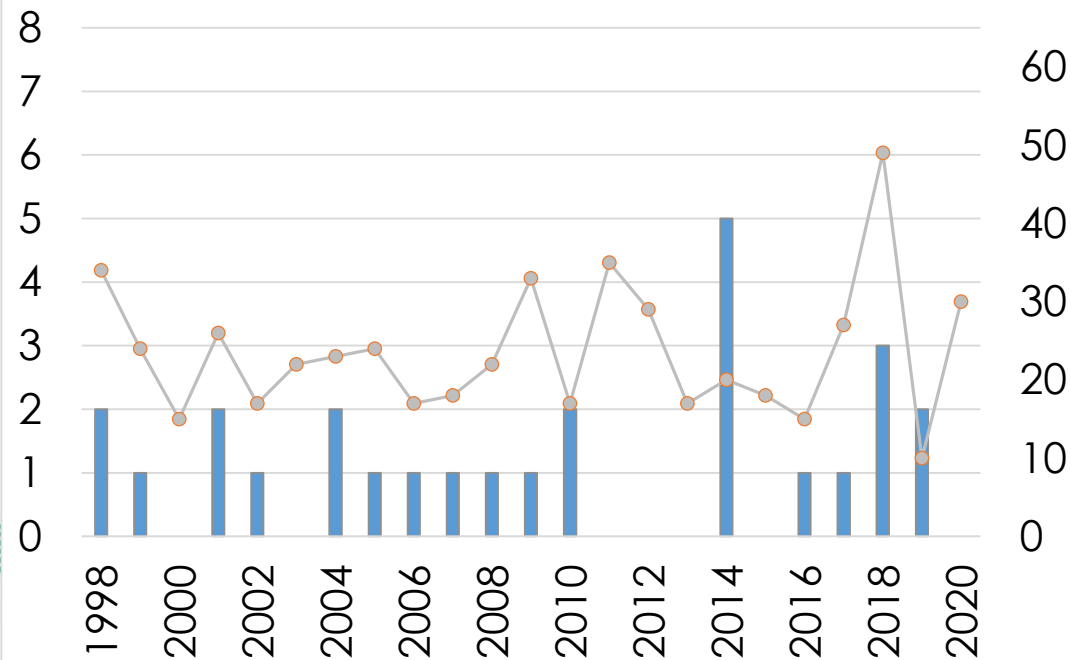


Some indices for selected stations

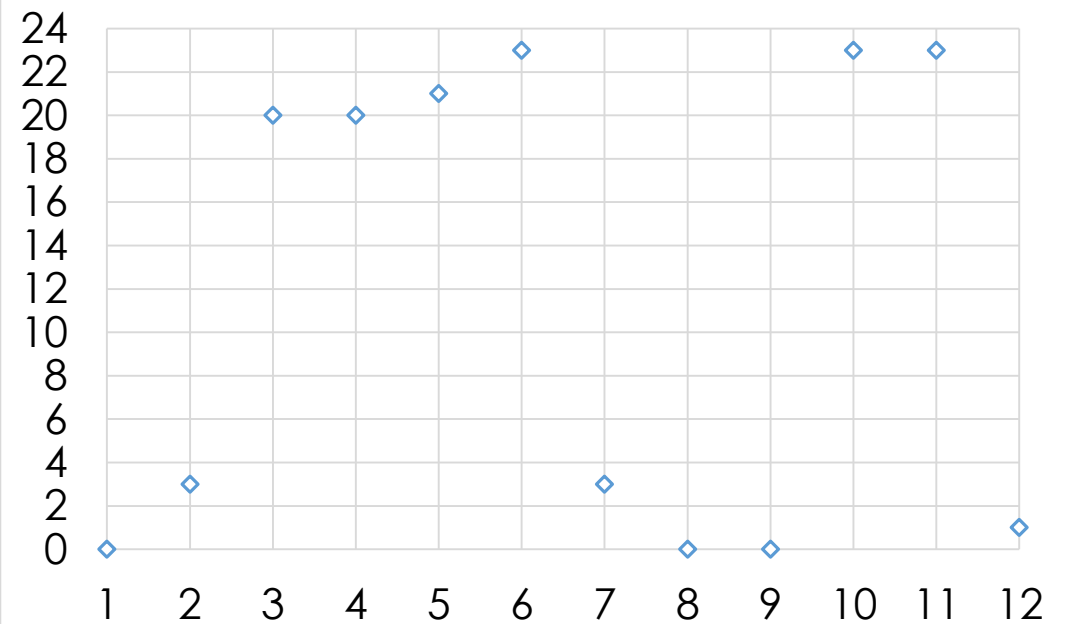
- **R3hr20mm** (count of 3-hours periods with greater than 20 mm (columns to the left axis) and **MxLWS** (Maximum length of wet spell, lines with marker to the right axis)

- **MoWH** (timing of the wettest hour)

Szeged-HU (I)



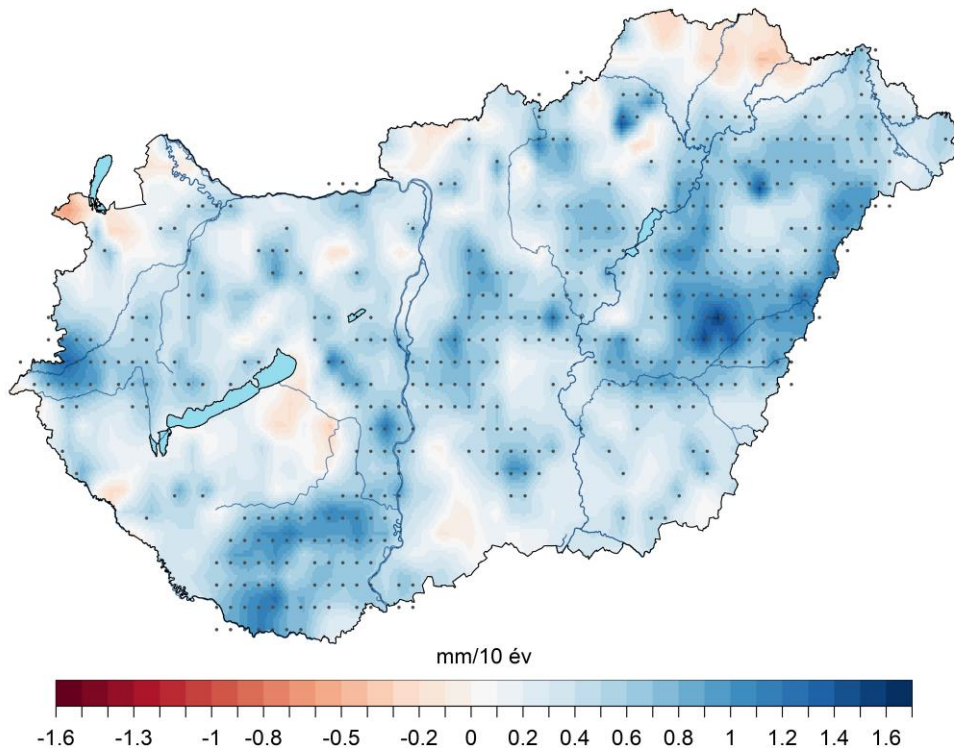
Szeged-HU (I)



Hungary - RX1day trend

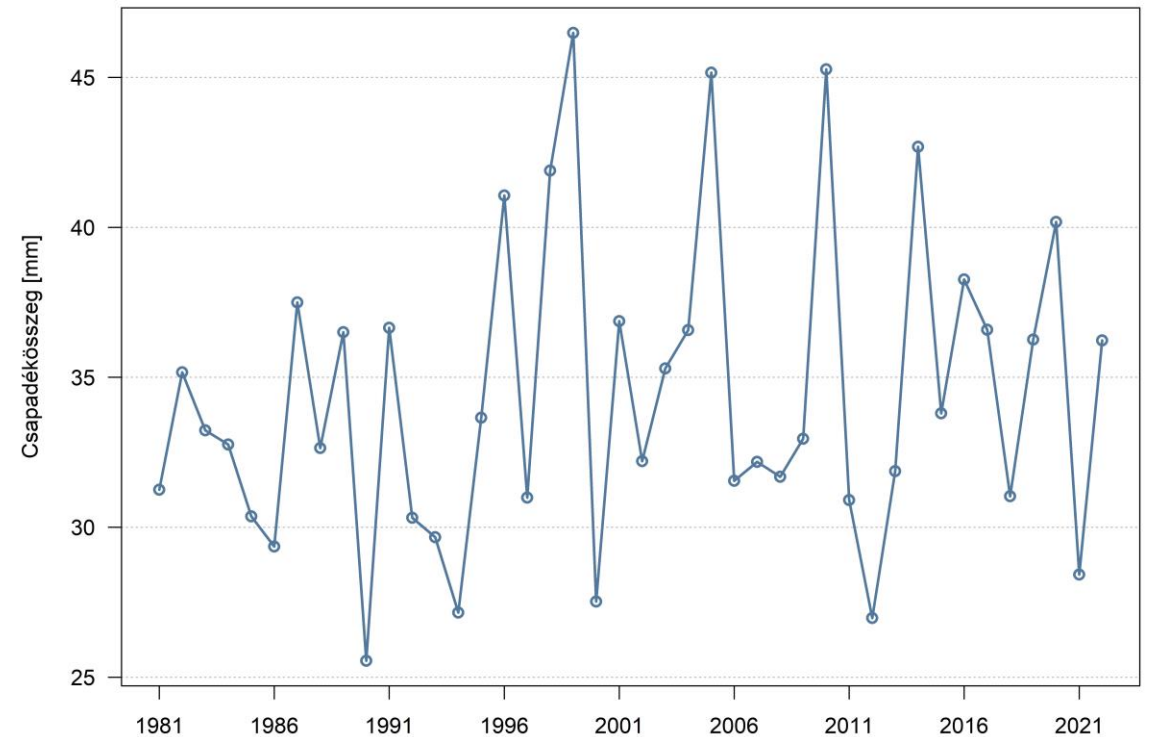
Decadal change (1901-2022) of the yearly RX1day

Napi csapadéköszegek éves maximumának változása (1901-2022)



Mean yearly RX1day for Hungary, 1981-2022

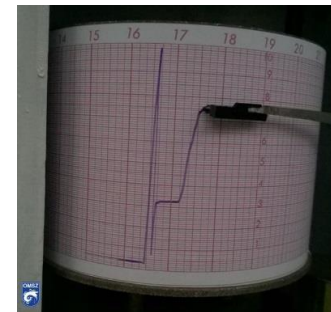
Órás maximális csapadéköszegek országos átlaga (1981-2022)



Homogenized (MASH) and gridded (MISH) data

Data availability in the data archive of the Hungarian Meteorological Service

- Ombrometers data before mid 1990s - **maximum** of 5,10,20,30,60,120,180min rainfall depth **per event**
- Automatic measurements: **10 min sum**, 1 min sampling only few stations
- **Downscaling** the 10 min data to 1 min - multivariate linear regression
- Recent digitization activity – ombrometers registering papers are digitized as it could have been measured by AWS



Public user service for design purposes

- **Return levels** of precipitation intensity (mm/h) at 101 stations for Hungary
- Data used: AWS measurement in the **period of 1998-2022**
- Yearly update
- Collaboration with OMSZ, General Directorate of Water Management (OVF) Hungarian Chamber of Engineers (Water Management and Water Construction Section)



Csapadékinintzés

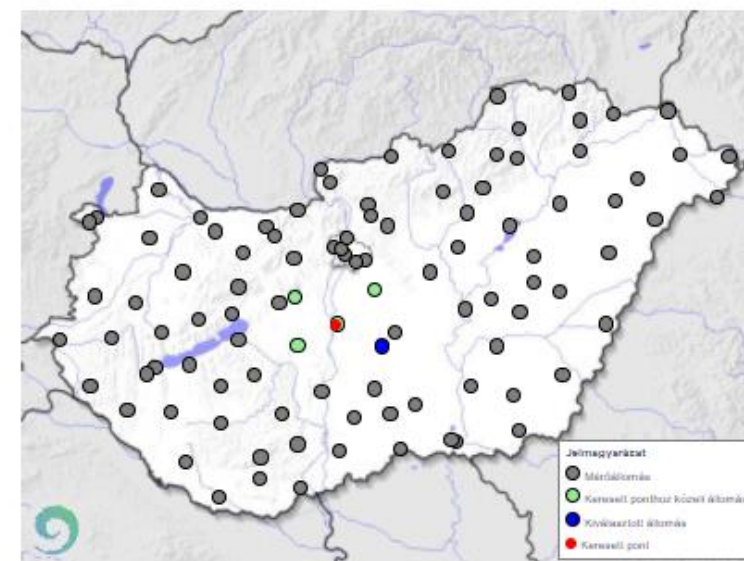


Ezen a felületen csapadékinintzés adatok letölthők le tervezési és méretezési (racionális módszertan lapján történő csapadékvízhozar számításához) feladatok kiszolgálása céljából. Az itt letölthető I_p - mértékadó intenzitás értékek a 101 automata mérőhelyre vonatkozóan az 1998-2020 időszak automata mérései alapján lettek meghatározva.

A tervezés helyszínének megadását követően (amely történhet EOVS, illetve fi-lambda koordináta párok megadásával is), a térképen piros színnel megjelenik a földrajzi koordináták által kijelölt pont piros színnel. Tájékoztatóként a legközelebbi állomás kék színnel, további 4 legközelebbi mérőhely pedig zöld színnel jelenik meg a térképen. A rendszer automatikusan a legközelebbi mérőállomás adatait adja meg, de a legördülő listából, vagy az állomást jelölő karrákra kattintva további mérőállomások adatai is lekérdezhetőek, letölthetőek (PDF és Excelbe importálható CSV formátumokban).

Ajánlott böngésző: Google Chrome, Firefox.

Szélesség: Hosszúság: Állomás:



Az ingyenes tervezői adatszolgáltatás biztosításához a szükséges fejlesztést az Országos Vízügyi Főigazgatóság (Telepítési Vizgazdálkodási Osztály) megbízásából a Magyar Mérnöki Kamara (Vizgazdálkodási és Vízépítési Tagozat) szakmai közreműködésével az Országos Meteorológiai Szolgálat készítette.

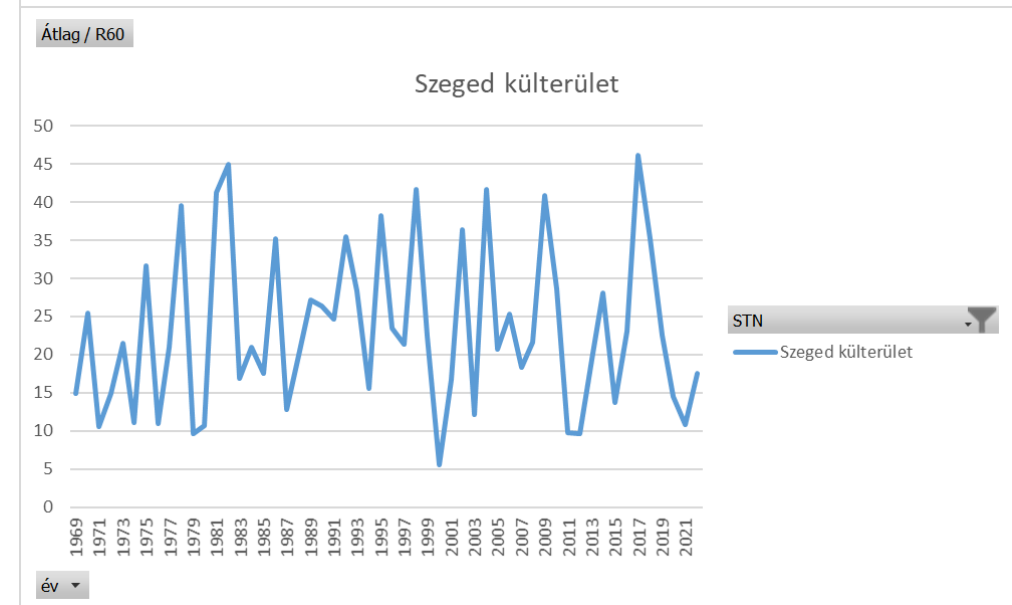
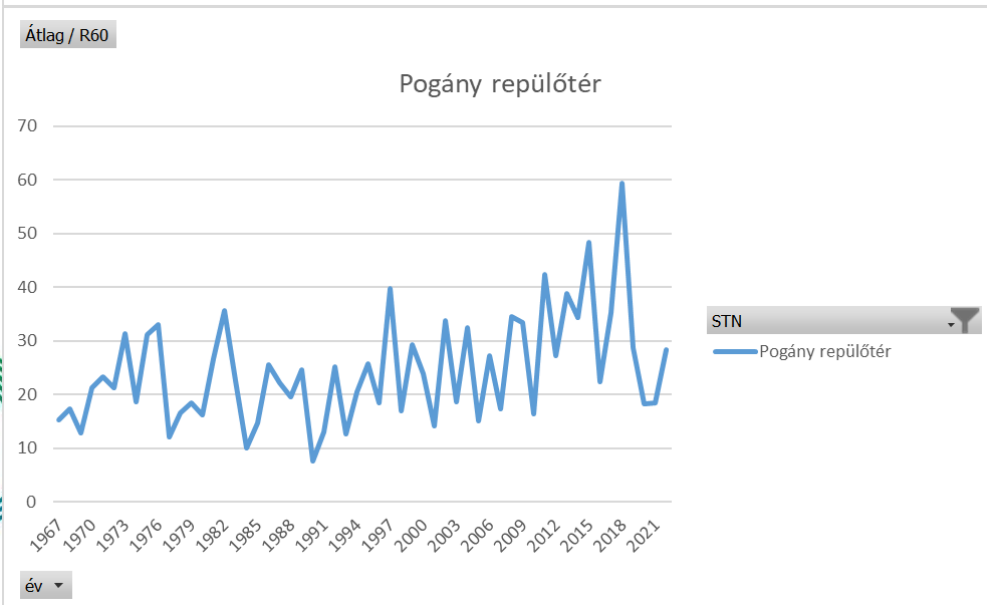
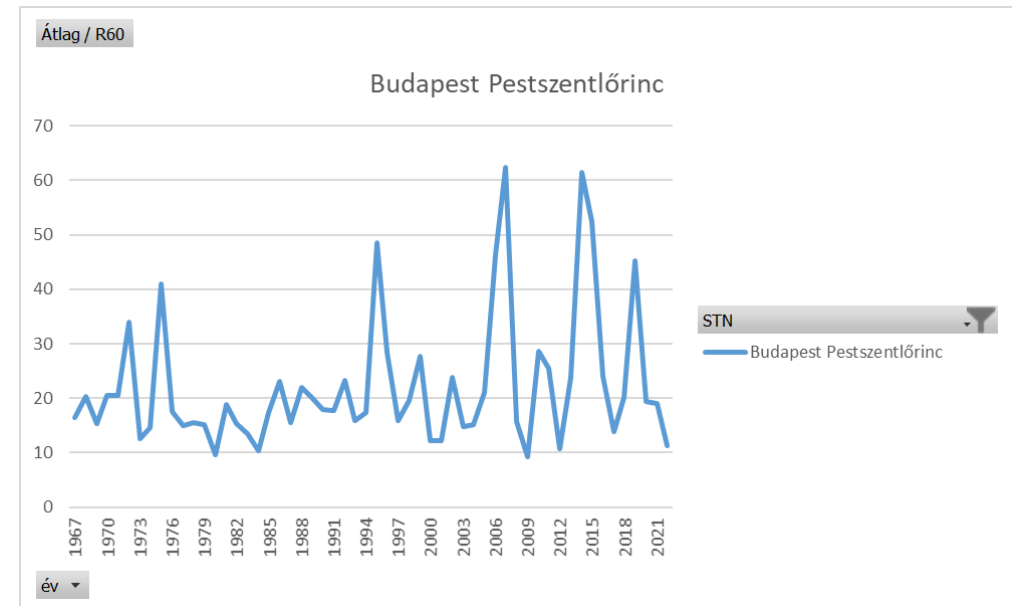
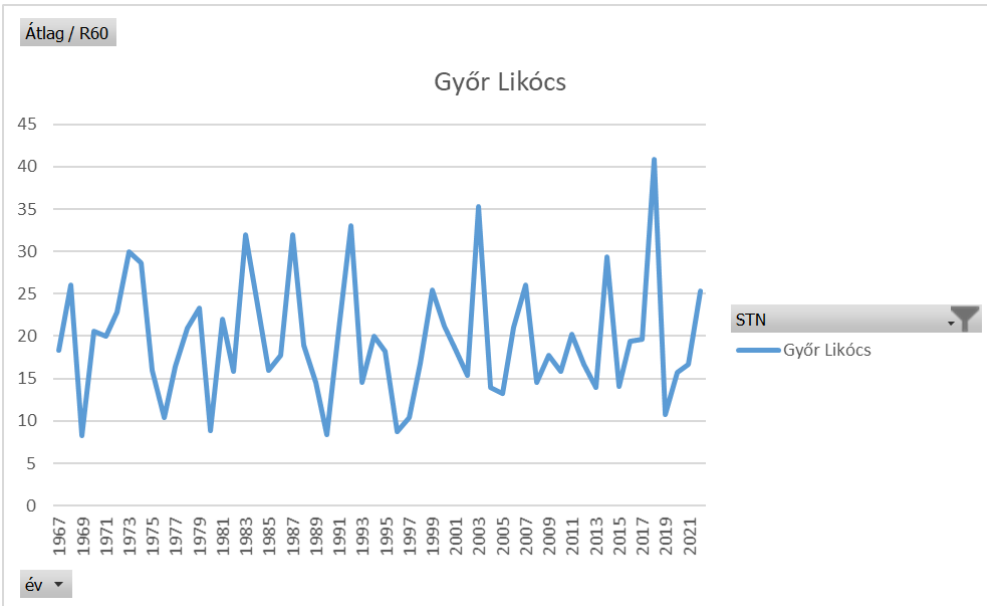
Mérőállomás: 57; Fülpözháza Koordináták: 46.87 N ; 19.42 E; 35.1 km távolságra

Intenzitás (mm/h)	10 perc	20 perc	30 perc	60 perc
1 éves, 100%-os	31,23	24,90	19,15	12,18
2 éves, 50%-os	59,56	47,36	36,21	21,31
4 éves, 25%-os	77,41	60,52	46,38	26,57
5 éves, 20%-os	82,25	63,96	49,06	27,94
10 éves, 10%-os	95,80	73,25	56,36	31,59
20 éves, 5%-os	107,78	81,08	62,56	34,63
50 éves, 2%-os	121,94	89,80	69,59	37,99
100 éves, 1%-os	131,64	95,46	74,21	40,14

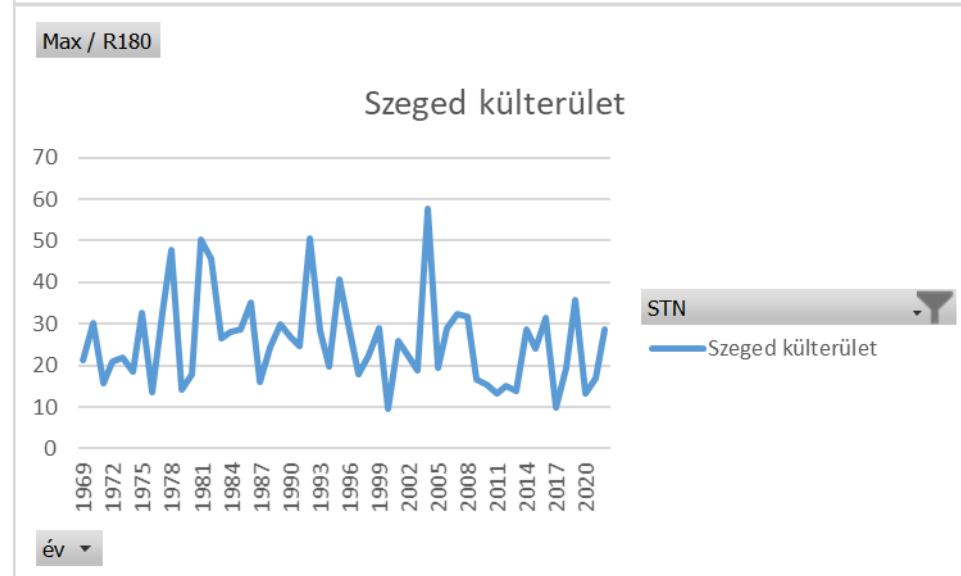
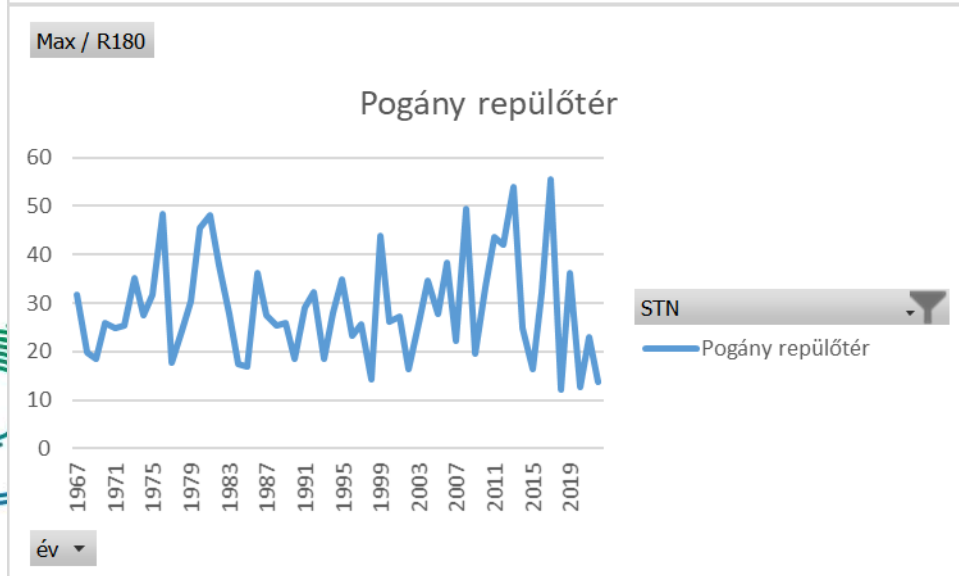
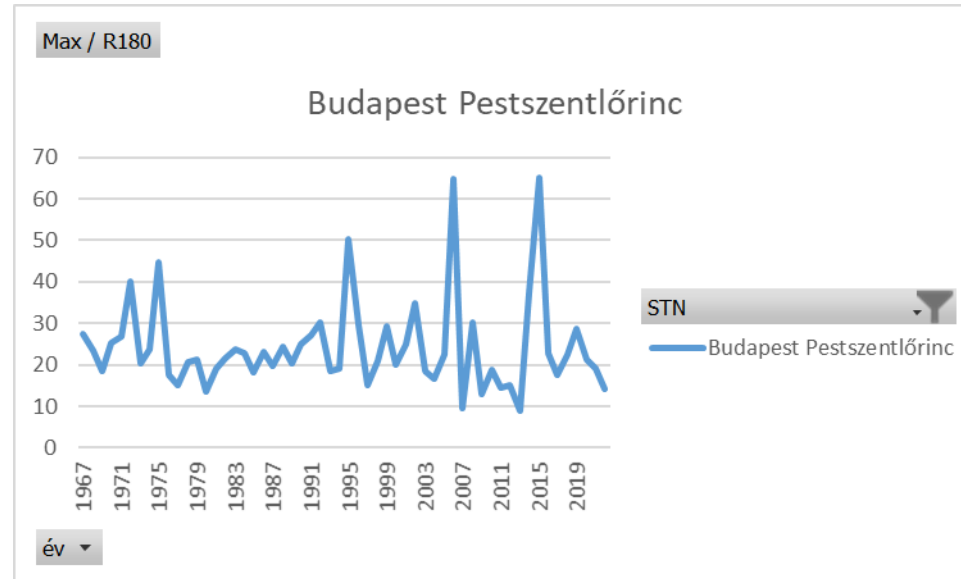
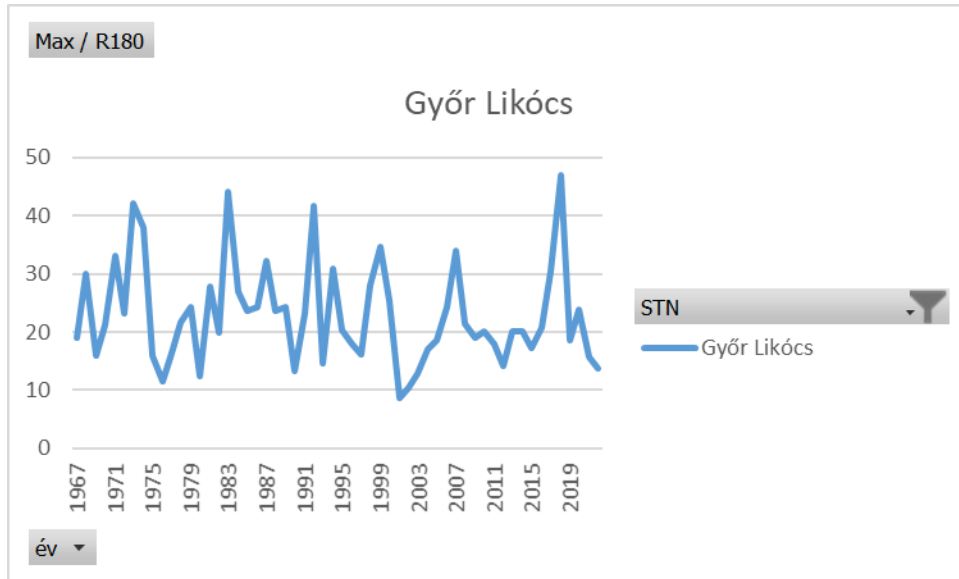
[I_p értékek számításának módszertana](#)
[Tervezési segédlet](#)

Kérdését, észrevételeit az alábbi email címen várjuk: intenzitas@met.hu

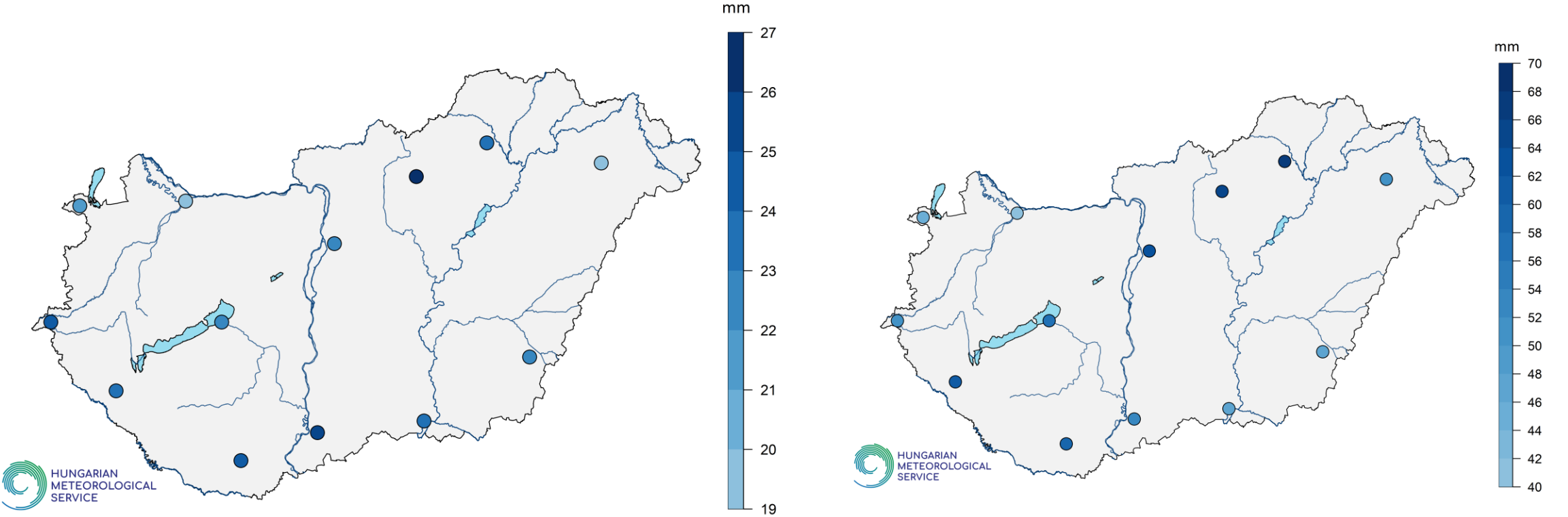
Yearly max 1-hours rainfall depth 1967-1997, 1998-2022, ombrometers and AWS



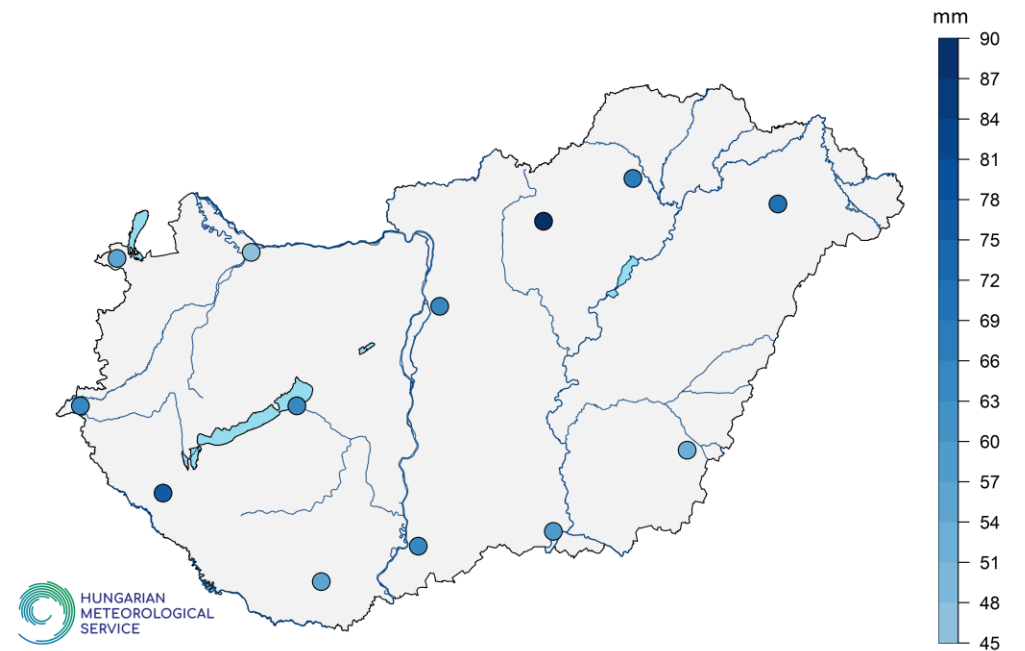
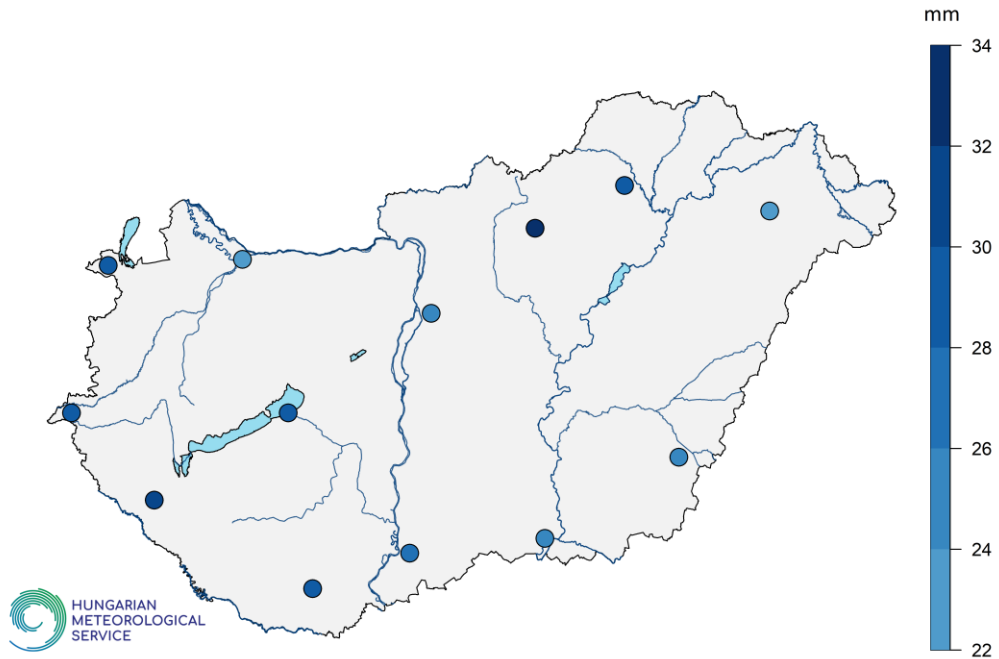
Yearly max 3-hours rainfall depth 1967-1997, 1998-2022, ombrometers and AWS



Annual average of 1-hours maxima (Rx1hr) (left) and the maximum 1-hours precipitation (right), 1967-2022



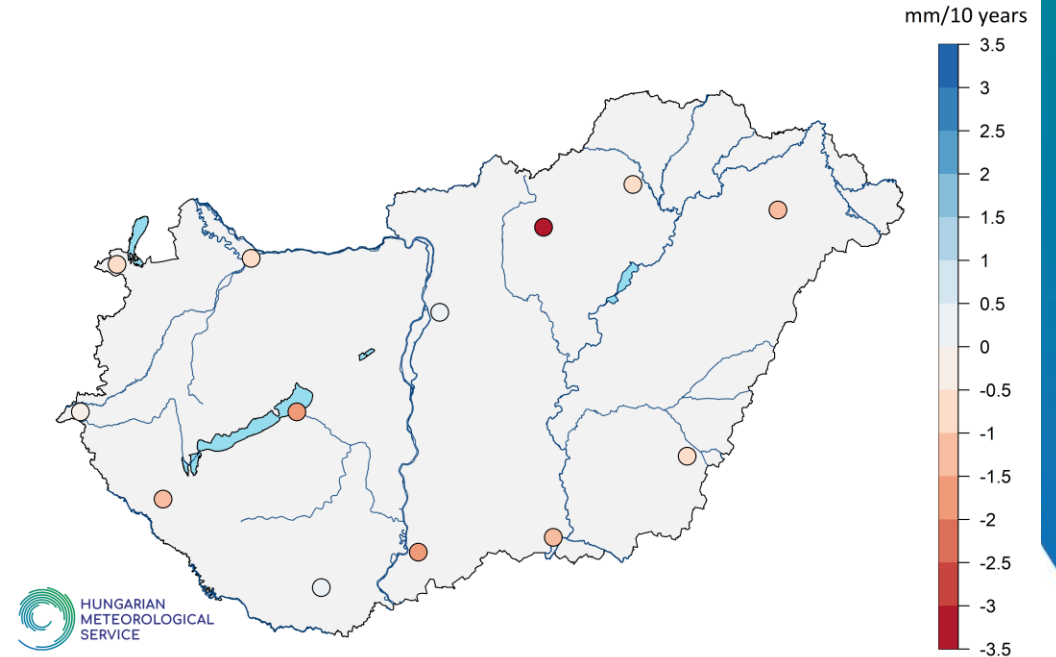
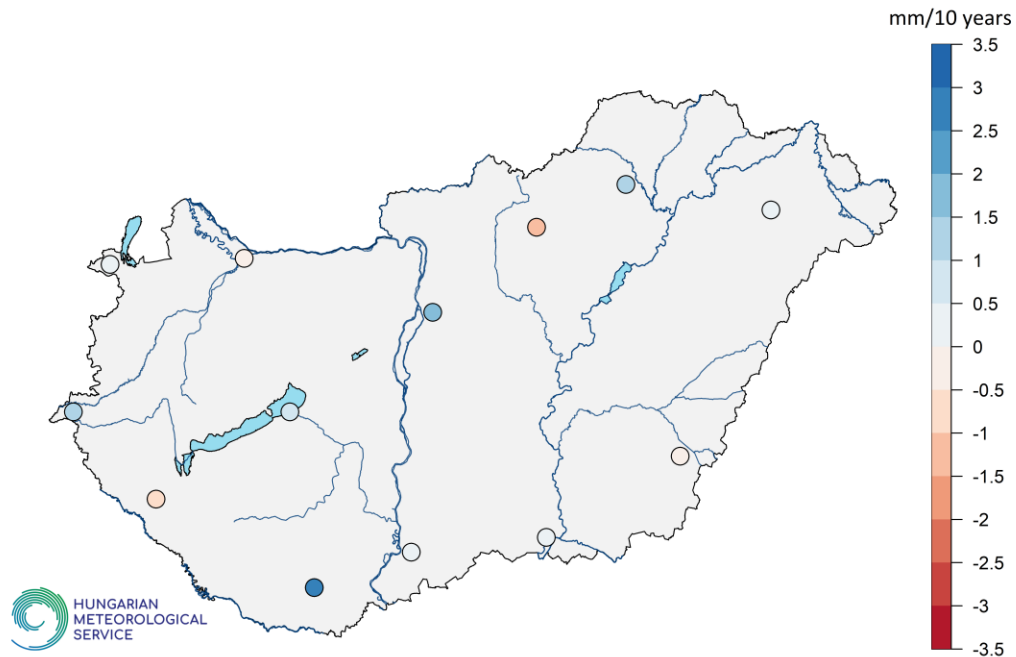
Annual average of 3-hours maxima (Rx3hr) (left) and the maximum 3-hours precipitation (right), 1967-2022



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Decadal change of 1-hour maxima (Rx1hr) and 3-hour maxima (Rx3hr), 1967-2022



Conclusion

- Initial analysis of the sub-daily precipitation in the PannEx region
- For Hungary only few significant change for the period 1967-2022 in 1-hours and 3-hours rainfall depth
- Plan: digitize more data; make services to urban planning for drainage systems more accurate

Thank you for your kind attention

Acknowledgements:

The research presented was carried out within the framework of the Széchenyi Plan Plus program with the support of the RRF-2.3.1-21-2022-00014 National Multidisciplinary Laboratory for Climate Change project.