CARPATCLIM
Climate of the Carpathian Region

Homogenization in the CarpatClim Cimate of the Carpathian Region project

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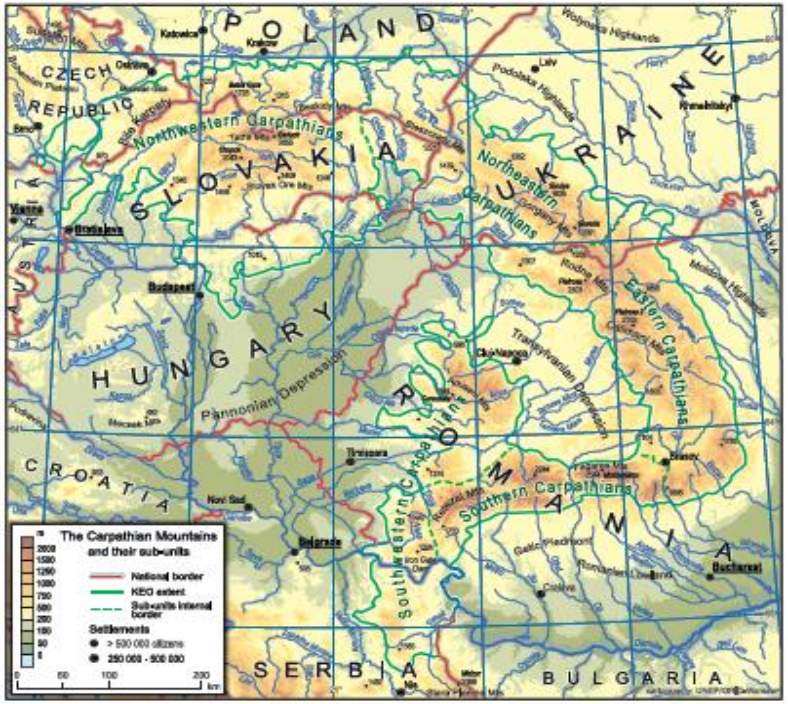
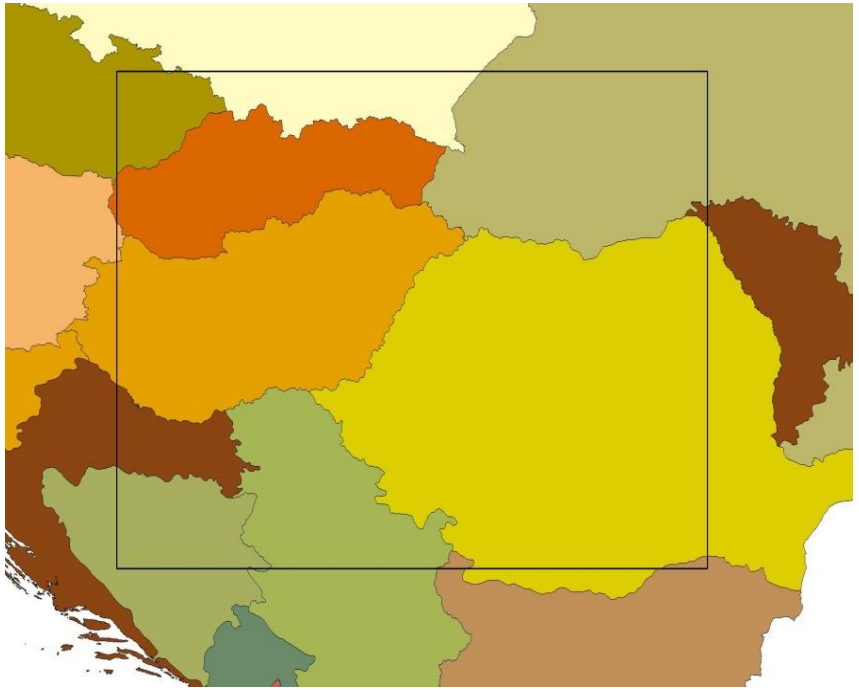
The target area of the project: between latitudes 50°N and 44°N, and longitudes 17°E and 27°E





Basic variables, daily basis, 1961-2010, 0.1°

Variable	Description	units
Ta	2 m mean daily air temperature	°C
Tmin	Minimum air temperature	°C
Tmax	Maximum air temperature	°C
p	Accumulated total precipitation	mm
DD	10 m wind direction, Degrees	0-360
VV	10 m horizontal wind speed	m/s
Sunshine	Sunshine duration	hours
cc	Cloud cover	tenths
Rglobal	Global radiation	J/cm^2
RH	Relative humidity	%
pvapour	Surface vapour pressure	hPa
pair	Surface air pressure	hPa
Snow depth	Snow depth (ZAMG model)	cm

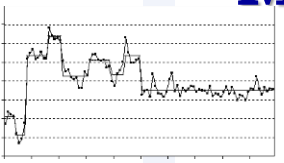
Module 1 SHMU
Meta data collection, data rescue, **near border data exchange, homogenization**

Module 2 OMSZ
Data harmonization, creation of the interpolated data

Module 3 RHSS
Digital climate atlas,data download, metadata catalogue

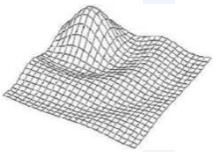
freely available, ~ 10 km resolution, gridded database, 1961-2010

Methodology: commonly used procedures, by country execution



MASHv3.03 (Multiple Analysis of Series for Homogenization; Szentimrey, T.) for homogenization, quality control and missing value completion of station daily data series

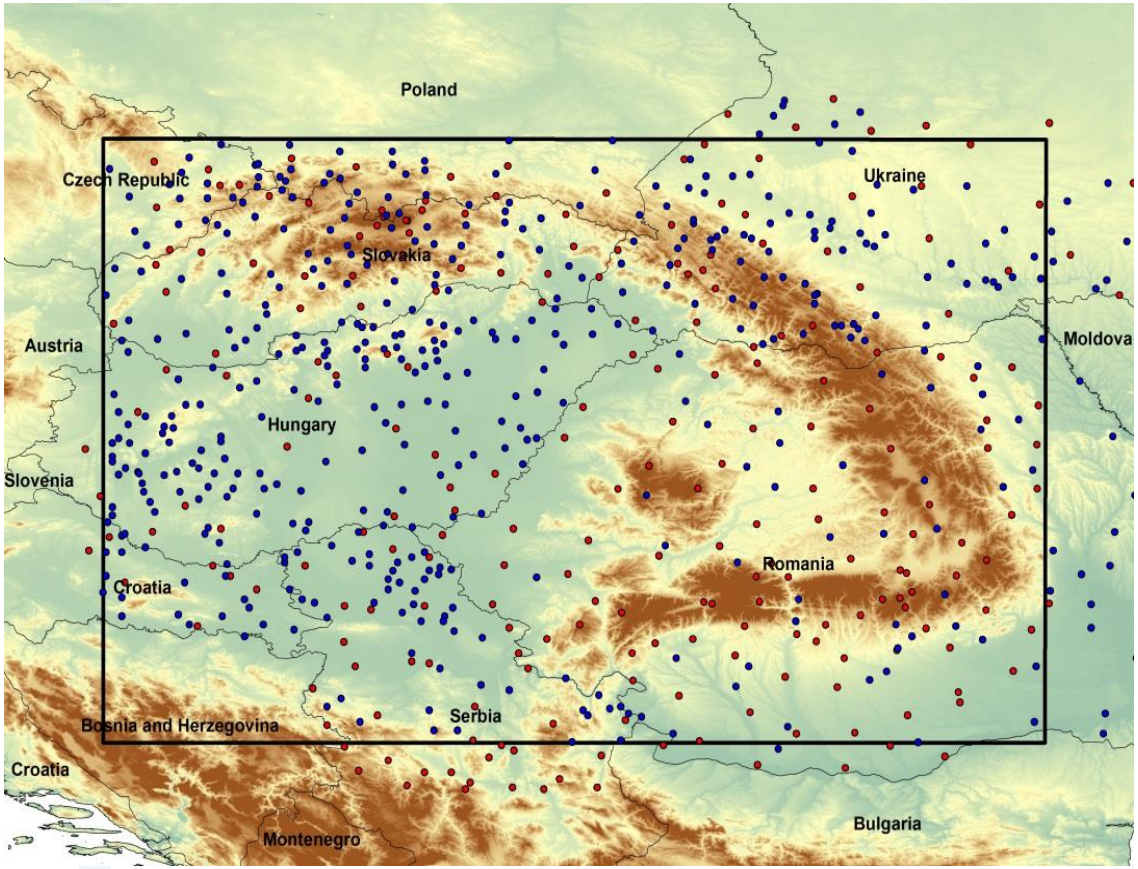
- COST ES0601 „HOME" action: good monthly benchmark results and promising daily tests, automatic method, documented homogenization process



MISHv1.03 (Meteorological Interpolation based on Surface Homogenized Data Basis; Szentimrey, T. and Bihari, Z.) for gridding (interpolation)

- Specially developed for interpolation of meteorological data, the modeling part and the gridding part could be run by countries. The gridded daily time series were generated automatically in one step for the 50 years long period.

Spatial distribution of stations used

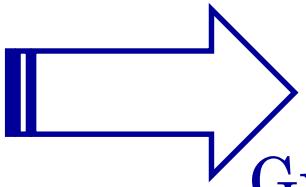


415 climate stations and 904 precipitation stations

Main steps from raw data to gridded value

Module 1

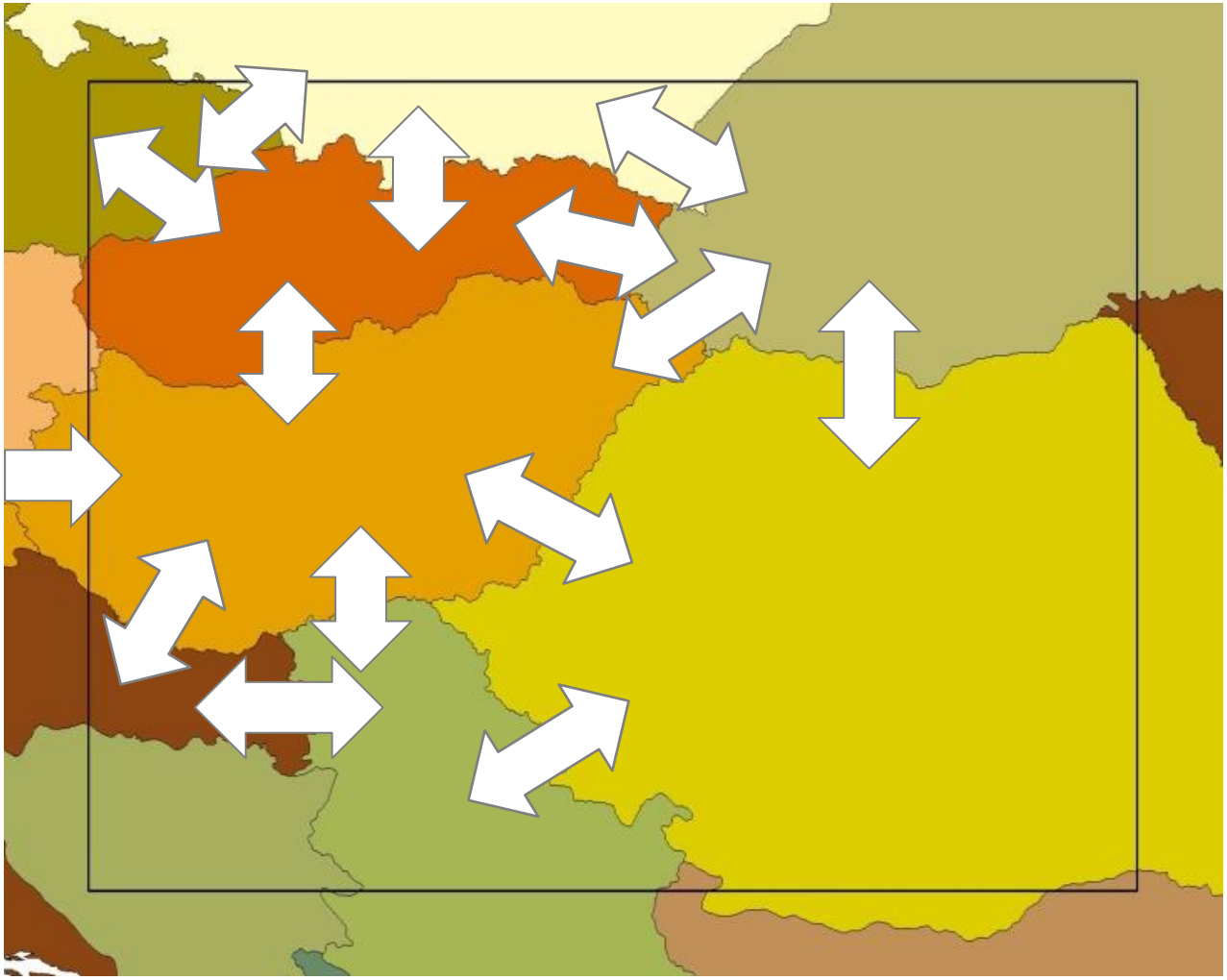
- Near border data exchange before homogenization
- Homogenization, QC of data series per country by MASH
- Data exchange after homogenization
- Controlling of cross border harmonization by MASH



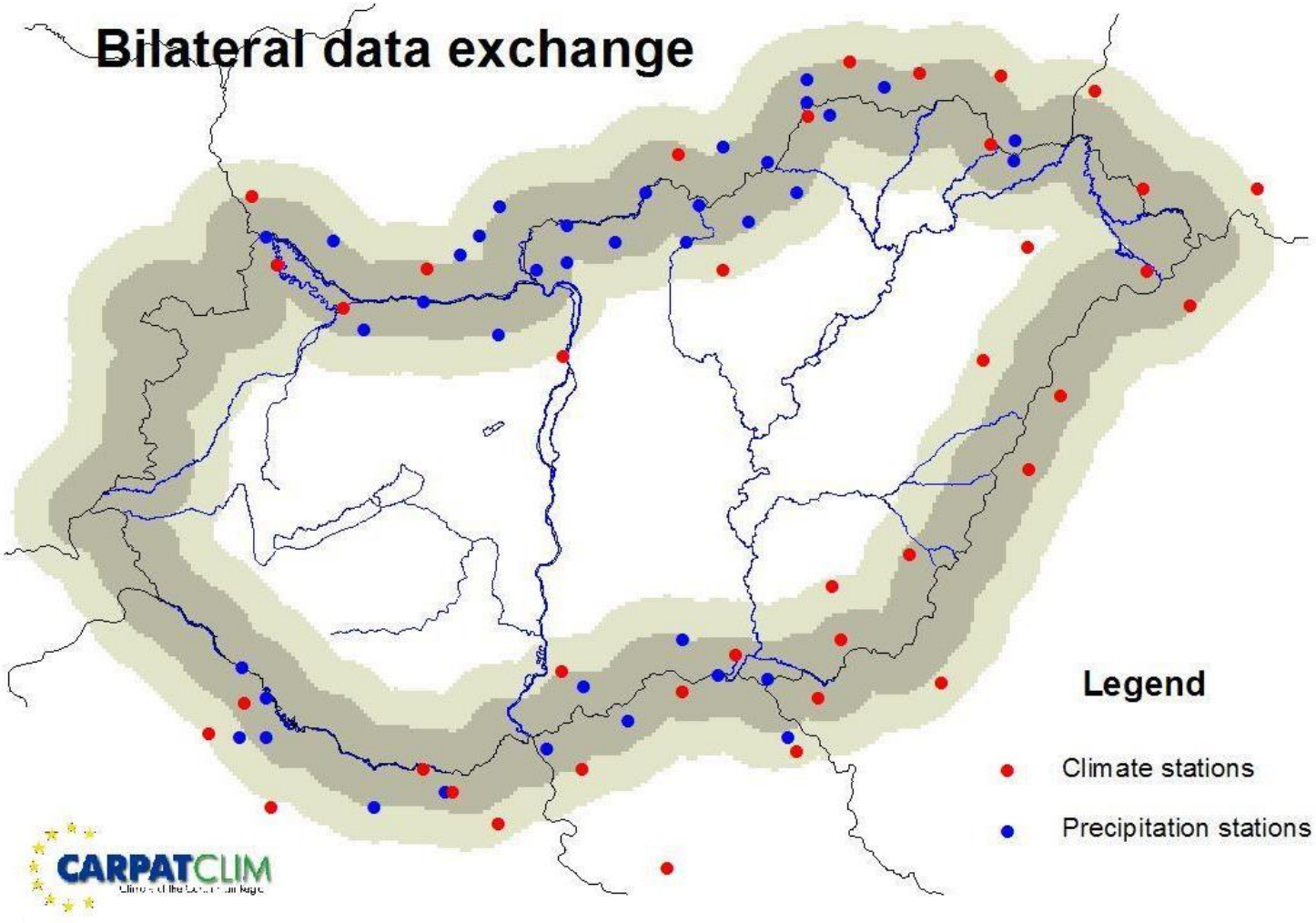
Module 2

- Gridding per country by MISH using the exchanged data
- Compilation of gridded series of the countries into one file

Harmonization: near border data exchange before and after homogenization



Example


Bilateral data exchange
Legend
Climate stations
Precipitation stations
CARPATCLIM

Main steps of homogenization process in CCR

1. Monthly series derivation from daily series.
2. MASH homogenization procedure for monthly series, estimation of monthly inhomogeneities. (Metadata can be used automatically.)
3. Smooth estimation of daily inhomogeneities on the basis of estimated monthly inhomogeneities.
4. Automatic correction of daily series.
5. Automatic quality control (QC) of homogenized daily data.
6. Automatic missing daily data completion.
7. Monthly series derivation from the homogenized, quality controlled, and completed daily data.
8. Test of homogeneity for the new monthly series with using the automatic verification results.

Deliverables

D1.6 - Report of data inventory of meteorological stations per month to be considered for the service, including the specification of existing data gaps and proposed methodologies to fill them, and of existing analogue datasets to be digitized

D1.10 - Final report on the documentation of the data rescue and digitization exercise, per country

D1.12 - Final report on quality control and data homogenization measures applied per country, including QC protocols and measures to determine the achieved increase in data quality

D1.15 - Implemented drafts version of metadata per country of meteorological stations selected for this project, including the length of record and observed parameters per station

D2.5 - Report with final results of the data harmonization procedures applied, including all protocols, per country

D2.8 - Final version of gridded datasets of all harmonized and spatially interpolated meteorological parameters per country

206 pages

D2.9 - Final report on the creation of national gridded datasets, per country

D2.10 - Final version of metadata per country of all national gridded datasets created within Module 2

D3.6 - Description of the final version of all gridded data sets of the climatology of the Carpathian Region

D3.7 - Final report on the production of the climatology of the Carpathian Region

D3.9 - Final version of interpretation sheets for all gridded datasets, publically downloadable with the datasets

D3.12 - Final and public version of the implemented web site with full functionality that hosts all relevant information on the Climate Atlas of the Carpathian Region, including a public download functionality within the web site for all gridded datasets of the climatology

D3.16 - Final version of the fully implemented and publically accessible metadata catalogue of the Carpathian Atlas, containing all metadata generated during all three modules of the project

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Validation

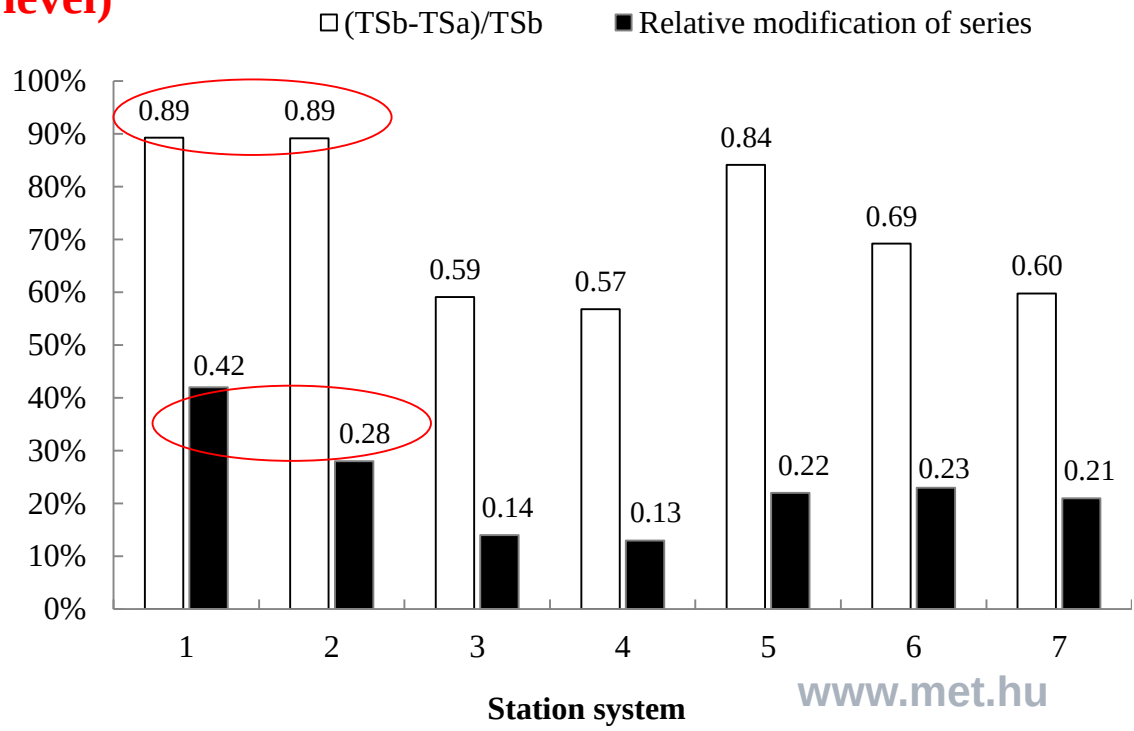
Average test statistics, QC results and verification results for minimum temperature

Station Sytem	1	2	3	4	5	6	7
Number of stations	68	39	140	53	59	38	18
TS after homog. (TSa)	24.3	52.5	52.5	51.9	28.5	43.5	37.8
TS before homog. (TSb)	227.5	484.7	128.3	120.3	179.7	141.3	93.9
Relative modification (%)	42	28	14	13	22	23	21
Total number of errors	4110	2161	6689	4111	3197	2592	375
Maximal positive error (°C)	23.7	11.8	95.1	79.3	14.9	15.9	0.7
Minimal negative error (°C)	–9.7	–8.0	–416.6	–417.6	–9.9	–10.0	–1.1

Critical value for TS is 20.86 (0.05 p level)

Hungary and Croatia (1), Serbia (2), Romania (3), Ukraine (4), Slovakia (5),

Poland (6), Czech Republic (7)



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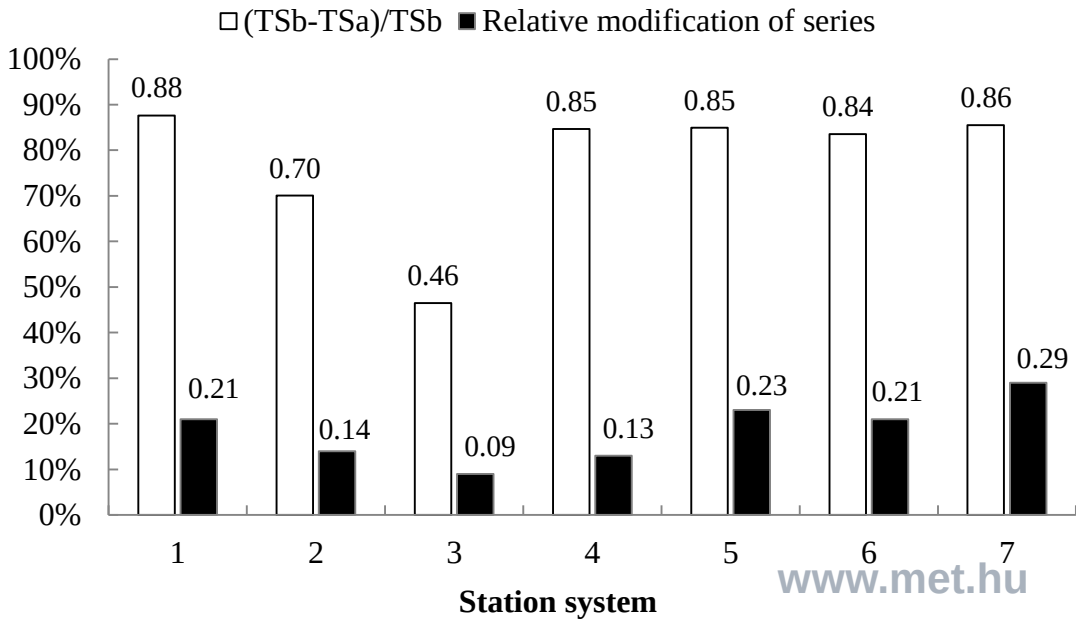
Average test statistics, QC results and verification results for maximum temperature

Maximum temperature							
No. of station system	1	2	3	4	5	6	7
Number of stations	68	39	140	53	59	38	18
Verification results of homogenization							
TS after homog. (TSa)	23.6	55.7	39.0	23.7	26.4	24.8	26.7
TS before homog. (TSb)	190.7	186.2	72.9	154.0	175.6	150.6	184.3
Relative modification (%)	21	14	9	13	23	21	29
Quality control results							
Total number of errors	6307	3811	10241	5444	4542	3288	1400
Maximal positive error (°C)	10.9	13.5	996.6	107.7	11.3	22.7	10.4
Minimal negative error (°C)	–2.3	–7.5	–21.0	–22.0	–14.5	–26.3	–6.2

Hungary and Croatia (1), Serbia (2), Romania (3), Ukraine (4), Slovakia (5),

Poland (6), Czech Republic (7)



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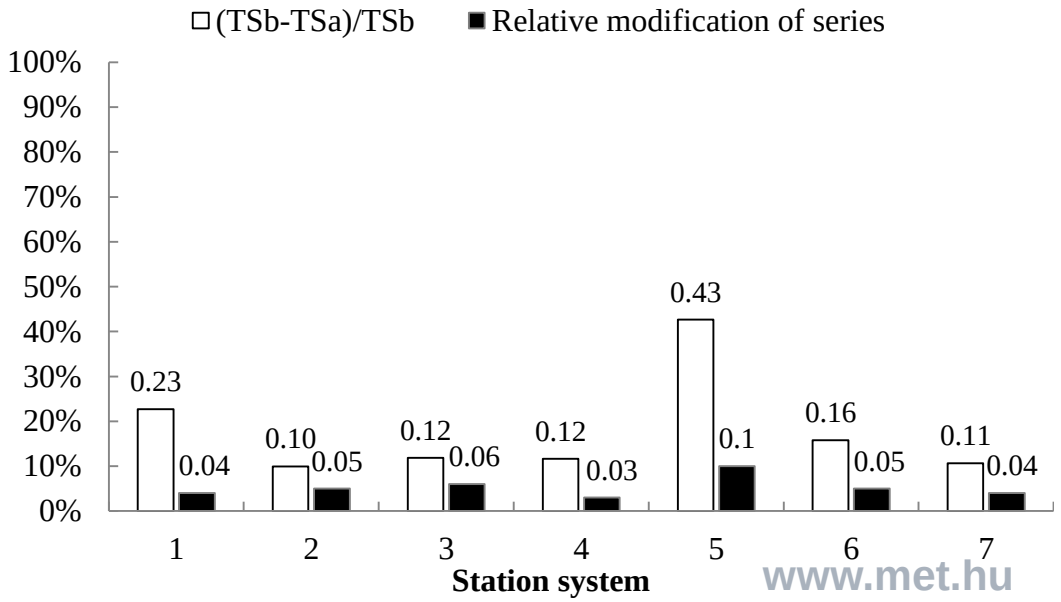
Average test statistics, QC results and verification results for precipitation

Station sytem	1	2	3	4	5	6	7
Number of stations	233	114	182	57	165	102	51
TS after homog. (TSa)	21.6	31.27	28.09	25.61	21.89	38.97	35.53
TS before homog. (TSb)	27.93	34.73	31.88	28.98	38.17	46.29	39.77
Relative modification (%)	4	5	6	3	10	5	4
Total number of errors	1531	672	975	313	803	408	223
Maximal positive error (mm)	71.94	230.27	10.27	179.46	94.29	93.36	60.38
Minimal negative error (mm)	23.24	–36.87	–1.52	–5.68	–59.46	–25.47	–11.41

Hungary and Croatia (1), Serbia (2), Romania (3), Ukraine (4), Slovakia (5),

Poland (6), Czech Republic (7)



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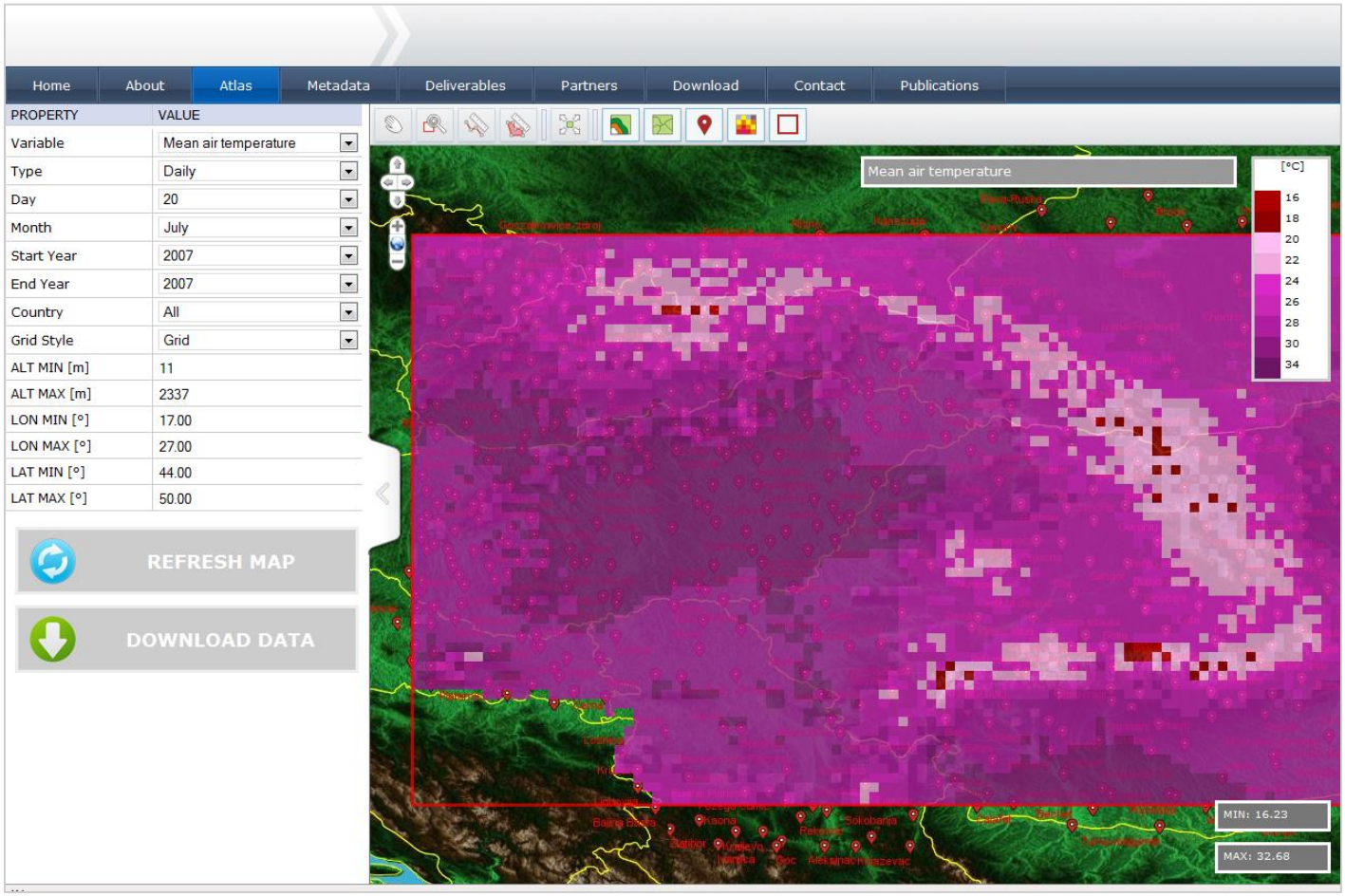
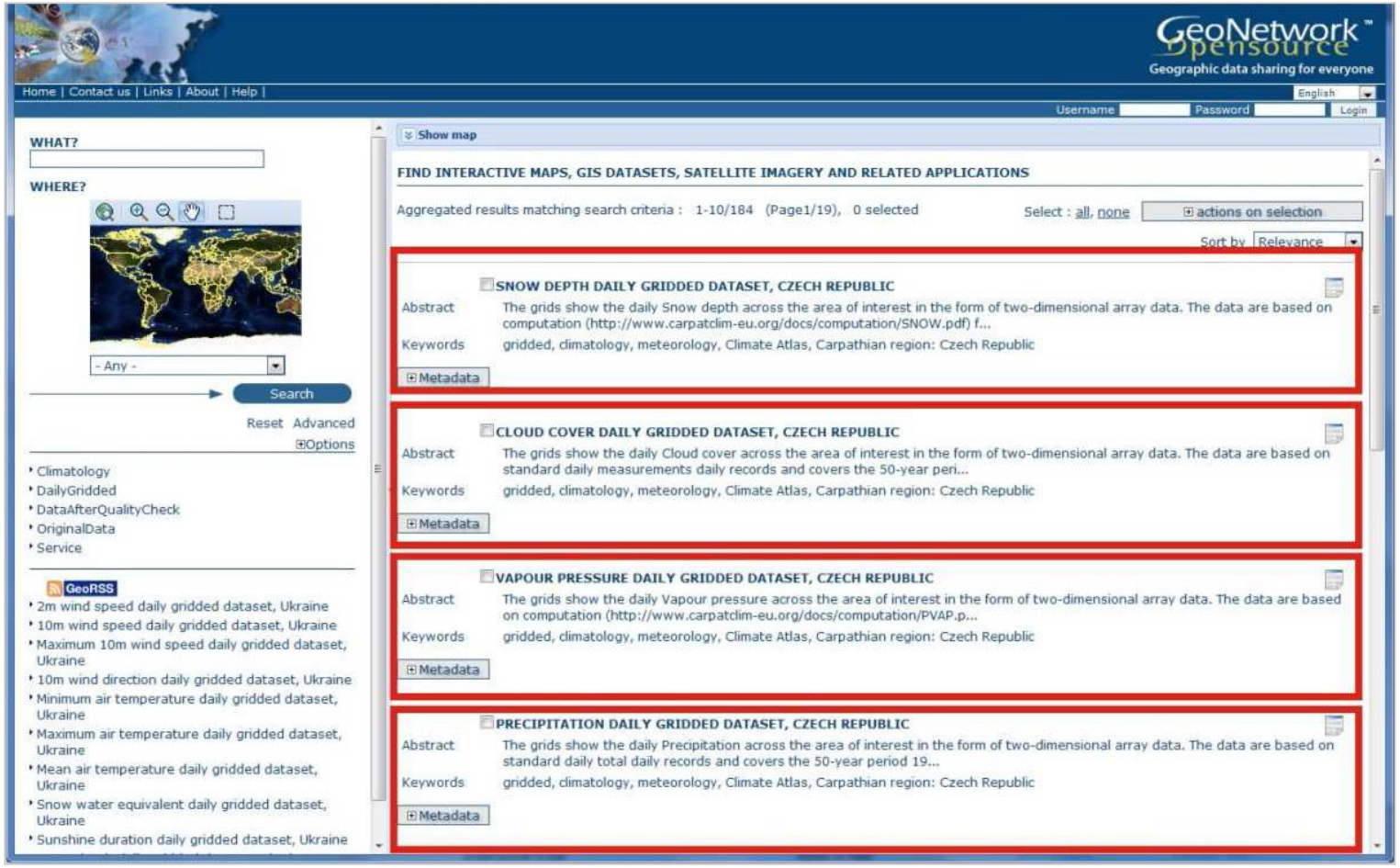
Maps on the Atlas web page: monthly/yearly

Module 3: Digital Climate Atlas on the web

Variable and time period based selection

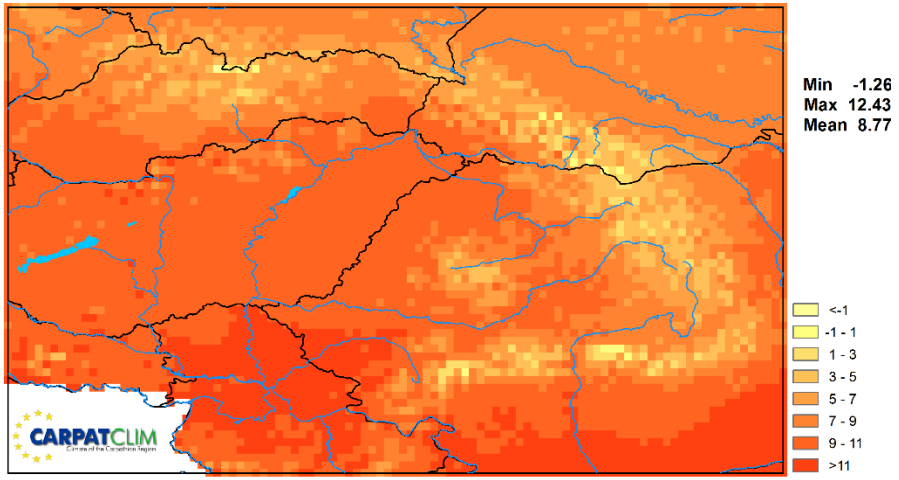


Searchable Metadata Catalog

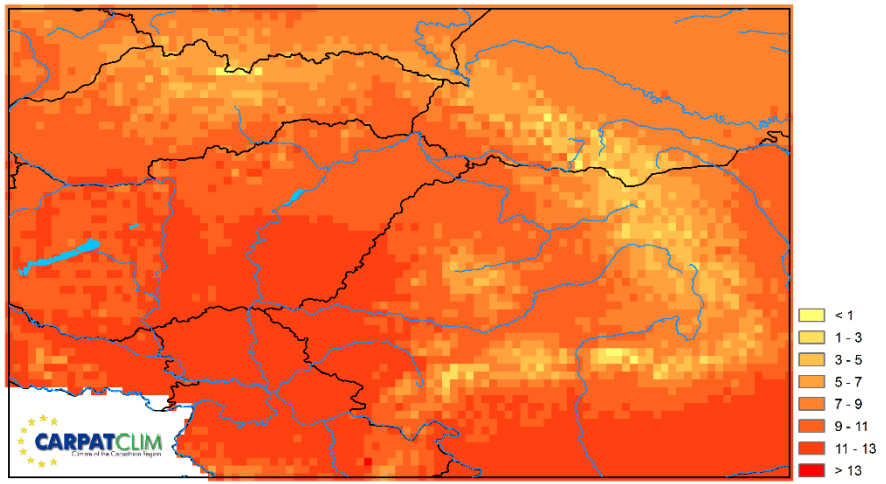


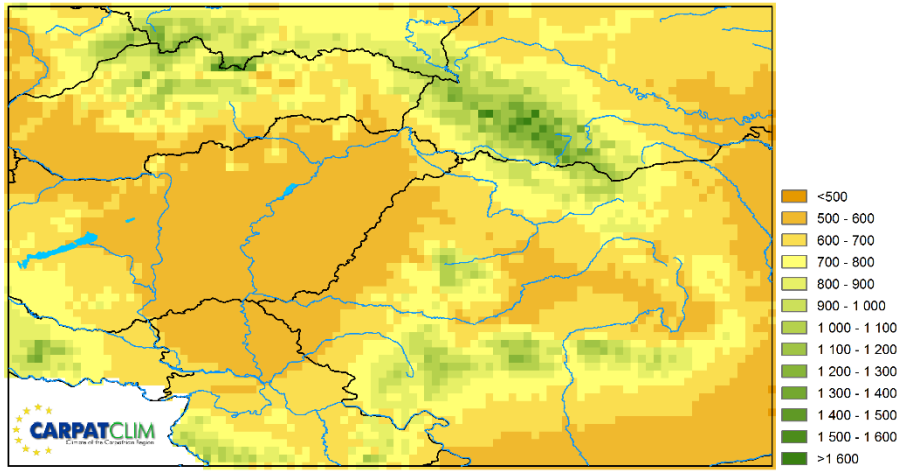
Normals

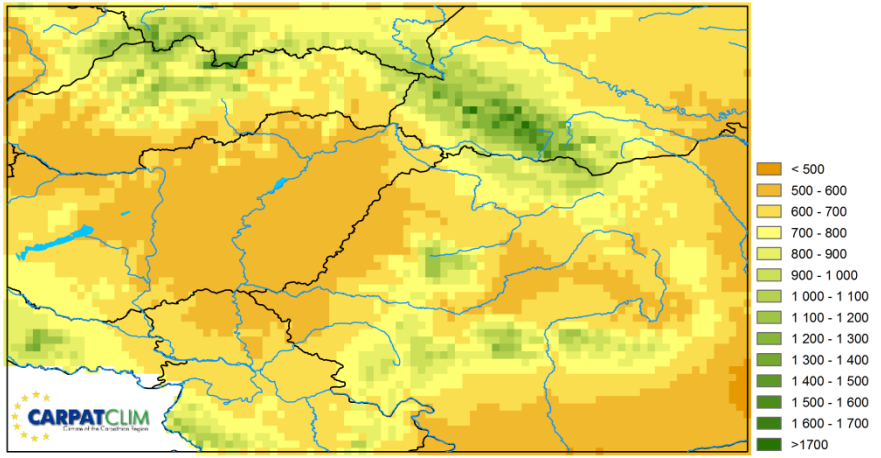
1961-90



1981-2010







Thank you for your attention!

Alapítva: 1870