

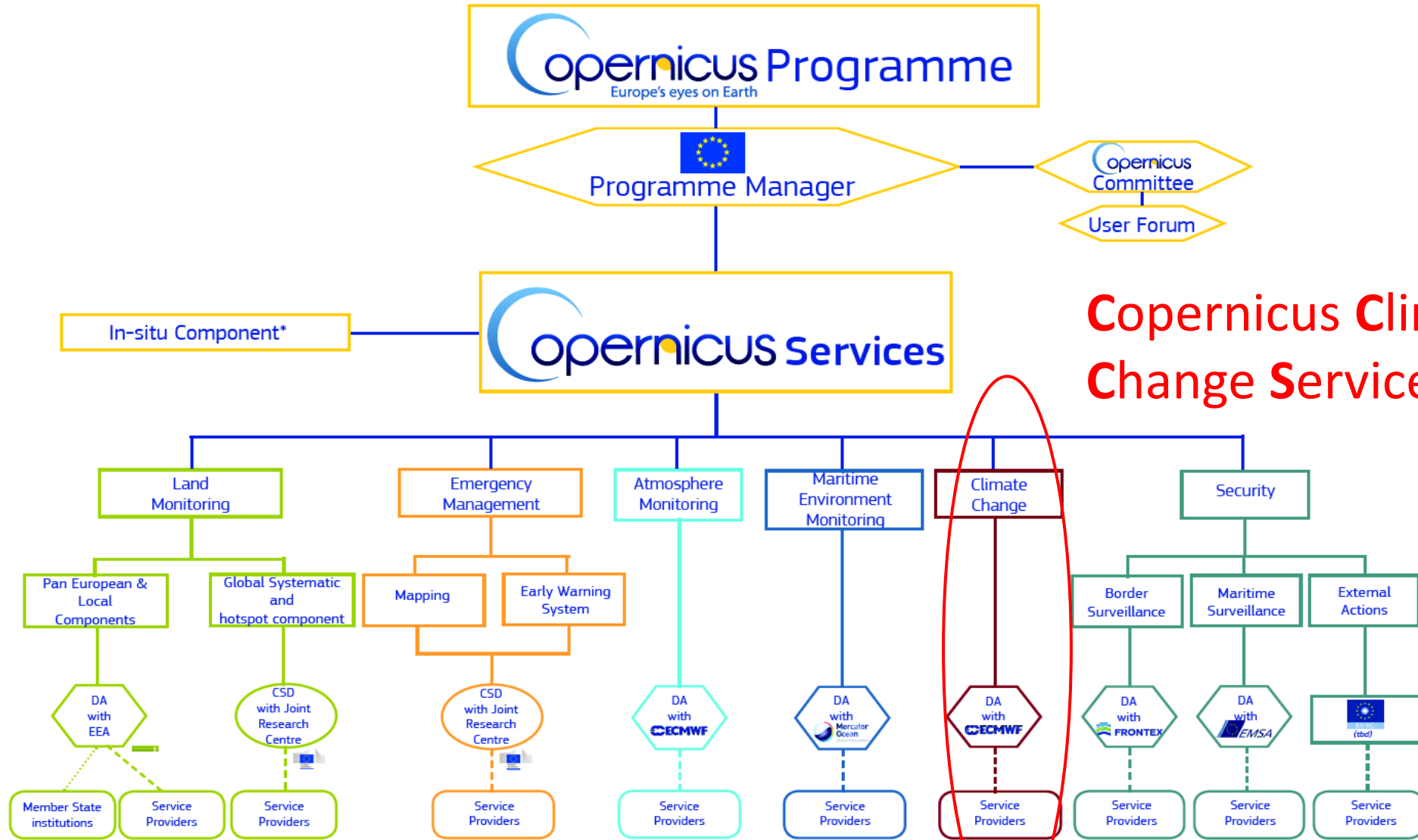
# FELSZÍNI MEGFIGYELÉSI ADATBÁZIS FEJLESZTÉSE A COPERNICUS PROGRAM ÉGHAJLATVÁLOZÁSI SZOLGÁLTATÁSAINAK TÁMOGATÁSÁRA

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Lilla<sup>1</sup>, Kircsi Andrea<sup>1</sup>

*<sup>1</sup>OMSZ, Éghajlati Osztály, <sup>2</sup>Varimax Bt.*

44. Meteorológiai Tudományos Napok, MTA, Budapest, 2018. november 22-23.





# Copernicus Climate Change Services: C3S

Legend:

- Implementation mode still to be defined
- Commercial contracts
- Grants
- Copernicus component
- Service Providers
- Mode of Implementation (direct/indirect)
- Indirect Management
- Direct Management
- \* Co-financing by EEA
- EA - European Agency
- OS - Open Sky-Access
- ISA - In-situ Access Agency
- EU-METEAT - European Organisation for the Exploitation of Meteorological Satellites
- EEA - European Environment Agency
- ESG - European Union Satellite Centre
- FRONTEX - The European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union
- EMSEA - The European Centre for Medium-Range Weather Forecasts



## Climate Data Store

- Alapvető éghajlati paraméterek
- **Mérések, reanalízisek, modellszimulációk**
- **Származtatott klímaindikátorok**
- Eszközök az alkalmazkodáshoz és a mérsékléshez globálisan és Európában

## Szektoriális információk



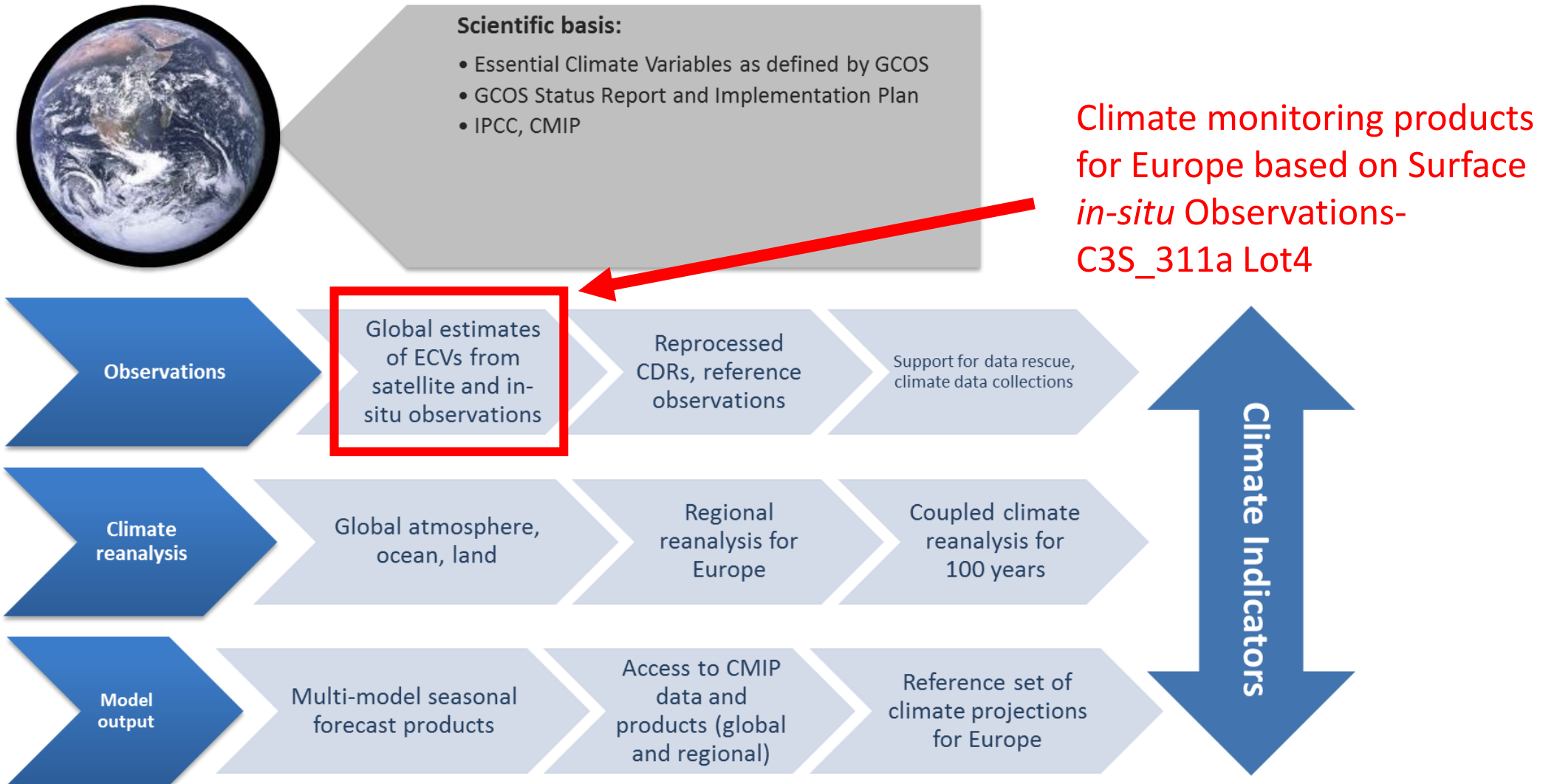
## Kiértékelés és minőségellenőrzés

-  Monitors quality of C3S products and services
-  Ensures C3S delivers state-of-the-art climate information to end-users
- **Identifies gaps in service provision**
- Bridges Copernicus with the research agenda in Europe (e.g. H2020, national research projects)

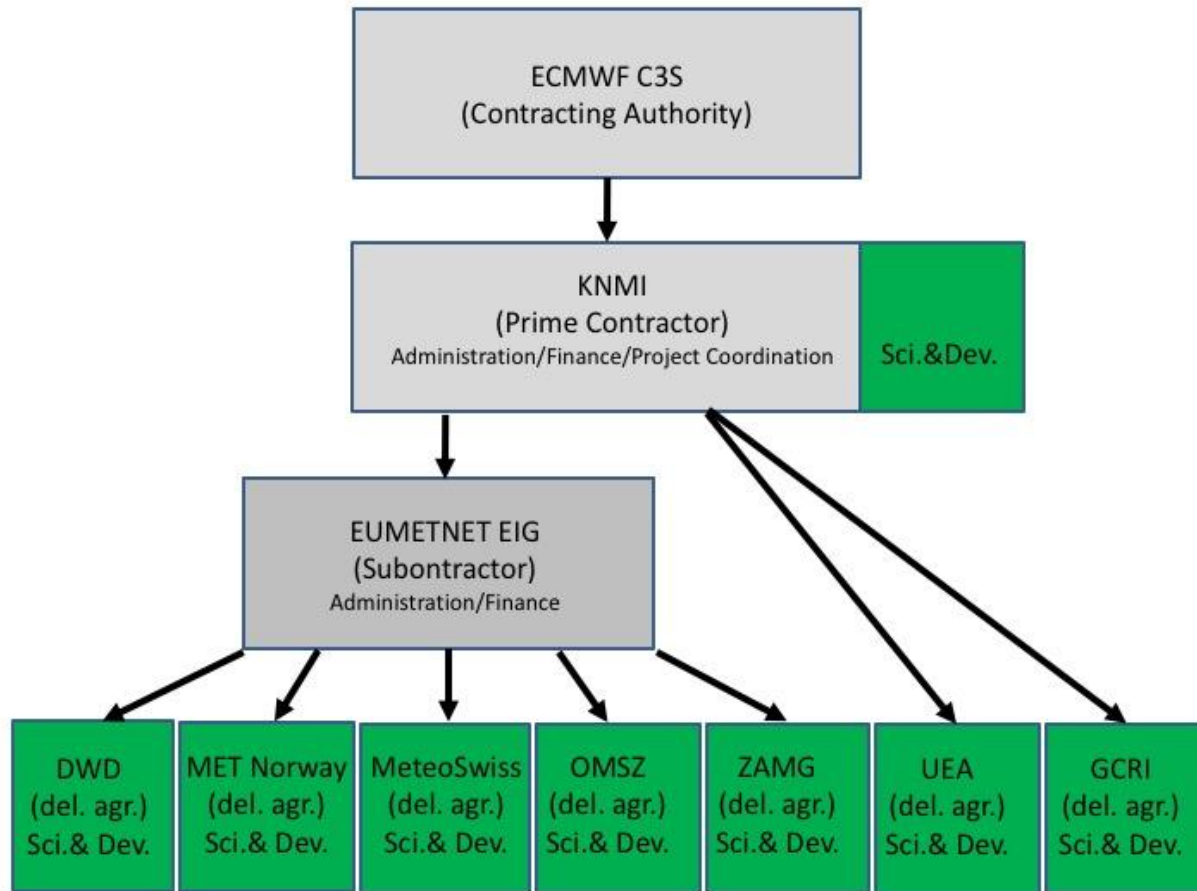
## Terjesztés

- **Web content**
- **Public outreach**
- Coordination with national outreach
- Liaison with public authorities
- Conferences, seminars
- Training and education

# CDS: Adatok fajtái



# Climate monitoring products for Europe based on Surface *in-situ* Observations: COPERNICUS PROJECT - C3S\_311a Lot4, 2017-2020



Acronym	Name	Country	Relevant expertise
<b>KNMI*</b>	Royal Netherlands Meteorological Institute	NL	Climate observations & monitoring, Climate Indices, Climate analysis & User interactions, Data access and Visualization.
<b>EUMETNET</b>	EIG EUMETNET	INT/BE	European Meteorological Services collaborating in the field of Observations, Numerical Weather Prediction, Climate.
<b>DWD*</b>	Deutscher Wetterdienst	D	Climate Monitoring
<b>METEOSWISS*</b>	Eidgenössisches Departement des Innern - MeteoSwiss	CH	Spatial analyses, Gridding, Homogenization, Dataset evaluation, Statistical Climatology, Climate of the Alps.
<b>MET Norway*</b>	Meteorological service of Norway	N	Spatial analyses, Statistical Climatology, Climate of the Nordic Countries.
<b>OMSZ*</b>	Hungarian Meteorological Service	HU	Gridding, Homogenization, QC procedures, Climate of the Carpathian region.
<b>GCRI</b>	Global Change Research Institute of the Czech Academy of Sciences	CZ	Observation databases, Homogenization and QC software.
<b>UEA</b>	University of East Anglia, Climatic Research Unit	UK	Collecting and Gridding of climate observations, Climate Indices, Climate analysis.
<b>ZAMG*</b>	Austrian weather and geophysics service	AT	Development of gridded Climatological datasets Climate of the Alps.

# C3S\_311a Lot4 munkacsomagok

## WP 0 Management

## WP 1 – Collection, QC and homogenization of station data

T1.1 (station data specification)

T1.2 (QC, blending, and homogenization of station data)

T1.3 (Implement, execute and monitor an operational data collection procedure)

## WP 2 – Production of gridded ECVs

T2.1 (Gridding and uncertainty estimation)

T2.2 (Production of pan-European gridded datasets)

T2.3 (Production of regional gridded datasets)

## WP 3 – Production of Climate Indices

T3.1 (Extension of the set of climate indices)

T3.2 (Production of indices)

## WP 4 - Product dissemination and user guidance

T4.1 (Providing access to C3S\_311a Lot4 products)

T4.2 (Product comparisons)

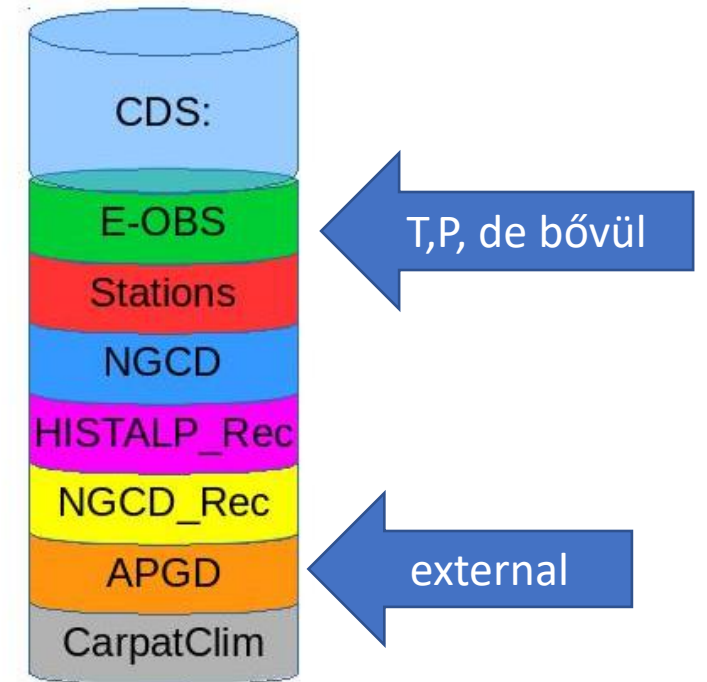
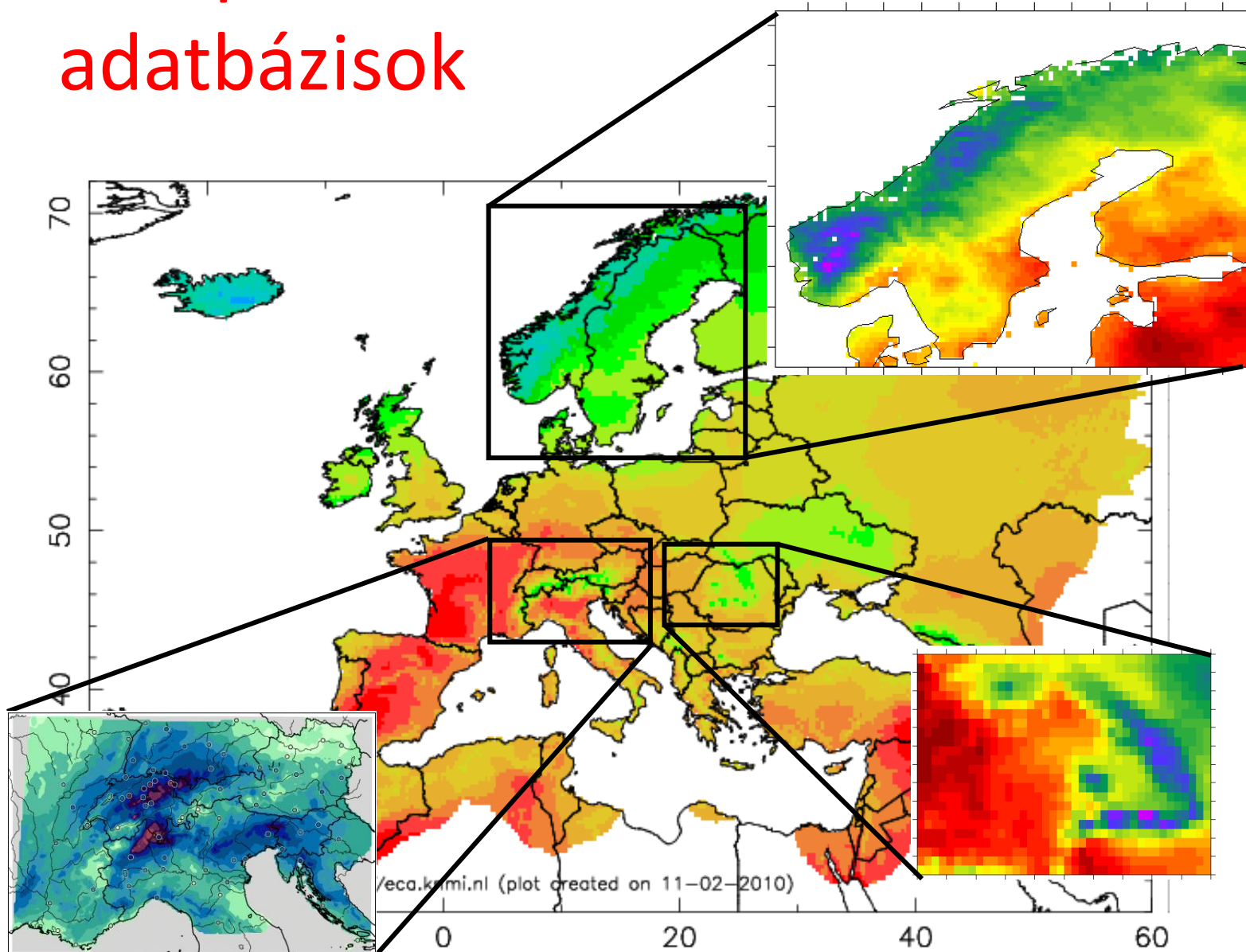
T4.3 (User guidance, technical user support and helpdesk)

T4.4 (Monthly and annual ‘State of the Climate in Europe’ summary reports)

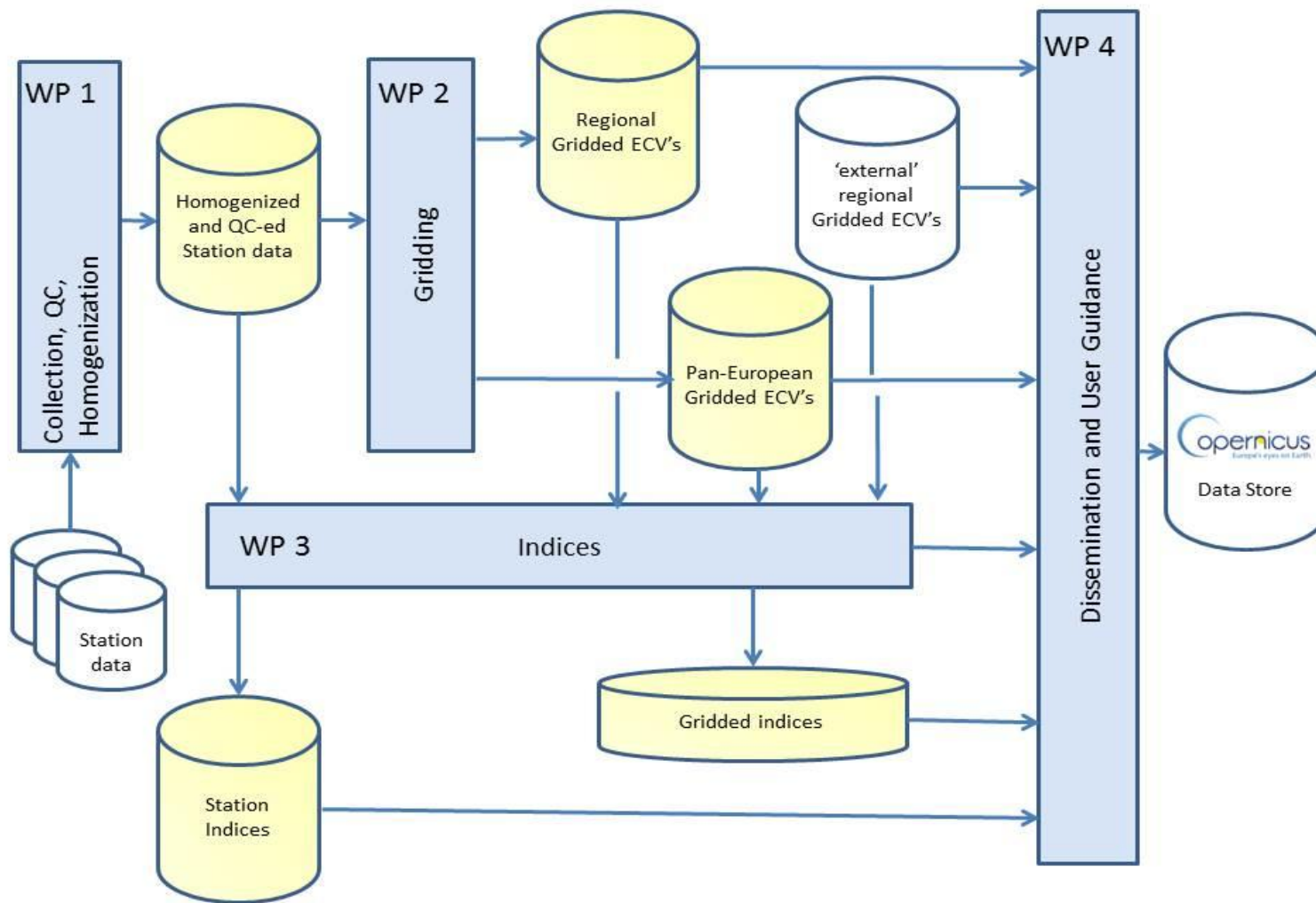
		6	12	18	24	30	36	42	48
WP 1	Data collection, QC, and homogenization								
WP1.1	Station data requirements	D1.1.1, D1.1.2	D1.1.3	D1.1.4					
WP1.2	QC, blending & homogenization	D1.2.1	D1.2.2, D1.2.3	D1.2.4					
WP1.3	data collection procedure	D1.3.1, D1.3.2, D1.3.3	D1.3.4	D1.3.5	D1.3.6				1 and 6 month updates of D1.3.2 and 1.3.3 respectively
WP 2	Production of gridded ECV's								
WP2.1	Gridding and uncertainties	D2.1.1	D2.1.2, D2.1.3	D2.1.4, D2.1.5	D2.1.6		D2.1.7, D2.1.10	D2.1.8, D2.1.9	
WP2.2	European grids	D2.2.1	D2.2.2	D2.2.3, D2.2.4	D2.2.5, D2.2.6		D2.2.7, D2.2.8	D2.2.9, D2.2.10	
WP2.3	Regional grids		D2.3.1, D2.3.2	D2.3.3	D2.3.4	D2.3.5, D2.3.6, D2.3.7	D2.3.8	D2.3.9, D2.3.10	D2.3.11
WP 3	Production of Climate Indices								
WP3.1	Indices development		D3.1.1	D3.1.2	D3.1.3	D3.1.4, D3.1.5	D3.1.6, D3.1.7		D3.1.8, D3.1.9, D3.1.10
WP3.2	Production of Indices		D3.2.1	D3.2.2, D3.2.3	D3.2.4	D3.2.5			D3.2.6, D3.2.7, D3.2.8, D3.2.9, D3.2.10, D3.2.11
WP 4	Product dissemination and User Guidance								
WP4.1	Providing access to C3Surf products	D4.1.3, D4.1.1	D4.1.4, D4.1.2, D4.1.13	D4.1.5	D4.1.10	D4.1.6		D4.1.7, D4.1.8	
WP4.2	Product comparison					D4.3.1		D4.3.2	
WP4.3	User guidance, support & helpdesk	D4.4.1	D4.4.2	D4.4.3, D4.4.4					updates of D4.4.2 and D4.4.4
WP4.4	State of the climate				D4.5.1, D4.5.2	D4.5.3, D4.5.4			updates of D4.5.2 and D4.5.4



# Rácspon- ti adatbázisok



# Adatáramlás a munkacsoportok között

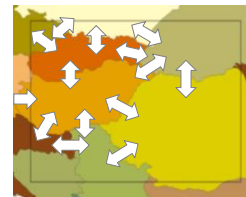




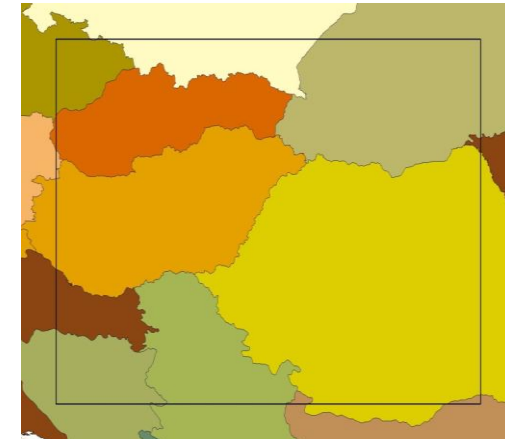
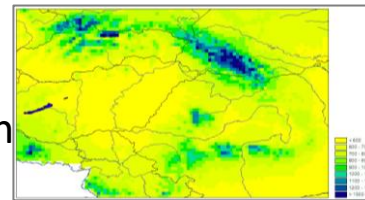
# CarpatClim

- JRC support, duration 2010-2013
- Commonly used methods: MASH-MISH
- Consortium leader: OMSZ, 9 countries
- Results: 13 basic meteorological variables, and 37 climate indicators, daily, 0.1 degree resolution, 1961-2010, publically available

- **MASHv3.03**: bilateral data exchange before and after homogenization guaranteed the harmonization



- **MISHv1.03**: the gridded daily time series were generated automatically in one step for the 50 years long period.

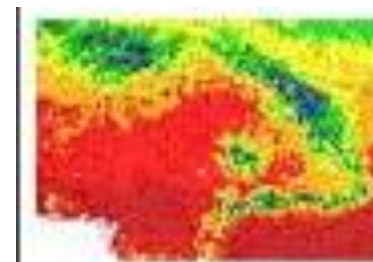


Variable	Description	units
Ta	2 m mean daily air temperature	°C
Tmin	Minimum air temperature	°C
Tmax	Maximum air temperature	°C
p	Accumulated total precipitation	mm
DD	10 m wind direction, Degrees	0-360
VV	10 m horizontal wind speed	m/s
Sunshine	Sunshine duration	hours
cc	Cloud cover	tenths
Rglobal	Global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

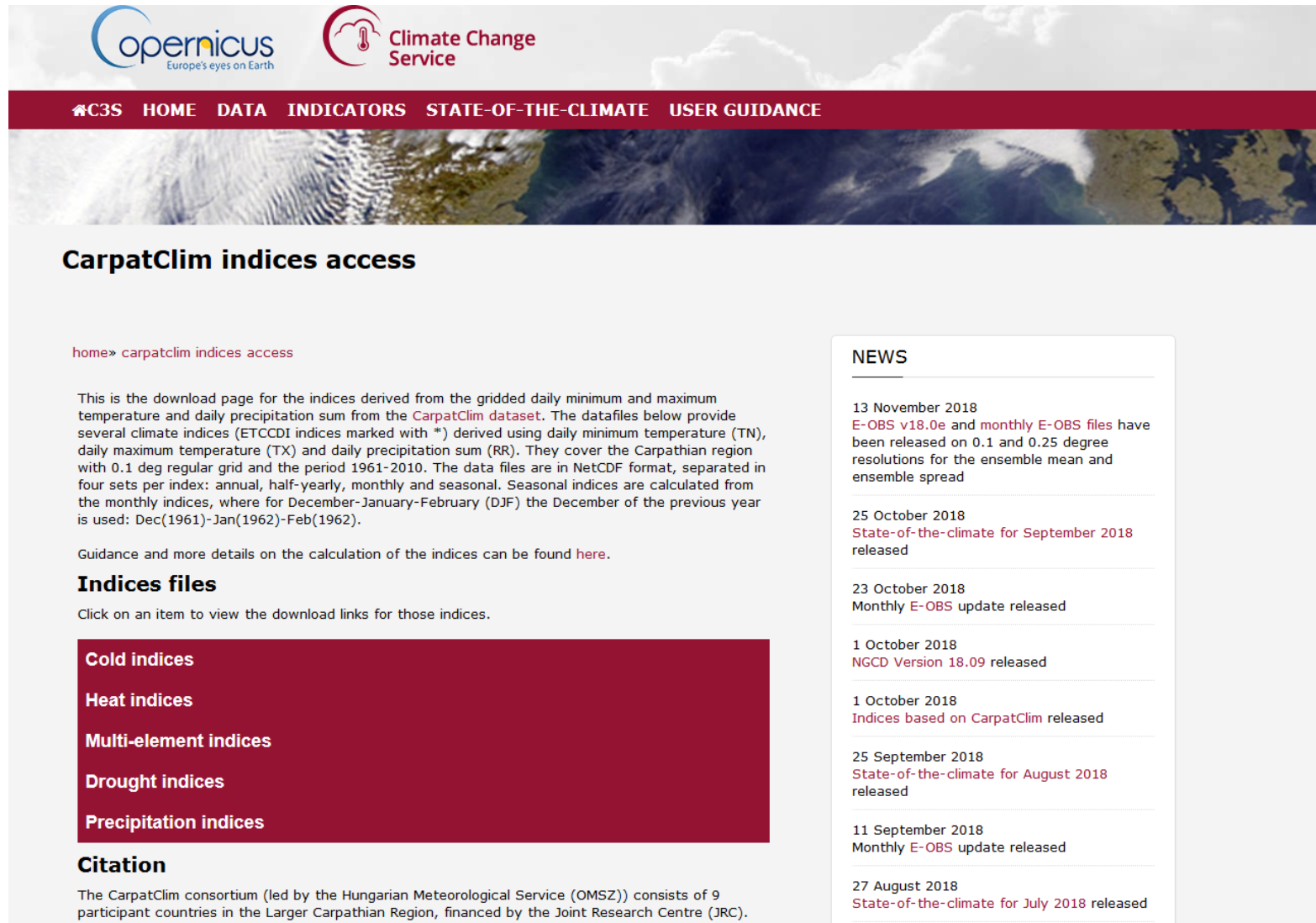
[www.carpatclim-eu.org/](http://www.carpatclim-eu.org/)

# OMSZ feladatok a C3S\_311a Lot4 projektben

WP1.2	QC, blending, and homogenization of station data
WP2.1	Budapest Gridding Workshop report
Wp3.2.2	ETCCDI indices based on CarpatClim
Wp3.2.8	Additional indices (scPDSI, PET, UTCI)
WP4.1.6	Access to regional datasets
Wp4.2	Product comparisons
Wp4.3	User guidance



# WP3.2.2 ETCCDI indices based on CarpatClim



The screenshot shows the Copernicus Climate Change Service website. At the top, there are logos for Copernicus (Europe's eyes on Earth) and the Climate Change Service. Below the logos is a navigation bar with links: C3S, HOME, DATA, INDICATORS, STATE-OF-THE-CLIMATE, and USER GUIDANCE. The main content area is titled "CarpatClim indices access". It includes a breadcrumb trail "home » carpatclim indices access", a detailed description of the data files (ETCCDI indices derived from gridded daily minimum and maximum temperature and daily precipitation sum from the CarpatClim dataset), and a link for more details on the calculation of the indices. A sidebar on the right contains a "NEWS" section with several updates from 2018, including releases of E-OBS files, state-of-the-climate reports, and index releases. At the bottom, there is a "Citation" section mentioning the CarpatClim consortium.

**Copernicus**  
Europe's eyes on Earth

**Climate Change Service**

[C3S](#) [HOME](#) [DATA](#) [INDICATORS](#) [STATE-OF-THE-CLIMATE](#) [USER GUIDANCE](#)

## CarpatClim indices access

home » [carpatclim indices access](#)

This is the download page for the indices derived from the gridded daily minimum and maximum temperature and daily precipitation sum from the [CarpatClim dataset](#). The datafiles below provide several climate indices (ETCCDI indices marked with \*) derived using daily minimum temperature (TN), daily maximum temperature (TX) and daily precipitation sum (RR). They cover the Carpathian region with 0.1 deg regular grid and the period 1961-2010. The data files are in NetCDF format, separated in four sets per index: annual, half-yearly, monthly and seasonal. Seasonal indices are calculated from the monthly indices, where for December-January-February (DJF) the December of the previous year is used: Dec(1961)-Jan(1962)-Feb(1962).

Guidance and more details on the calculation of the indices can be found [here](#).

### Indices files

Click on an item to view the download links for those indices.

- [Cold indices](#)
- [Heat indices](#)
- [Multi-element indices](#)
- [Drought indices](#)
- [Precipitation indices](#)

### Citation

The CarpatClim consortium (led by the Hungarian Meteorological Service (OMSZ)) consists of 9 participant countries in the Larger Carpathian Region, financed by the Joint Research Centre (JRC).

### NEWS

- 13 November 2018  
[E-OBS v18.0e](#) and [monthly E-OBS files](#) have been released on 0.1 and 0.25 degree resolutions for the ensemble mean and ensemble spread
- 25 October 2018  
[State-of-the-climate for September 2018](#) released
- 23 October 2018  
[Monthly E-OBS update](#) released
- 1 October 2018  
[NGCD Version 18.09](#) released
- 1 October 2018  
[Indices based on CarpatClim](#) released
- 25 September 2018  
[State-of-the-climate for August 2018](#) released
- 11 September 2018  
[Monthly E-OBS update](#) released
- 27 August 2018  
[State-of-the-climate for July 2018](#) released

[http://surfobs.climate.copernicus.eu/dataaccess/access\\_carpatclim\\_indices.php](http://surfobs.climate.copernicus.eu/dataaccess/access_carpatclim_indices.php)

# WP4.1.6 Access to regional datasets

**Copernicus** Europe's eyes on Earth

**Climate Change Service**

[C3S](#) [HOME](#) [DATA](#) [INDICATORS](#) [STATE-OF-THE-CLIMATE](#) [USER GUIDANCE](#)

## CarpatClim data access

home» [carpatclim data access](#)

The CarpatClim dataset covers approximately 500 000 km<sup>2</sup> in Europe in daily resolution. It is a homogenized (MASH, Szentimrey), harmonized and gridded (MISH, Szentimrey and Bihari) dataset, including several ECVs of which temperature and precipitation are available from this page. More detailed information can be found on the [webpage of the CarpatClim project](#). For questions regarding CarpatClim, please contact us at [carpatclim@met.hu](mailto:carpatclim@met.hu)

### Actual version and update policy

CarpatClim is an existing and static dataset, developed outside Copernicus (see below).

Release date	Period covered
2013	1961-01-01 - 2010-12-31

### CarpatClim datafiles 1961-01-01 - 2010-12-31

The datafiles below contain gridded data for 4 elements (daily mean temperature **T2M**, daily minimum temperature **T2MIN**, daily maximum temperature **T2MAX** and daily precipitation sum **PRE**). They cover the Larger Carpathian Region. The data files below are in gzipped NetCDF format.

Version 1.0	1961 - 1990	1991 - 2010	Elevation
0.1 deg. regular grid	T2M T2MIN T2MAX PRE	T2M T2MIN T2MAX PRE	all elements

### Citation

The CarpatClim consortium (led by the Hungarian Meteorological Service (OMSZ)) consists of 9 participant countries in the Larger Carpathian Region, financed by the Joint Research Centre (JRC).

Reports, articles, papers, scientific and non-scientific works of any form, including tables, maps, or any other kind of output, inprinted or electronic form, based in whole or in part on the data supplied,

### NEWS

- 13 November 2018  
[E-OBS v18.0e](#) and [monthly E-OBS files](#) have been released on 0.1 and 0.25 degree resolutions for the ensemble mean and ensemble spread
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[http://surfobs.climate.copernicus.eu/dataaccess/access\\_carpatclim.php](http://surfobs.climate.copernicus.eu/dataaccess/access_carpatclim.php)


# Wp4.2 Product comparisons

- (mainly a visual comparison **between the plots of E-Obs and the high-resolution dataset**):
- ⇒ Case study for intense events/special weather phenomena (precipitation: heavy precipitation events, temperature: inversions)
- ⇒ Mean climate (mean annual precipitation, mean annual temperature)
- ⇒ Yearly cycle (mean monthly precipitation sums, mean monthly temperature)
- ⇒ Daily statistics (wet-day frequency, monthly maximum/minimum value of daily mean temperature)
- ⇒ Extremes (95% and 99% quantile)
- ⇒ Frequency distribution function
- ⇒ Scores (MSESS, RMSE for temperature, SEEPS for precipitation - less sensitivity to outliers)
- ⇒ Long-term variations (trends) → Only for long-term consistent products. See additional comment below.
- ⇒ Interannual variations → standard deviation of yearly/monthly means and daily index (daily means, wet-day frequency, monthly maximum/minimum value of daily mean temperature, yearly 75% quantile)
- Trends and interannual variations are analysed for spatial means. We think of mean values over a country and for subregions (defined by “similar” climatology).
- ⇒ Uncertainty characterization (Rank-Histogram, error-spread score  
(?): [https://www2.physics.ox.ac.uk/sites/default/files/2011-07-05/cmp2014\\_qjrmets\\_pdf\\_13675.pdf](https://www2.physics.ox.ac.uk/sites/default/files/2011-07-05/cmp2014_qjrmets_pdf_13675.pdf))
- Of course, the sub regions may have some specific analyses regarding peculiarities existing there (coasts, topography,...) and specific strengths of datasets.
- Some participants may have experiences with an analysis technique. In this context, a first input from the **Hungarian Meteorological Service is the use of ANOVA.**

# ANOVA

## Partitioning of Total Variance (Theorem)

$$\hat{D}^2 = \frac{1}{N} \sum_{j=1}^N (\hat{E}(\mathbf{s}_j) - \hat{E})^2 + \frac{1}{N} \sum_{j=1}^N \hat{D}^2(\mathbf{s}_j) = \frac{1}{n} \sum_{t=1}^n (\hat{E}(t) - \hat{E})^2 + \frac{1}{n} \sum_{t=1}^n \hat{D}^2(t)$$



Időbeli átlag térbeli szórása	Időbeli szórás térbeli átlaga	Térbeli átlag időbeli szórása	Térbeli szórás időbeli átlaga
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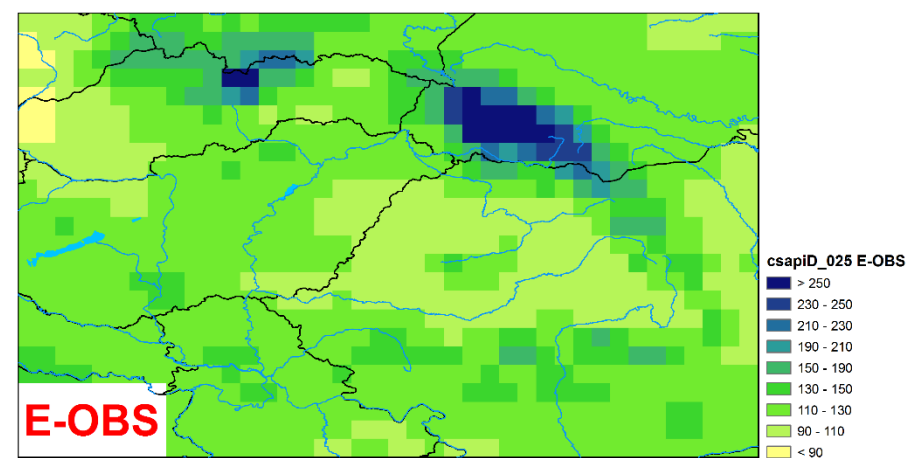
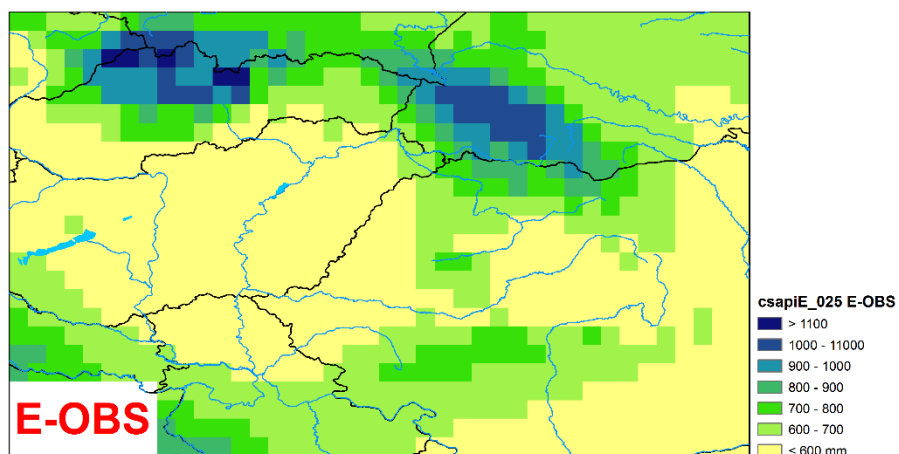
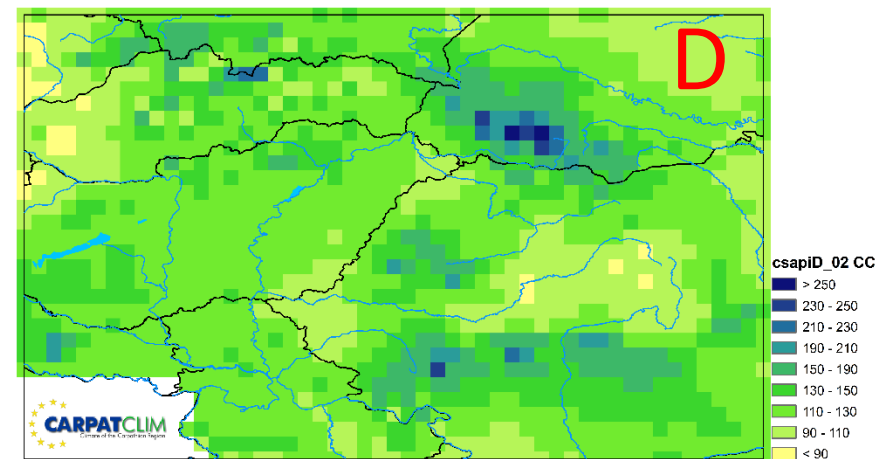
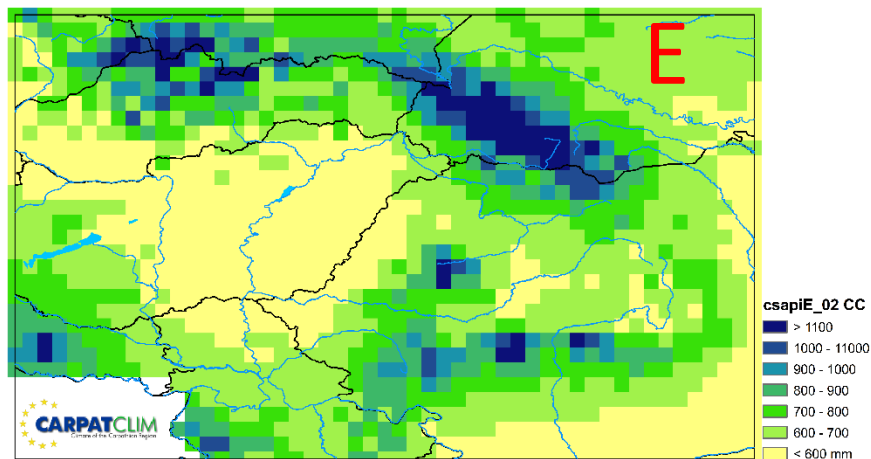
Lakatos, M., Szentimrey, T., Izsák, B., Hoffmann, L.: Comparison of E-OBS and CARPATCLIM gridded datasets of minimum temperatures, maximum temperatures and precipitation by Analysis of Variance (ANOVA)

*9th Seminar for Homogenization and Quality Control in Climatological Databases and 4th Conferences on Spatial Interpolation Techniques in Climatology and Meteorology, Budapest, 2017. április 3-7.*

[http://www.wmo.int/pages/prog/wcp/wcdmp/wcdmp\\_series/WCDMP\\_85.pdf](http://www.wmo.int/pages/prog/wcp/wcdmp/wcdmp_series/WCDMP_85.pdf)



# Csapadék 50 év



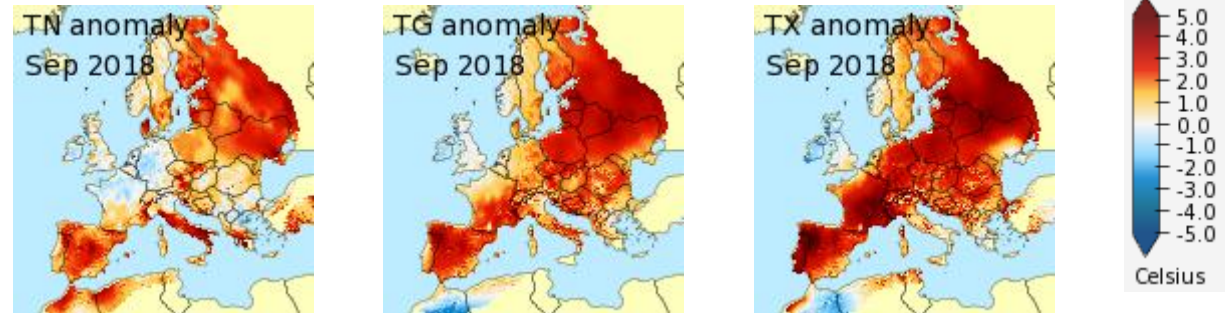
időbeli átlagok

Időbeli szórások

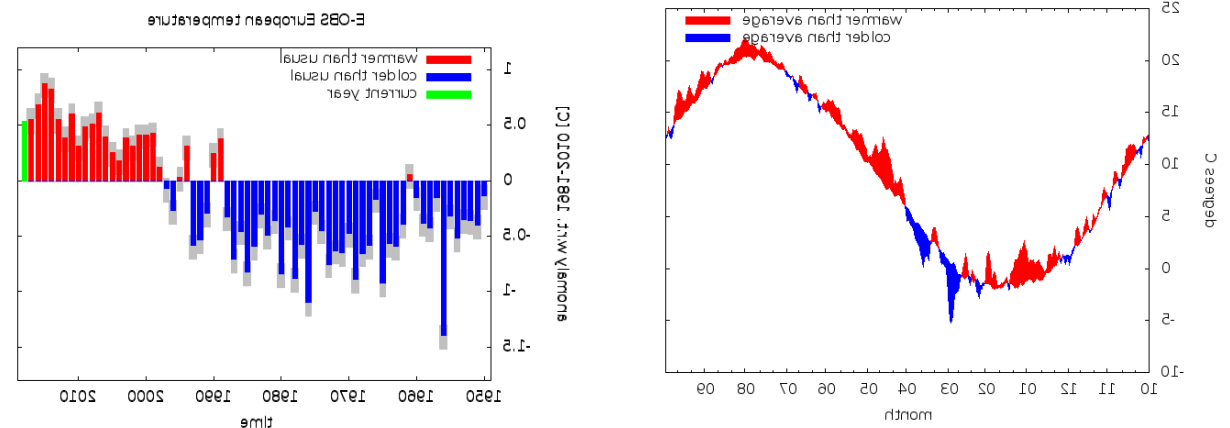
# Wp4.4 State-of-the-European-climate: September 2018

- Event in September 2018
- Specific climate indicators for September 2018
- Temperature deviations and extremes
- Evolution of the European land-surface temperature
- Precipitation
- Cloudiness and Radiation

## The weather in September 2018 Temperature deviations and extremes



September 2018 minimum (left), average (middle), and maximum (right) temperature differences from reference period 1981-2010 (E-OBS)



# Aktualitások

*13 November 2018*

- [E-OBS v18.0e](#) and [monthly E-OBS files](#) have been released on **0.1 and 0.25 degree** resolutions

*25 October 2018*

- [State-of-the-climate for September 2018](#) released

*23 October 2018*

- Monthly [E-OBS](#) update released

*1 October 2018*

- [NGCD Version 18.09](#) released

*1 October 2018*

- [Indices based on CarpatClim](#) released

# Hasznos linkek:

C3S <https://climate.copernicus.eu>

CDS <https://climate.copernicus.eu/climate-data-store>

Monitoring European climate using surface observations

<http://surfobs.climate.copernicus.eu/>



Köszönöm a figyelmet!