HUNGARIAN METEOROLOGICAL SERVICE

BUDAPEST WATER SUMMIT
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About Us: Hungarian Meteorological Service (OMSZ)

According to its more than 140-year old tradition, OMSZ fulfils duties such as collecting, processing and (in the last few decades) providing meteorological data and information. Besides running nationwide monitoring network, OMSZ provides radiosonde upper air measurements, operates meteorological radar system as well as lightning localization system, and guarantees the continuous collection, verification and assimilation of the above information, as well as the maintenance of the meteorological data base. Our institute analyses and calculates weather development by using its own numerical model, runs as well up to date forecast products issued from international weather forecast centres. By the exchange of its products, OMSZ contributes to the effective operation of the information channels coordinated by the WMO and the International Civil Aviation Organization. In order to fulfil the above listed duties on a high standard, OMSZ is engaged in research and development projects. Therefore it is capable for carrying out safeguarding activities such as catastrophe warning system, storm warning system at Lake Balaton and Lake Velence, and the prediction of chemical as well as nuclear pollution dispersion. In addition, OMSZ provides the authorities (under the terms of a special agreement) with meteorological information (civil aviation, hydrology, catastrophe protection). Moreover, our institute also provides commercial services.

Climate: Precipitation in Hungary

Average annual precipitation in Hungary based on the 1971–2000 period

The annual precipitation amount in Hungary is 500–750 mm, but there are remarkable differences between different regions.

The spatial distribution of the annual precipitation amount shows double effects. The effects of the altitude and the distance from the Mediterranean Sea are important, but the Atlantic Ocean also influences our climate. A hundred meters increase in altitude equals to about 35 mm extra in the annual amount, while the growing distance from the seas means a decrease. The wettest are the south western areas of the country and the mountains, where the amount could exceed 800 mm. On average, the low altitude valley of the River Tisza receives the least precipitation, the value does not reach 500 mm. In general, the annual sum decreases from SW to NE.

Annual precipitation in 2010

The yearly total precipitation in 2010 was the highest since 1901, the sum of countrywide amount set out 169 % of the long time average. Almost all monthly amounts were over the mean, only March and October were drier than the usual.

Annual precipitation in 2011

Immediately after the wettest 2010, 2011 was the driest year since 1901. The precipitation amount was just 72 % of the average amount of 1971–2000. The monthly precipitation was above the average only in two months (July and December), while other months were drier. November received the lowest amount of rain since 1901 with just 0.4 mm.

Monthly mean precipitation of Hungary, based on the 1971–2000 period

The most precipitation falls between May and July, while the least between January and March. Due to a stronger cyclone activity, there is a secondary maximum in most parts of the country during the autumn – this is particularly true for Southern Transdanubia.

Precipitation extremes in Hungary

Event	*Value*	*Station*	*Date*
Maximum annual precipitation:	1555 mm	Miskolc–Lillafüred–Jávorkút	2010
Minimum annual precipitation:	164 mm	Budapest Ferihegy	1961
Maximum monthly precipitation:	444 mm	Dobogókő	June 1958
Maximum 48-hour precipitation:	288 mm	Kékestető	11–12 June 1958
Maximum 24-hour precipitation:	260 mm	Dad	9 June 1953
Maximum 60-minute precipitation:	120 mm	Heves	23 August 1988
Maximum 10-minute precipitation:	64 mm	Zirc	24 May 1915
Maximum annual number of rainy days (>=0.1 mm):	216 days	Mesztegnyő	2010
Minimum annual number of rainy days (>=0.1 mm):	49 days	Balmazújváros	1983
Maximum of average annual precipitation:	807 mm	Kőszeg	1971–2000
Minimum of average annual precipitation:	450 mm	Békésszentandrás	1971–2000
Maximum of average annual number of rainy days (>=0.1 mm):	147 days	Kékestető	1971–2000
Minimum of average annual number of rainy days (>=0.1 mm):	88 days	Pincehely	1971–2000

Anomalies of the average annual precipitation sum in Hungary for the period 1901–2012

The long-term precipitation trend is showing a decreasing pattern, although the yearly total precipitation in 2010 (959 mm) was the greatest since 1901. Extremely dry conditions were experienced in recent years, in 2011 and in the first half year of 2012. The drought – lasting for almost two years – caused severe damage to agriculture; the total losses due to the drought in 2012 were estimated to be more than US$ 1.8 billion in Hungary.

Precipitation change in Hungary in the middle of the century (2021–2050)

Climate change has influence on hydrological cycle through changes in precipitation. This effect can have serious consequences like floods, droughts, or lack of drinking water. For adaptation it is essential to obtain detailed and quantified information about the changes and its uncertainty. At the Hungarian Meteorological Service two regional climate models (RCMs) are applied, ALADIN-Climate and REMO, to serve high-resolution (10–25 km) information about the climate change over the Carpathian Basin and provide a basis for simple quantification of the uncertainties.

Both models resulted clearly in a slight annual precipitation change, but in different seasonal distributions. In summer (~5 %) decrease and autumn (3–14 %) increase are projected, but there is great uncertainty about spring and winter.

More simulations could provide a hint about the probable change and quantitative information about simulation uncertainties. According to 17 projections of the international ENSEMBLES project, the probabilities of precipitation increase in spring and winter exceed 50 and 80 %, respectively. Regarding precipitation not only its amount but also its intensity, frequency and the duration of its absence are important. Based on the results of two adapted RCMs, the growing precipitation intensity and longer dry periods (days when precipitation amount is less than 1 mm) are concluded. It is noted that the changes at the end of the century are more robust.

Weather forecast

Precipitation forecast at the Hungarian Meteorological Service for the river basins of Danube and Tisza

Since 1978 precipitation forecast have been produced by the Hungarian Meteorological Service on a daily basis. The forecast area is the river basins of Danube and Tisza. Short term forecast is based on ALADIN and AROME numerical weather prediction models run on the supercomputer of Hungarian Meteorological Service, furthermore on ECMWF model. The medium range forecast (>2days) is prepared mainly from ECMWF deterministic model and EPS (probabilistic) forecast.

Extreme flood on Danube in the summer of 2013

Between 30 May and 3 June 2013 in the Bavarian and Austrian basins of Danube heavy rainfall occurred resulting in severe floods all along the river. Record high water levels were observed along the Hungarian part of the Danube. In Budapest the flood peaked at 891 cm at night on 9 June 2013. The weather situation causing the extreme flood was forecast accurately by ECMWF model. A warm conveyor belt was built up which transported warm and wet air masses toward higher latitudes. These airflows, which arrived perpendicularly to the Alps, were forced to lift upward by the mountain range. As a result, 200–300 mm precipitation / 3 days was observed. This weather situation with unusual precipitation amount could be foreseen 5 days in advance by ECMWF model. This was confirmed by Extreme Forecast Index (EFI). EFI is a dimensionless number between –1 and 1. The closer the index lies to 1, the bigger the deviation from the ECMWF model climate is, i. e. the expected weather is rather extreme.

Zsófia cyclone, 15–18 May 2010

The most severe rainfalls in Hungary can be connected to the so-called Mediterranean cyclones. These cyclones transport warm and wet air from the Mediterranean region to Hungary. This happened on 15 May 2010, when Zsófia cyclone arrived to Hungary. The cyclone centre was located over the country for 3 days until 18 May 2010 resulting in severe rainfalls all around the country. The forecast precipitation pattern in ECMWF model correlated well with the observed precipitation over 72 hours. The extreme rainfall broke records in precipitation amounts. The accumulated precipitation amount between 15 May and 18 May exceeded 200 mm, while the monthly average precipitation in May was around 62 mm, so in certain places the registered precipitation over 72 hours was twice or three times more than the monthly average.

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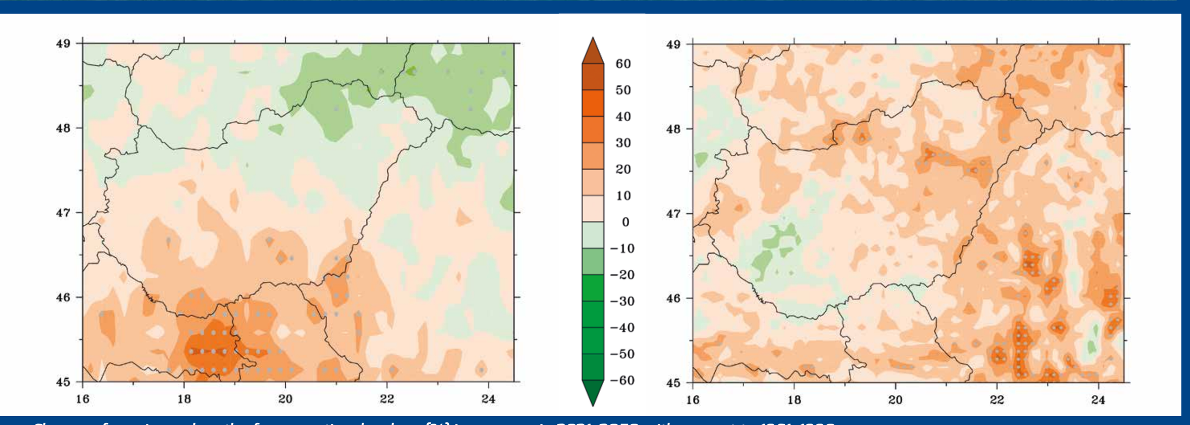
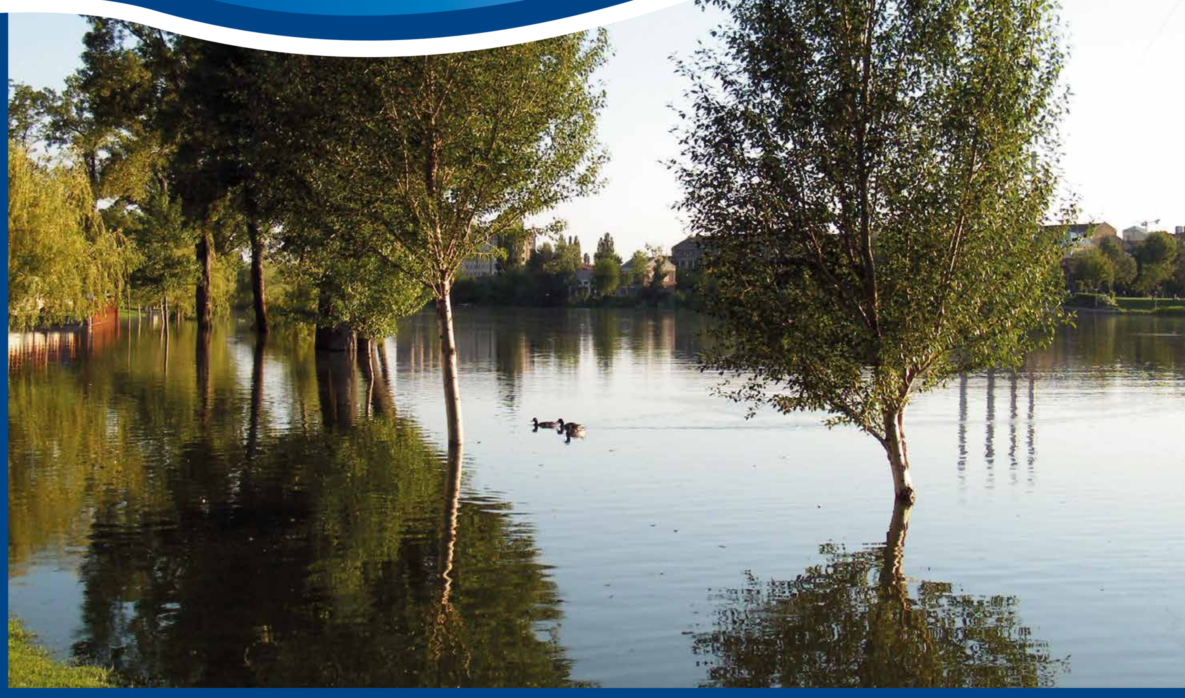
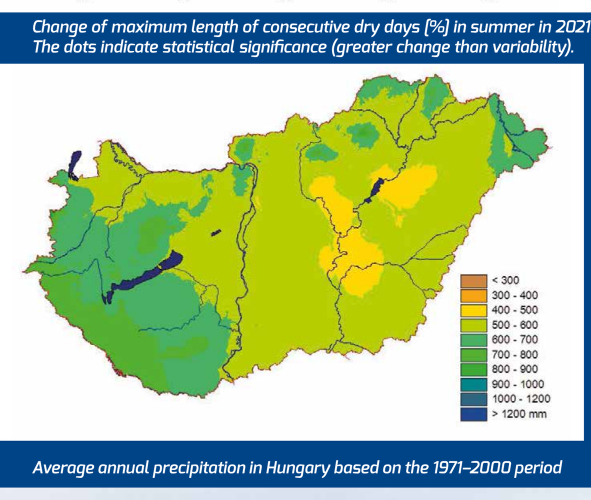
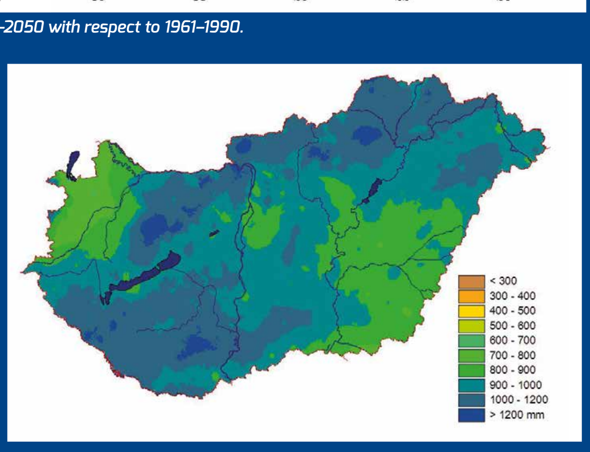


Change of maximum length of consecutive dry days (%) in summer in 2021–2050 with respect to 1961–1990. The dots indicate statistical significance (greater change than variability).

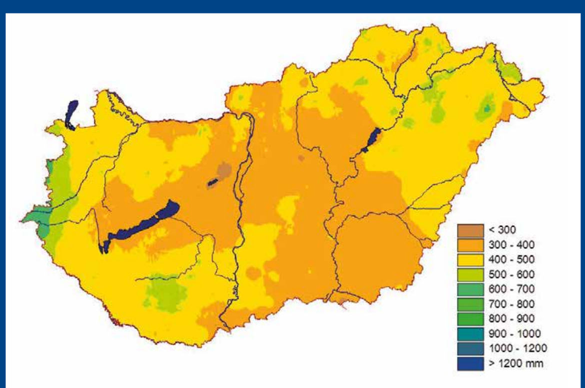




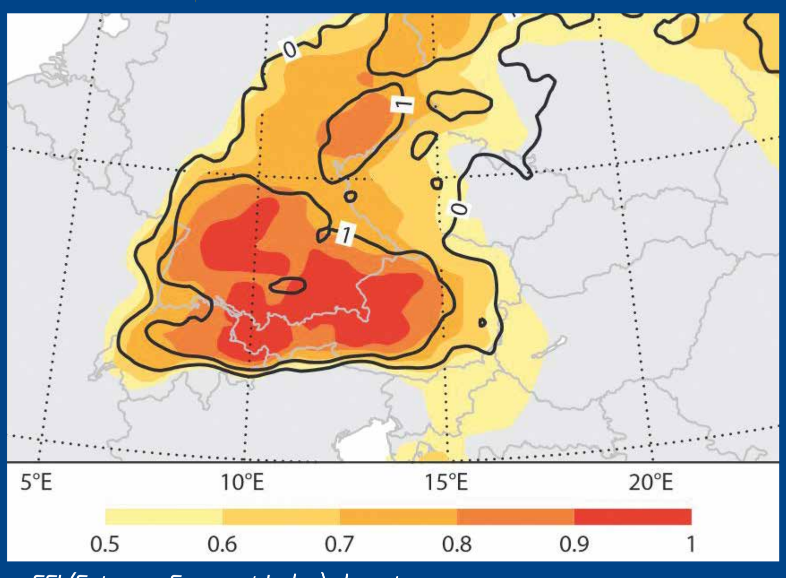
Average annual precipitation in Hungary based on the 1971–2000 period



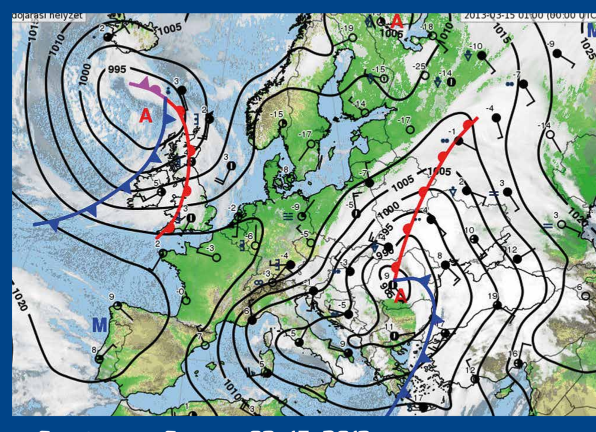
Annual precipitation in 2010



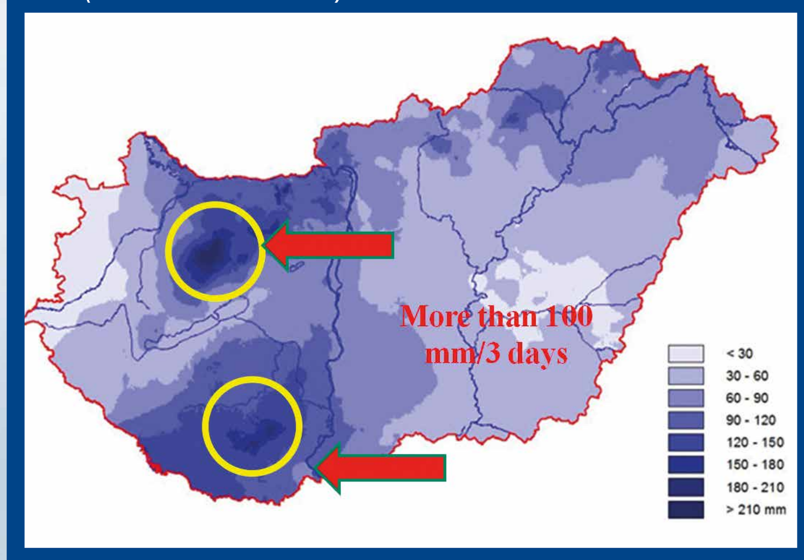
Annual precipitation in 2011



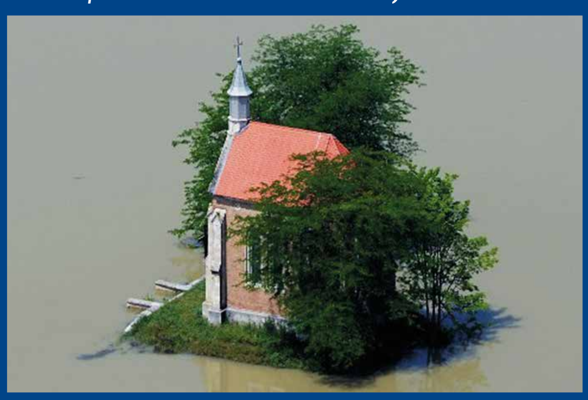
EFI (Extreme Forecast Index) close to one

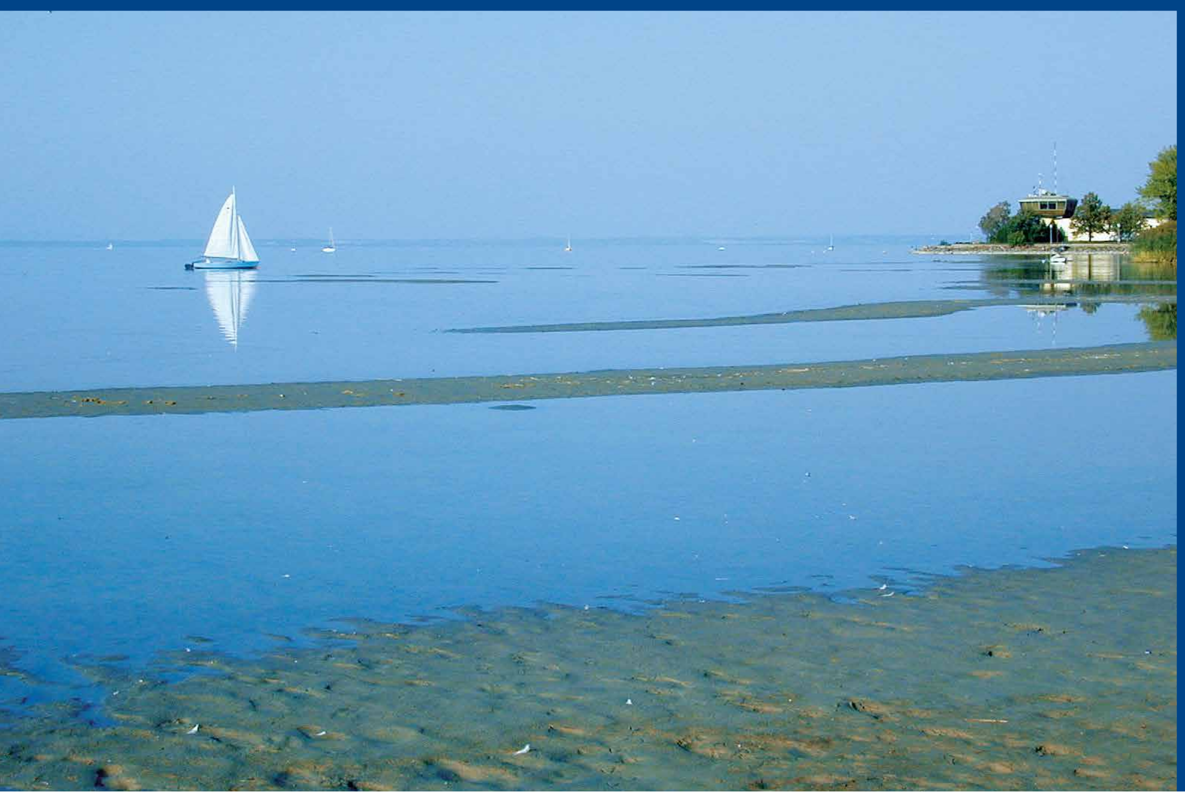


Fronts over Europe, 03. 15. 2013.

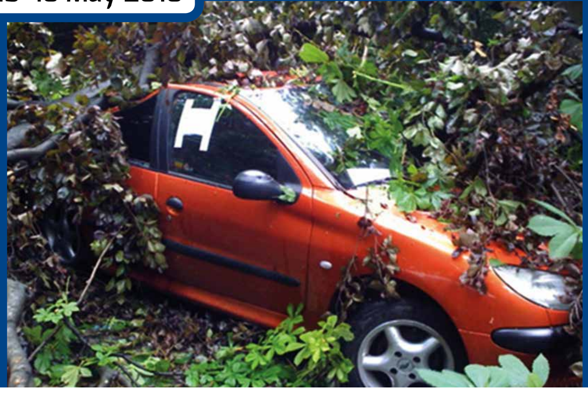


Precipitation amount 15–18 May, 2010





Zsófia cyclone 15–18 May 2010



Ministry of Rural Development