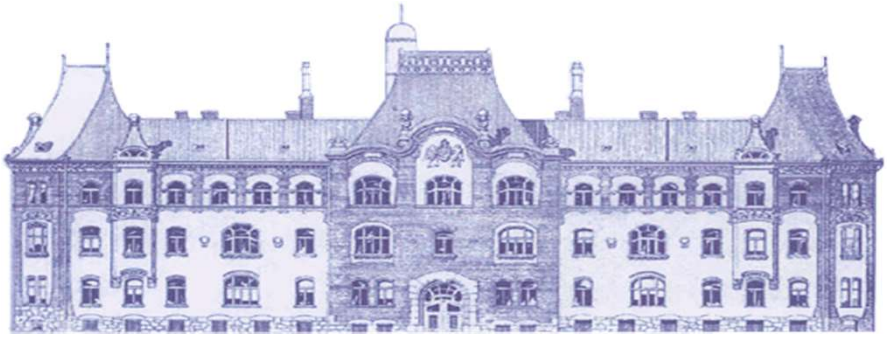
HUNGARIAN METEOROLOGICAL SERVICE

COUNTRY REPORT: HUNGARY

Andrea Kircsi and Attila Kovács

Agrometeorologist for farmers in hotter, drier, wetter future
EUMETCAL WORKSHOP
Ljubljana, 9-10 November 2016



Founded in 1870

Content

1. Agriculture of Hungary
2. Main challenges and risk
3. Agrometeorological services at HMS
    1. Operational services
    2. Climatological case studies
4. Overview of relevant research projects and data collections
5. Plans for future

1. Agriculture of Hungary

- Agriculture is an important sector of the Hungarian economy.
- About 70% of the land area of the country is suitable for agricultural production.
- Hungary has an area of 9 303,000 ha, of which 79%, i. e. 7 413,000 ha, is used for agriculture; 59%, (4 434,000 ha) is arable land and (1 939,000 ha) 20% is forestland in 2016.

Prior to the political and economic transition, agriculture was Hungary's most successful industry. It produced 17% of GDP - including the processing, trade and other industrial activities of the large farms – and employed about the same percentage of the labor force. The share of food exports was 22% of total exports.

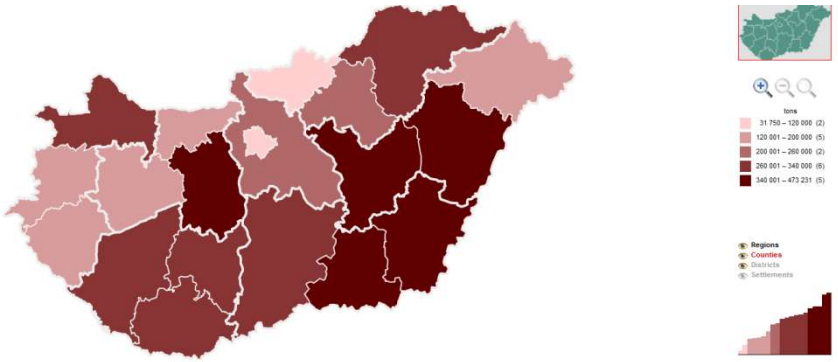
These proportions have decreased and the current figures are now: 3.3% (GDP), 4.7% (labor force) and the share of food exports 7% of total exports.

Agriculture of Hungary

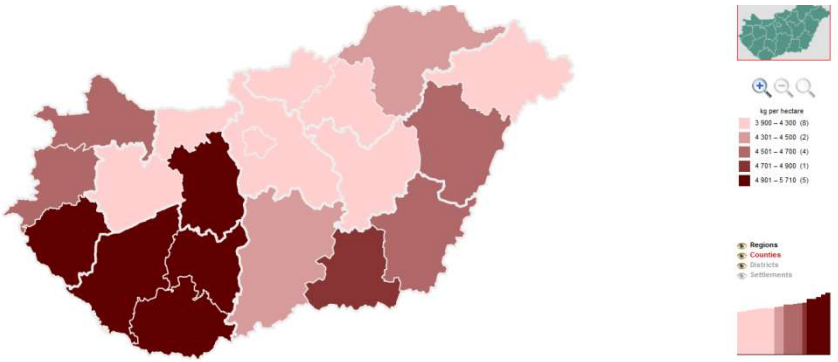
- Cereals occupy about 70% of the arable land.
- The major cereals are wheat and maize. The average yield of wheat is 51,8t/ha (2015) and that of maize 57,9t/ha (2015), 78t/ha in 2014.
- Other important crops are: sugar beet, oilseeds (sunflower), potatoes, fruits, vegetables and wine grape.

Wheat and Maize

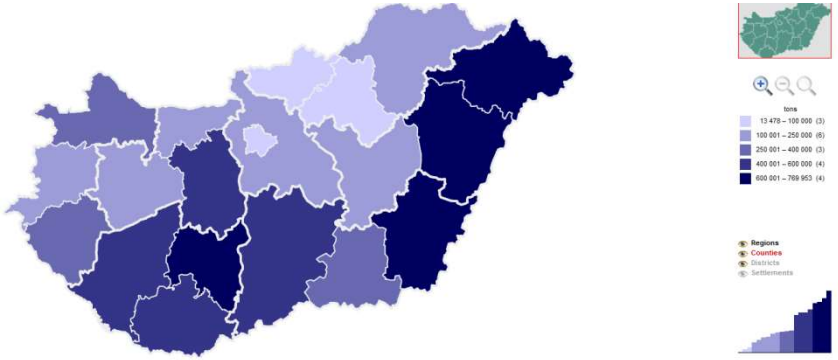
Total wheat production in 2013



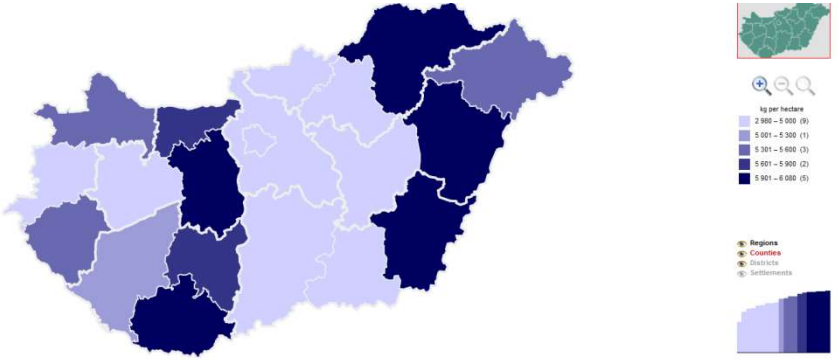
Average wheat yield in 2013



Total corn production in 2013



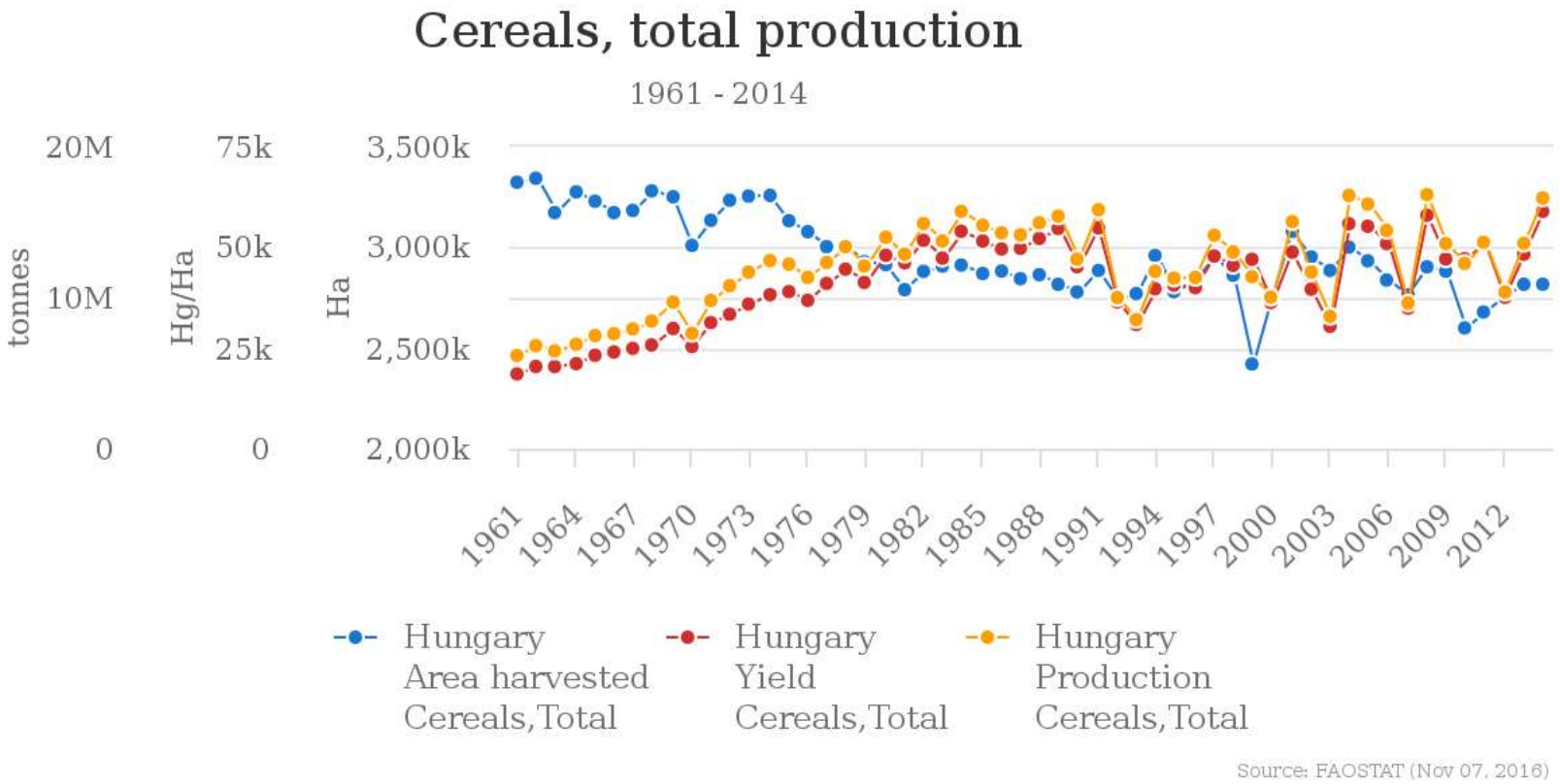
Average corn yield in 2013



http://www.ksh.hu/interaktiv/terkepek/mo/mezogazd_eng.html?mapid=OMF007?mapid=OMN002&layer=coun&color=3&meth=sug&catnum=5

http://www.ksh.hu/interaktiv/terkepek/mo/mezogazd_eng.html?mapid=OMF007?mapid=OMN002&layer=coun&color=3&meth=sug&catnum=5

Production of Cereals



- Harvested area is decreasing
- Total production and yield of cereals are increasing
- After 1991 the production is changeable

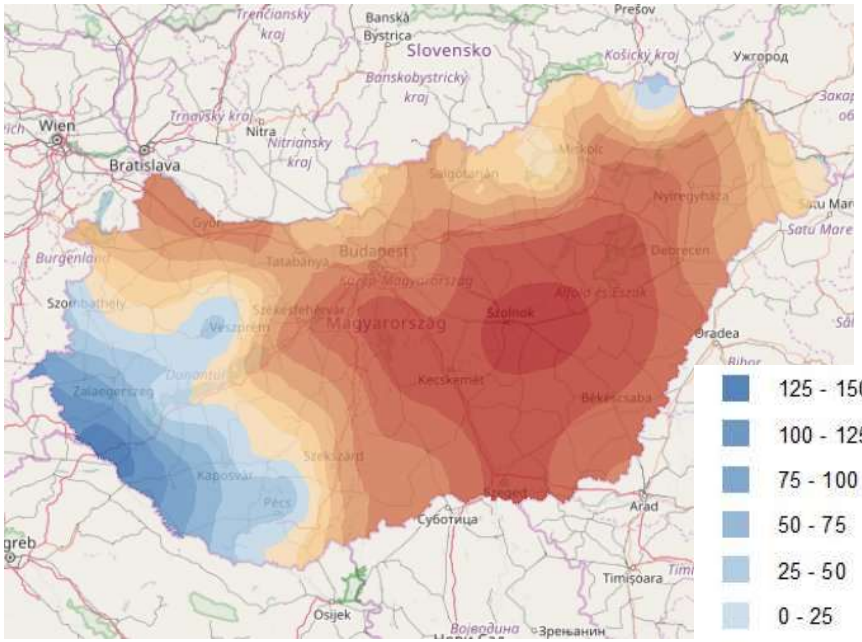
2. Main climatologically challenges and risks

1. Rain deficit → meteorological – agricultural – hydrological **DROUGHT**
2. Rain surplus → inland inundation – flood risk in the watershed basins of Danube and Tisza River
3. Extreme weather events:
   Hails, thunderstorms, windstorms, frost
4. Adaptation to impacts of climate change

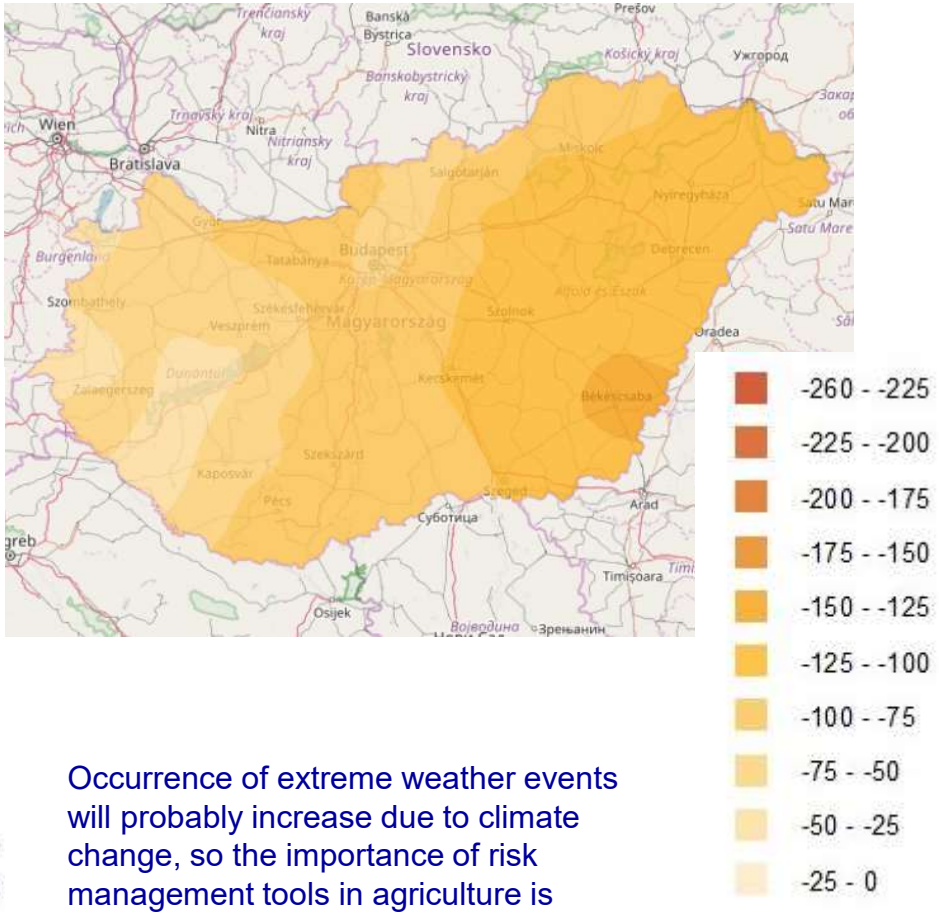
These risks cause losses in a volume about 5 % of the annual gross output value of the Hungarian agriculture (G. Kemény, L. Rieger, 2014)

Climatic Water Balance (mm)

1961-1990



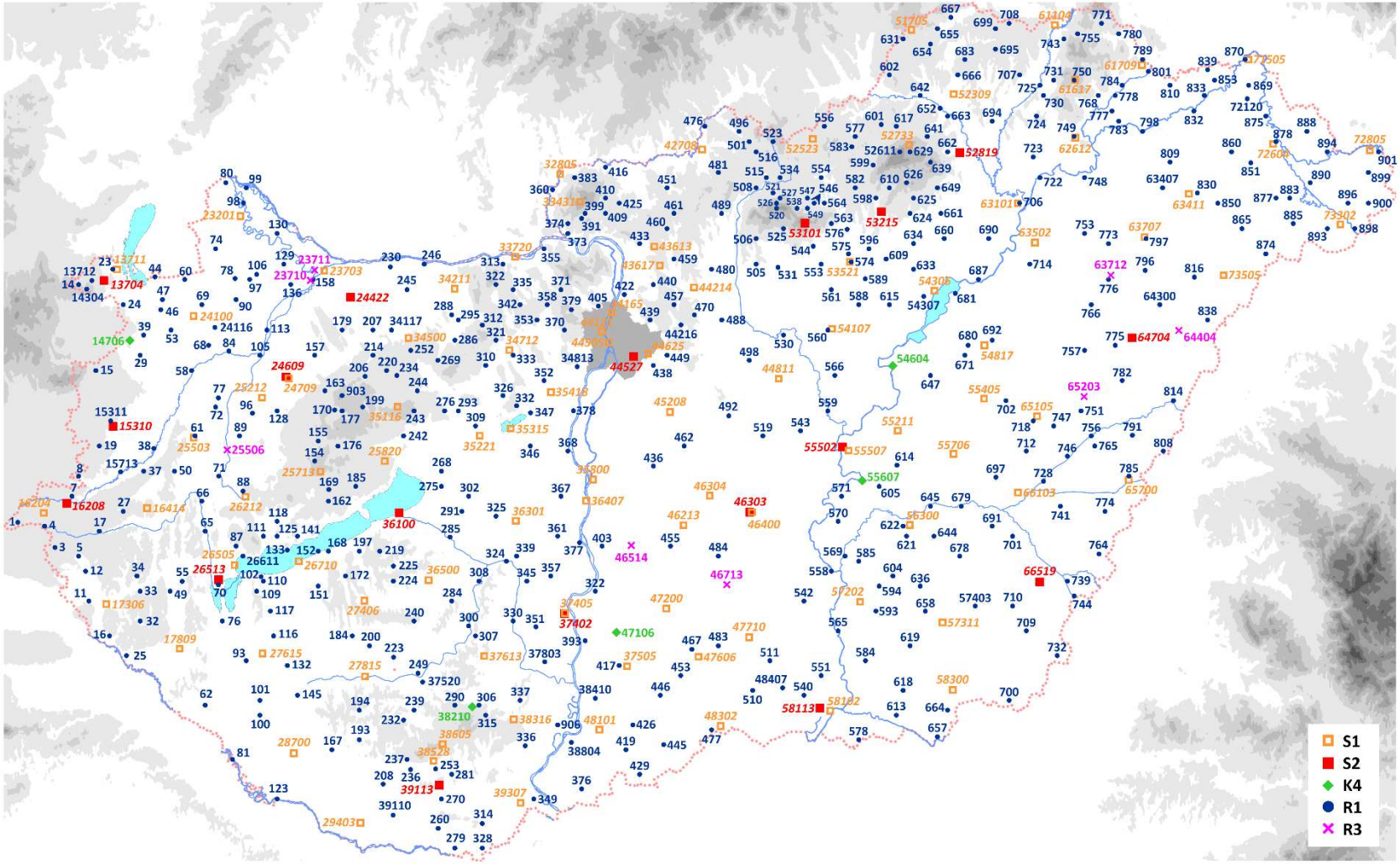
Change of Climatic Water Balance by 2021-2050 ALADIN-Climate modell



Occurrence of extreme weather events will probably increase due to climate change, so the importance of risk management tools in agriculture is growing.

https://map.mfgi.hu/nater/#

Meteorological stations in Hungary



www.met.hu

3. Agrometeorological services in Hungary

3.1. Operational services:

- Agrometeorological information on the official webpage (www.met.hu):
  - Information on the maps
    - Present and past state of meteorological elements (temperature, precipitation, sunshine duration) for 1, 5, 10, 30 and 90-days periods
    - Present properties of soils (soil temperature, moisture content of soils, deficiency of moisture)
  - Analysis of weather situations and agrometeorological conditions for farming activity twice a week
  - Agrometeorological forecast for the next 7-10 days twice a week

3. Agrometeorological services in Hungary

OMSZ Országos Meteorológiai Szolgálat

Nincs érvényben riasztás

IDŐJÁRÁS ÉGHAJLAT LEVEGŐKÖRNYEZET ISMERET-TÁR OMSZ

Aktuális időjárás | Veszélyjelzés | Előrejelzés | Humánmeteorológia | Agrometeorológia | Repülésmeteorológia | Tavaink

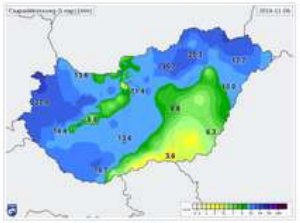
IDŐJÁRÁS > Agrometeorológia

Agrometeorológia

Térképek »

1 nap | 5 nap | 10 nap | 30 nap | 90 nap

Átlaghőmérséklet »



Csapadékösszeg »

Napfénytartam »

Elemzés, értékelés »

OMSZ: 2016. november 3. 10:53

Ideje a szántásnak

Az átmeneti csendes, napos őszi idő szerdán egy hidegfrontnak köszönhetően némileg megváltozott. Több helyen megnövekedett a felhőzet, és kevés csapadék is hullott főleg a Dunántúlon, és az Alföld déli részein. Csütörtöktől szombatig csendes őszi időre van kilátás napsütéssel, hajnali fagyokkal és pára- illetve ködfoltokkal. Jelentősebb mennyiségű eső vasárnapig nem zavarja a talajmunkákat és a még hátra lévő betakarítást, ekkor egy nyugat felől érkező frontrendszer hatására csapadékos idő valószínű, jelen számításaink szerint nagy mennyiségű csapadékkal.

Az elmúlt napok szeles, napos időjárása kedvezett a talajok száradásának, és a szerdai hidegfront jelentősen nem befolyásolta azt, a csekélyebb mennyiségű csapadéknak köszönhetően. Így a talaj felső 20 cm-ének nedvességtartalma 70-80%, és a felső 50 cm-é is 60-90% között alakul. Jelentősebb (50-100 mm) vízhiány csak az ennél mélyebb rétegekben jelentkezik. Jelen állapotban a szántáshoz ideális állapotban van a talaj, amit érdemes vasárnapig elvégezni. Az őszi mélyművelés során érdemes a szántás mélyégének helyes megválasztására figyelmet fordítani az esetleges téli-tavaszi belvíz lehetőség szerinti csökkentésére, akár megelőzésére. Az elmúlt héten a hőmérséklet az ilyenkor megszokott értékek körül, kevéssel a fölött alakult, de megjelentek 2 méteres magasságban is gyenge fagyok, a talajon pedig országszerte többfelé fagypont alatt alakult a hőmérséklet. Ezzel együtt folyamatosan hűl a talaj hőmérséklete, ami 5 cm-es mélységben most 10 fok körül alakul, de a hét végére várhatóan 5-6 fok körüli

Agrometeorológia

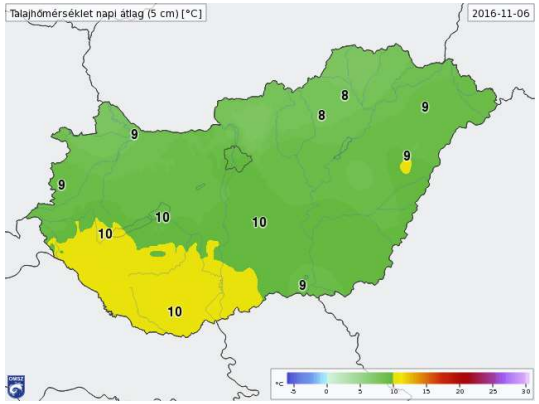
- Hőmérséklet
- Csapadékösszeg
- Napfénytartam
- Talajnedvesség, hőmérséklet
- Elemzés
- Előrejelzési térképek
- Agrometeorológia ismertető

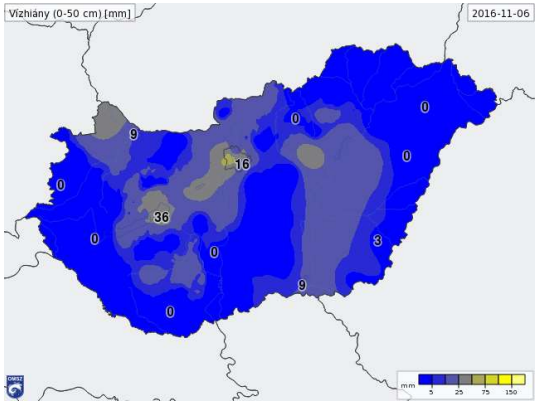
Tetszik 3,1 ezer

v.met.hu

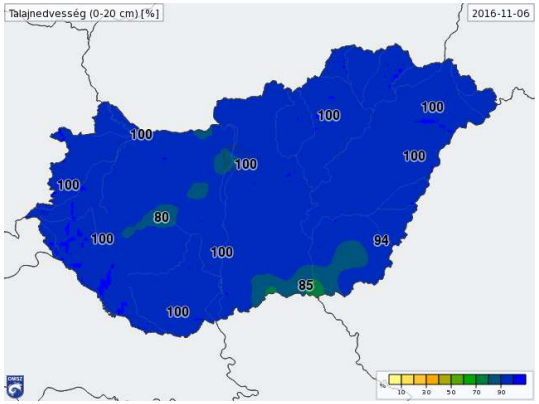
Information on maps

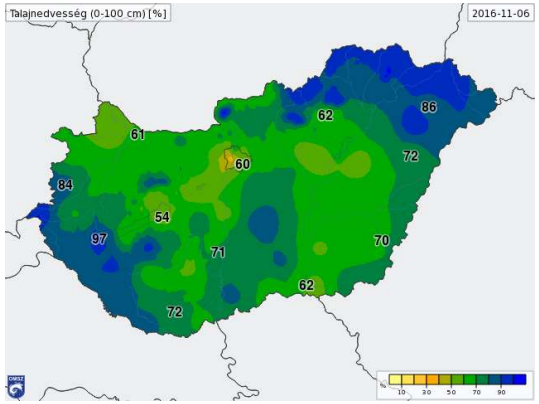
Temperature of soils (5cm) in °C

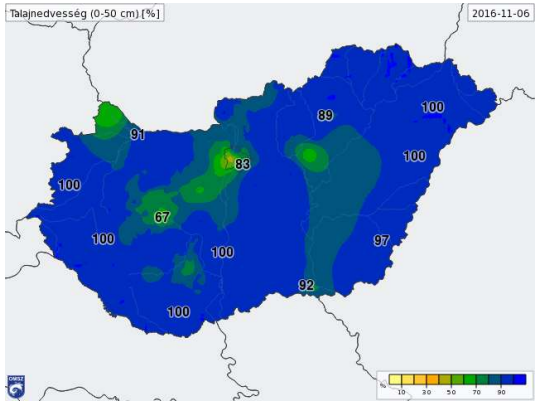


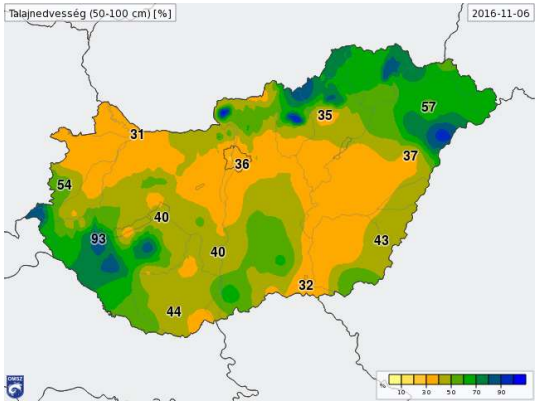


Soil moisture (0-20 cm, 0-50 cm, 0-100 cm, 50-100 cm deep) in %

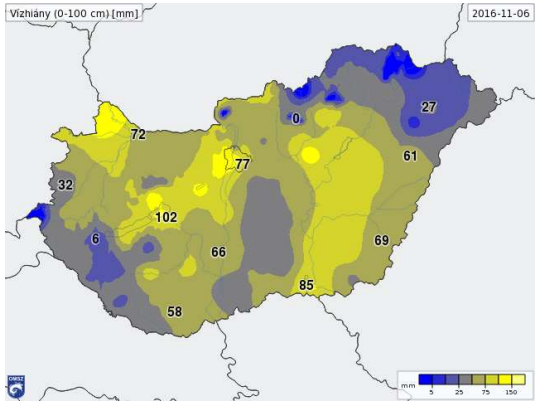








Deficiency of moisture (0-50 cm and 0-100 cm) in mm



www.met.hu

Specialized weather forecast for farmers

Model forecasts with maps:

- Soil temperature for 9 days
- Precipitation for next 10 days
- Air temperature, wind, humidity for next 10 days

3.Agrometeorological services in Hungary

3.1. Operational services:

- **Complex Agricultural Risk Management System**

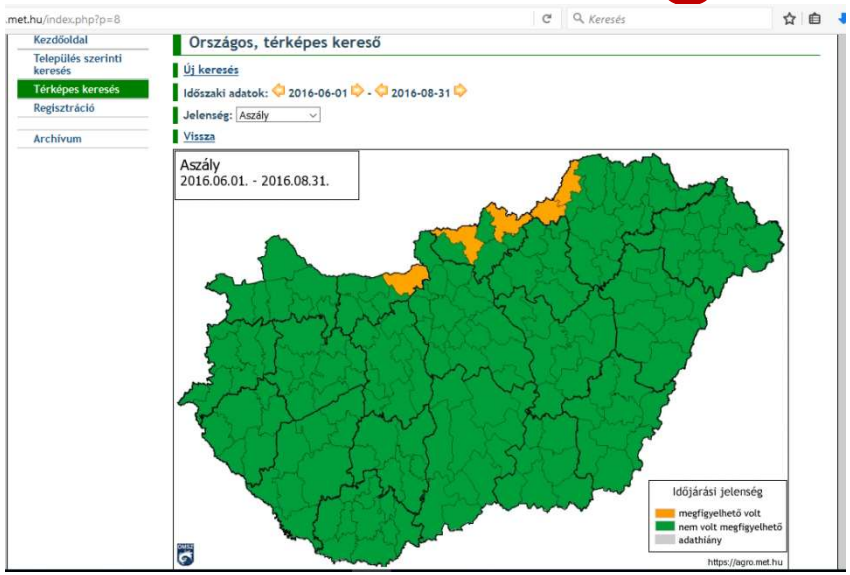
Hungarian agricultural administration formed this System with the object to reduce losses of the farmers. The system is based on two pillars: the first pillar is an extended mitigation system, and the second one is a business-based state-sponsored insurance system.

Together with other organizations Hungarian Meteorological Service (OMSZ) provides technical support to these system.

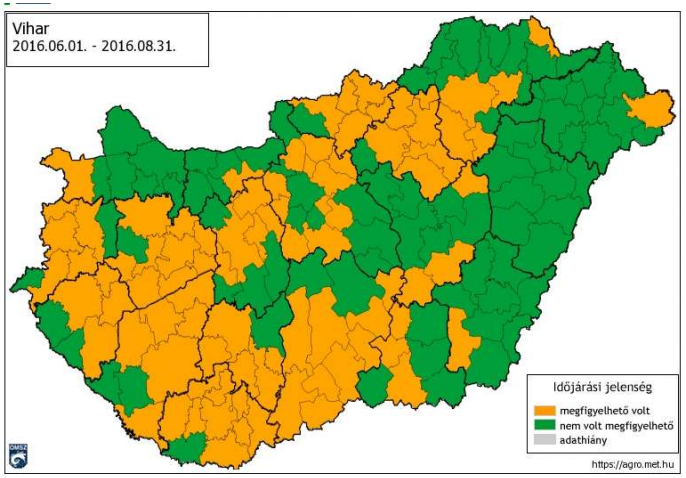
Complex Agricultural Risk Management System

- In the system OMSZ provides gridded information about the occurrence of the specified meteorological events on a grid with 0.05° resolution.
- Freely available for users (private farmers, enterprises) on agro.met.hu webpage.
- The following extreme events are identified: drought, frost, rainstorm, hail, windstorm.
- Their definition are more administrative than scientific, the aim was to find easily understandable definitions both for decision-makers and end-users.

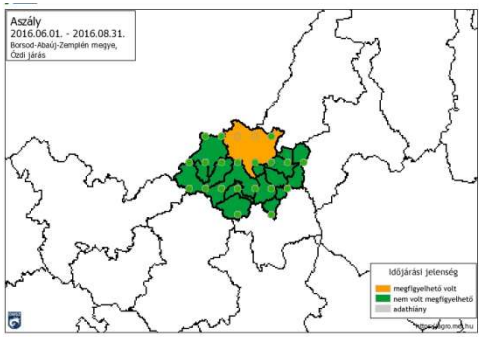
agro.met.hu

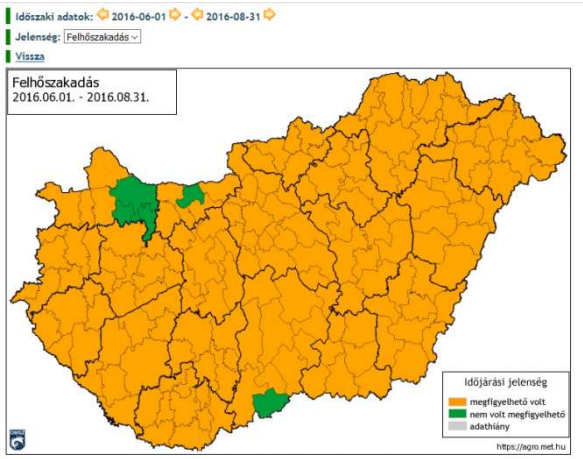


Drought: Precipitation amount is less than 10 mm during 30 consecutive days



Wind storm: wind speed is higher than 20 m/s.

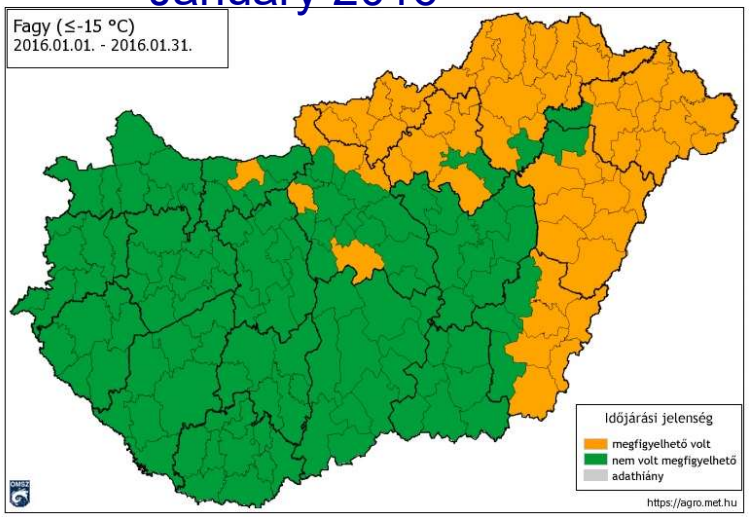




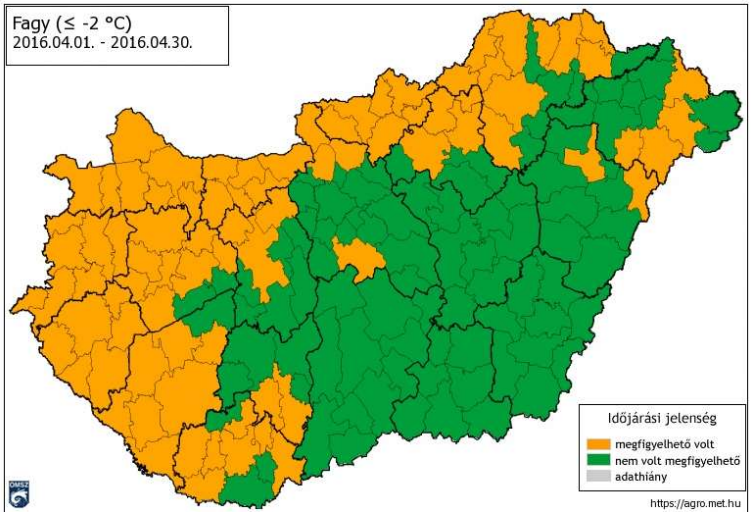
Rainstorm: mean precipitation intensity is higher than 0.75 mm/min during 20 minutes or the daily precipitation amount is higher than 45 mm.

agro.met.hu

January 2016



April 2016



- Three types of frost are distinguished:
  - spring and autumn frost: minimum temperature is below -2°C
  - winter frost: minimum temperature is below -15°C

Complex Agricultural Risk Management System

- The results are created through spatial interpolation of station datasets.
- The spatial interpolation is done applying the MISH method (Szentimrey and Bihari, 2007), which developed at the Hungarian Meteorological Service.

3.2 Climatological case studies

Content of studies depend on demand of consumers.

4. Overview of relevant research projects and data collections

Activities within the project:

- improve the basis of climate data in the Carpathian Region for applied regional climatological studies (Climate Atlas and/or drought monitoring)
- investigate the fine temporal and spatial structure of the climate in the Carpathian Mountains and the Carpathian basin with unified methods.
- Freely available, high resolution gridded database has been produced for the Larger Carpathian Region (LCR).

Participant in closed and ongoing projects

- Drought Management Centre for Southeastern Europe – DMCSEE

- DANUBECLIM: methodology similar to Carpatclim just expand to other countries. For example Montenegro.

- DRIDANUBE project with Slovenian Environmental Agency. It start in 2017.

ImagineS Project

Implementation of Multi-scale Agricultural Indicators Exploiting Sentinels

EU-FP7 project: http://fp7-imagines.eu

Period: 40 month (Nov. 2012. – June 2016.)

8 Institutions (Fr, Sp, Be, UK, Hu),

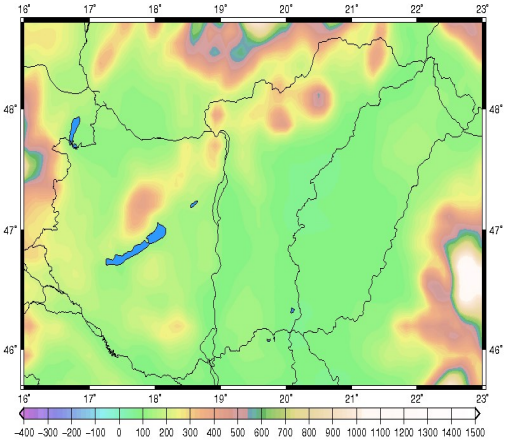
Aims:

- Improve the retrieval of basic biophysical variables coming from PROBA-V and LandSat for Copernicus Global Land Service.
- Assimilation of these satellite data into Surface model → monitoring of the evolution of the vegetation and the soil.
- Demonstrate the added value of this products for the community of users

• **Surface** was run over Hungary with 8 x 8 km resolution, 24 h forecast with 6 h outputs freq.
• Atmospheric forcings come from ALADIN NWP model (air temperature, humidity, wind speed, precipitation) + LandSAF long and short wave radiation
• Run with offline mode -> no influence to the atmosphere

OUTPUTS:

- LAI (Leaf Area Index)
- WG2 (Volumetric soil moisture content)
- GPP (Gross Primary Product), NEE (Net Ecosystem Exchange)
- ETR (Evapotranspiration), LE (Latent Heat Flux)



VALIDATION:

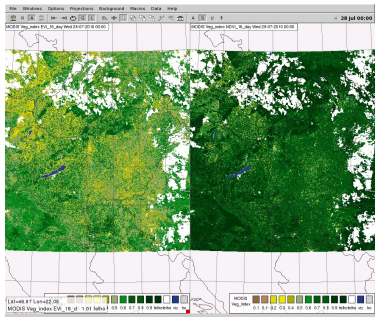
- 1D (against in situ measurements of Hegyhátsál)
- 2D (against satellite)
- agricultural utilization: simm. biomass vs. yield statistics (National measurements, WOFOST crop model)

Drought monitoring using MODIS satellite images

Two vegetation indices are derived by NASA from atmospherically-corrected reflectance in the red, near-infrared, and blue wavebands:

- The normalized difference vegetation Index (NDVI), which provides continuity with NOAA's AVHRR NDVI time series record for historical and climate applications, and
- the enhanced vegetation index (EVI), which minimizes canopy-soil variations and improves sensitivity over dense vegetation conditions.

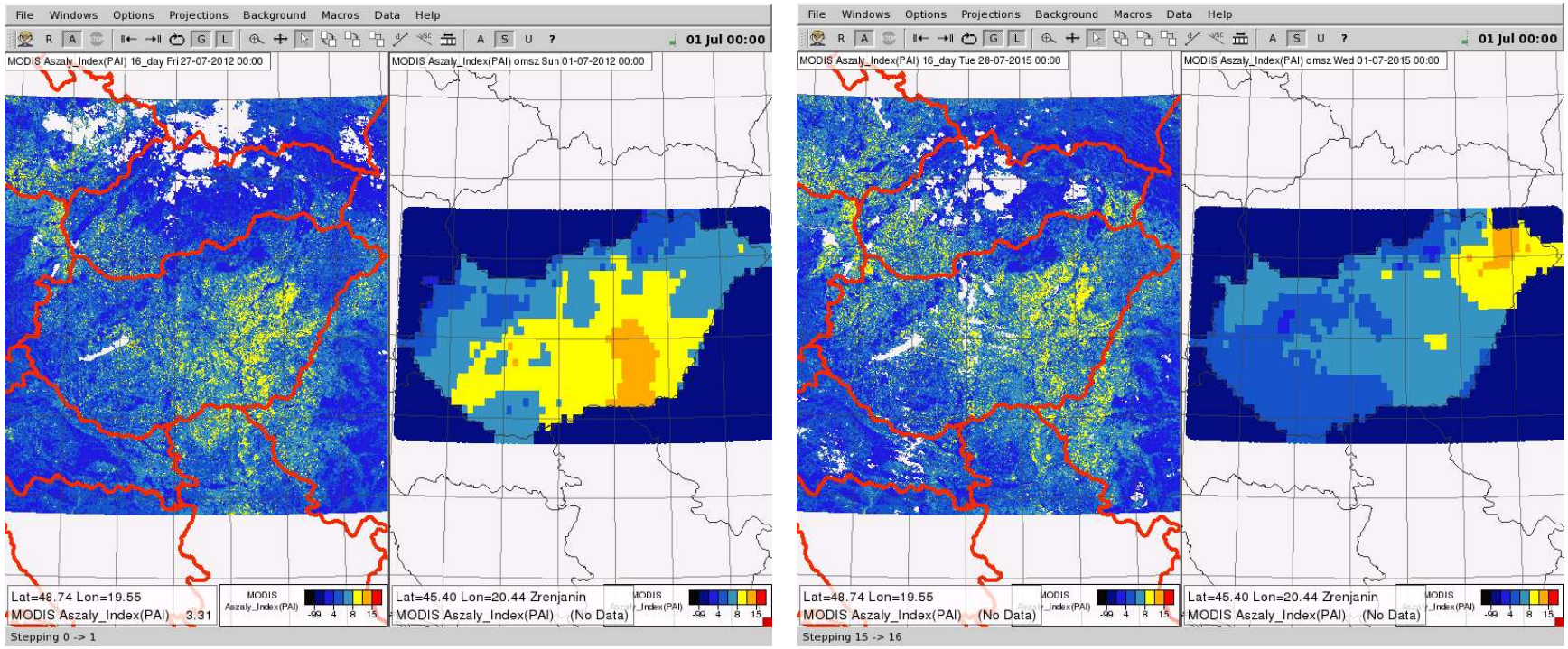
These data have been downloaded since 2003, and processed at the Hungarian Meteorological Service (HMS). Monthly maps were derived (based on the maximum values of the 30 days) for Hungary.



Judit Kerényi , Ildikó Szenyán, 2016

PADI indexes based on satellite data (left) and meteorological observations (right) in 2012 and 2015

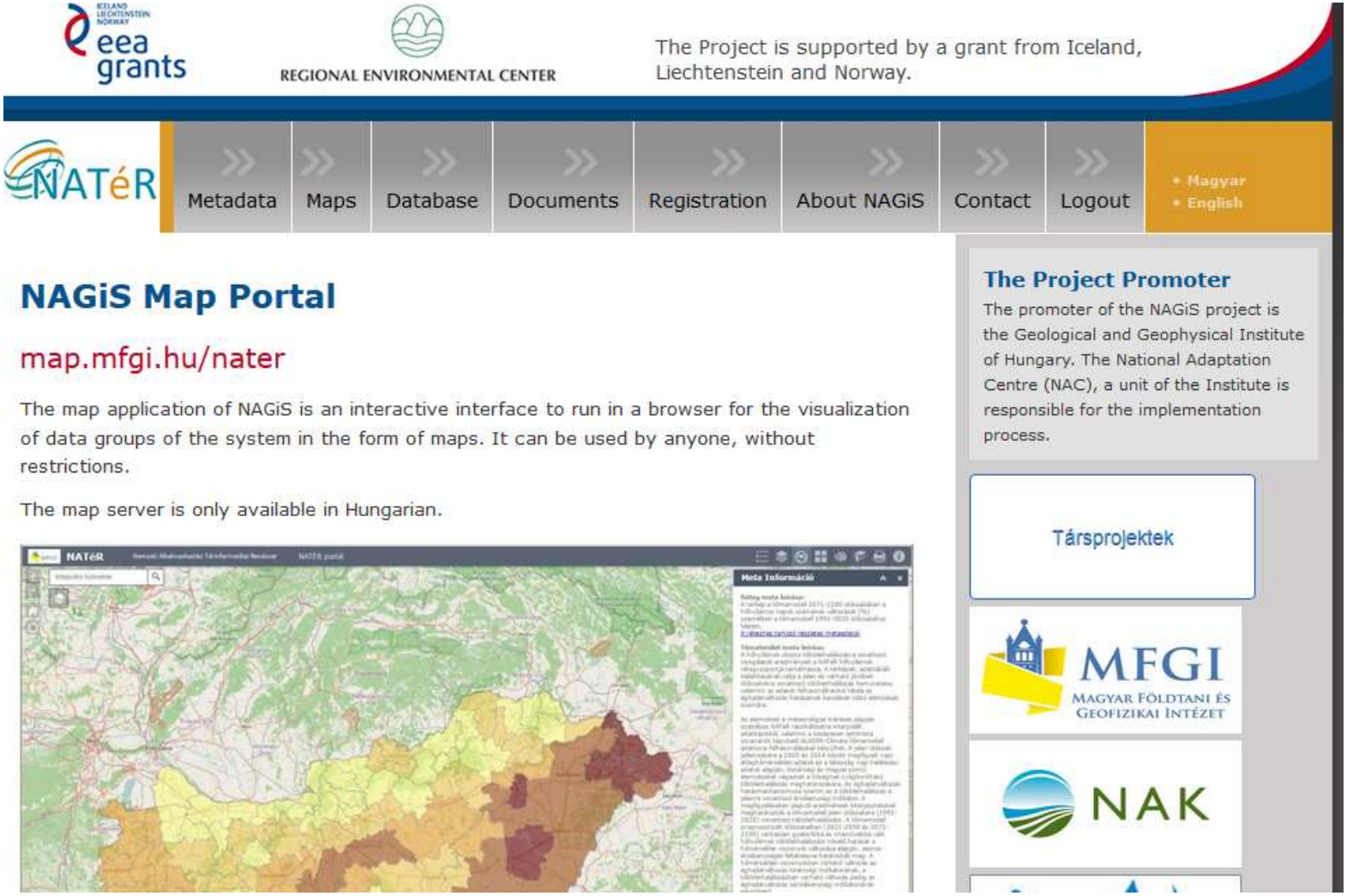
2012 **2015**



The Palfai Drought Index (PADI) is calculated operationally at HMS. A method was developed to derive a similar PADI using only MODIS vegetation maps. NDWI(**Normalized Difference Water Index**) helps to monitor changes in water content of leaves.

Judit Kerényi , Ildikó Szenyán, 2016

National adaptation Geo-information System

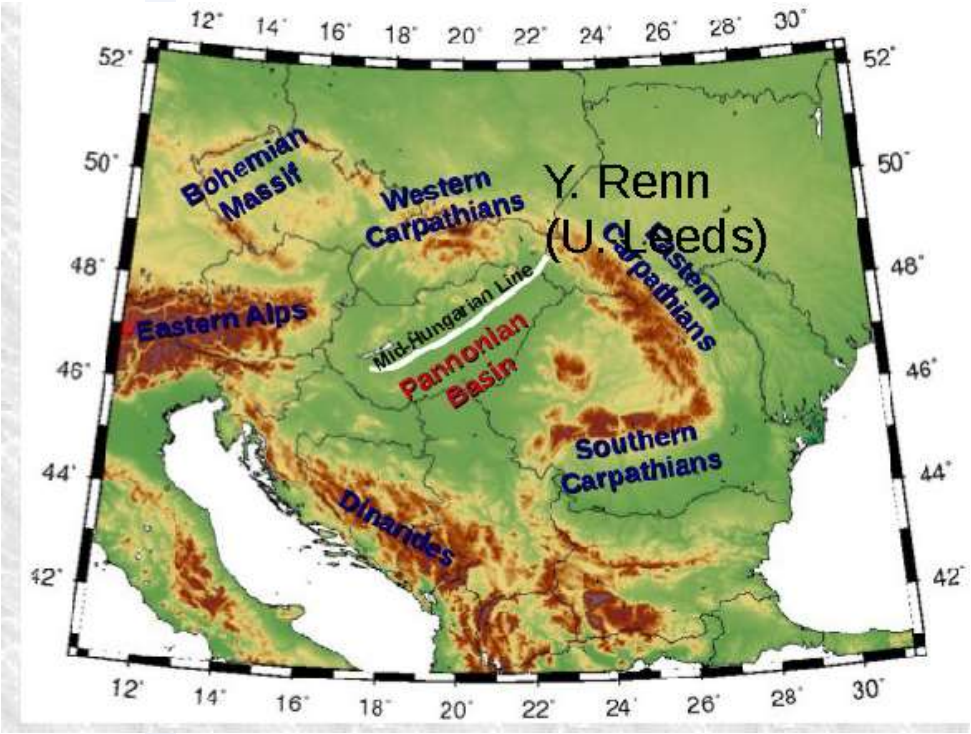


National center of adaptation: 2nd Climate Change Strategy of Hungary

5. Plans for future

PannEx

is a prospective Regional Hydroclimate Project in the Pannonian Basin



PannEx was initiated by

- GEWEX (Global Energy and Water cycle Exchanges) Hydrology Panel

GEWEX is a core project of the

- WMO WCRP

to become a Regional

- Hydroclimate Project in the Pannonian Basin

Initiation of PannEx

1st WS: The GEWEX-promoted workshop took place at the Faculty of Agriculture of the University of Osijek, 9 - 11 November 2015, Organized by the Hydrometeorological Service of Croatia, the University of Osijek, the University of Zagreb and the GEWEX Hydrological Panel

2nd PannEx WS Budapest, 1-3 June, Hungarian Meteorological Service, GEWEX travel support

1st PannEx WS Osijek → ~Half year → 2nd PannEx WS Budapest, 1-3 June

International Planning Committee

Branka Ivancan-Picek (DHMZ, Croatia)

Monika Lakatos (OMSZ, Hungary) *PannEx chair*

Adina Croitoru (University of Cluj-Napoca, Romania)

Danijel Jug (University of Osijek, Croatia)

Vladimir Djurdjevic (University of Belgrade, Serbia)

Tamás Weidinger (Eötvös Loránd University at Budapest, Hungary)

Ivan Guettler (DHMZ, Croatia) *PannEx secretary*

Joan Couxart University of the Balearic Islands Palma, Majorca, Spain*: member of the GEWEX Global Hydrology Panel (GHP)*

The PannEx Flagship science Questions and Cross Cut subjects were identified in Osijek

FQ1: Adaptation of agronomic activities to weather and climate extremes

FQ2: Understanding of air quality under different weather and climate conditions

FQ3: toward a sustainable development

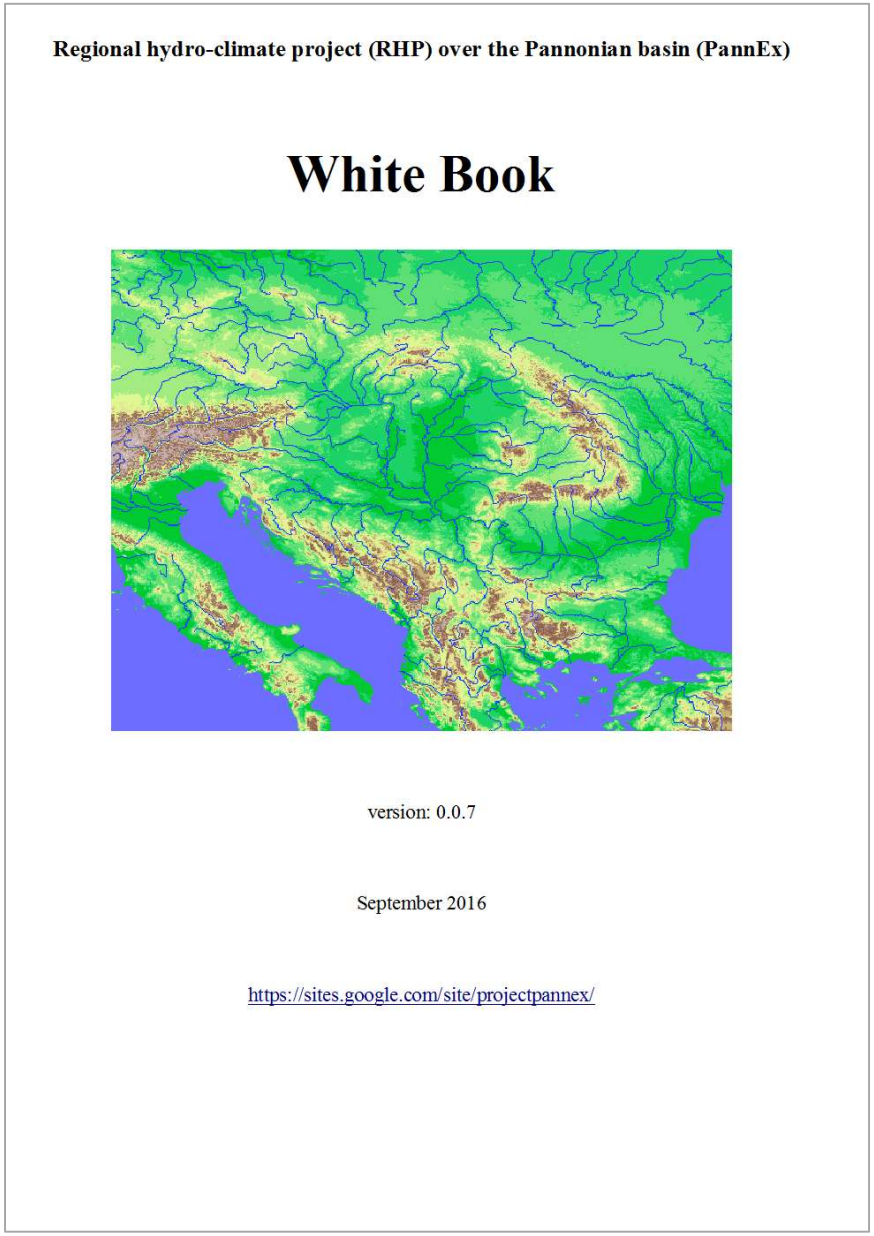
FQ4: water management, droughts and floods

FQ5: Education, knowledge transfer and outreach

CC1: Data/knowledge rescue and consolidation

CC2: Process modelling

CC3: Development and validation of modelling tools



PannEx White book is ready

Ver.0.0.7.

76 pages,

~60 contributors from the region

Will be uploaded to the webpage early 2017

FQ1: Adaptation of agronomic activities to weather and climate extremes

FQ1 chapter – group of writers - Coordinator: Danijel Jug (status 2016-05-31)			
Contributors	Field of expertise	Country	Contact
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Irena Jug	Agroecology, Ecophysiology	Croatia	ijug@pfos.hr
Márta Birkás	Soils and crop management	Hungary	Birkas.Marta@mkk.szie.hu
Vesna Vukadinović	Pedology	Croatia	Vesna.vukadinovic@pfos.hr
Boris Đurđević	Soil science	Croatia	bdurdevic@pfos.hr
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FQ1 (Flagship Questions) identified in Osijek:

Adaptation of agronomic activities to weather and climate extremes

- Weather scale predictions of yields and plant phenology
- Response to climate change (farming practices, crop types, pests and diseases)
- Water management and irrigation
- Land and soil use changes
- Perception of agricultural stakeholders and evolution of European policies
- Preserving ecological services

PannEx activities

Science Plan will be developed based on the White Book this year

try to apply fund to carry out the science plan

Next WS in Romania, Cluj-Napoca, 20-22 March, 2017

National PannEx Seminars in Hungary:

- 17 November 2016: Adaptation of agronomic activities to weather and climate extremes (José Camacho, scientific officer, World Meteorological Organization) – related to FQ1
- 8 December 2016: Land Degradation Neutrality (Representative of UNCCD: The LDN Programme) – related to FQ1, FQ3 and CC2

More info on the PannEx webpage:

https://sites.google.com/site/projectpannex/home

We are welcome comments to FQs and looking for contributors, and partners to PannEx.

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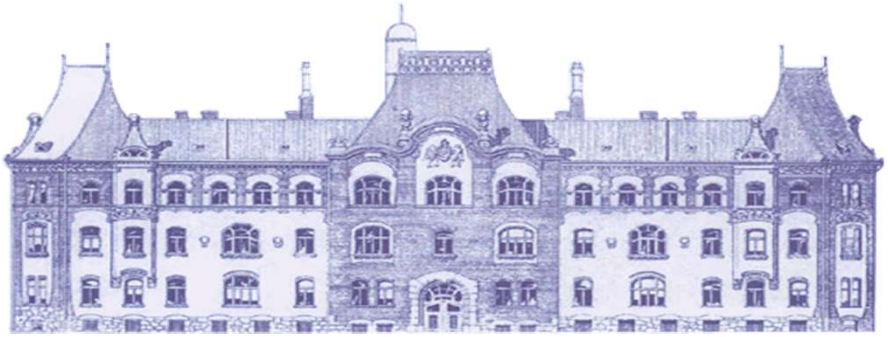

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Thank you for your attention!

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