Earth Observation in Hungary
Overview and examples

Dániel Kristóf
Lechner Knowledge Centre, EO Unit
& MFA - Hungarian ESA Delegation

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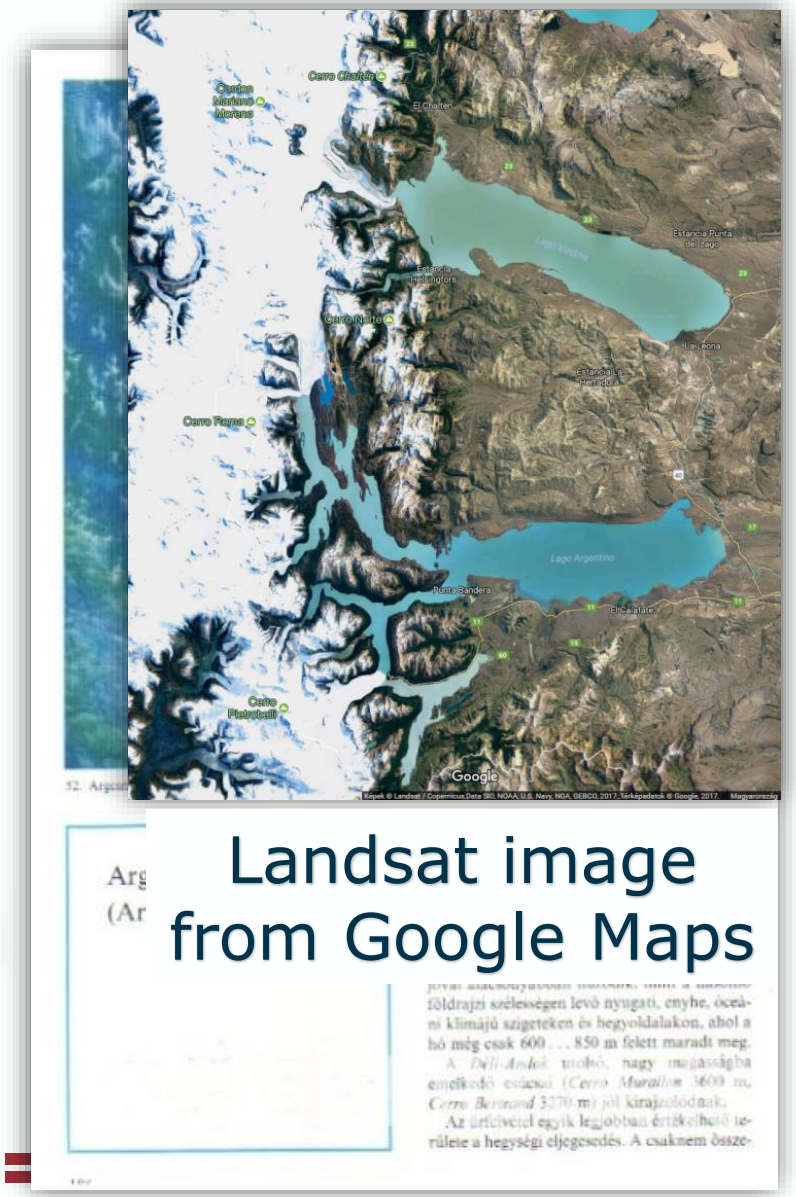
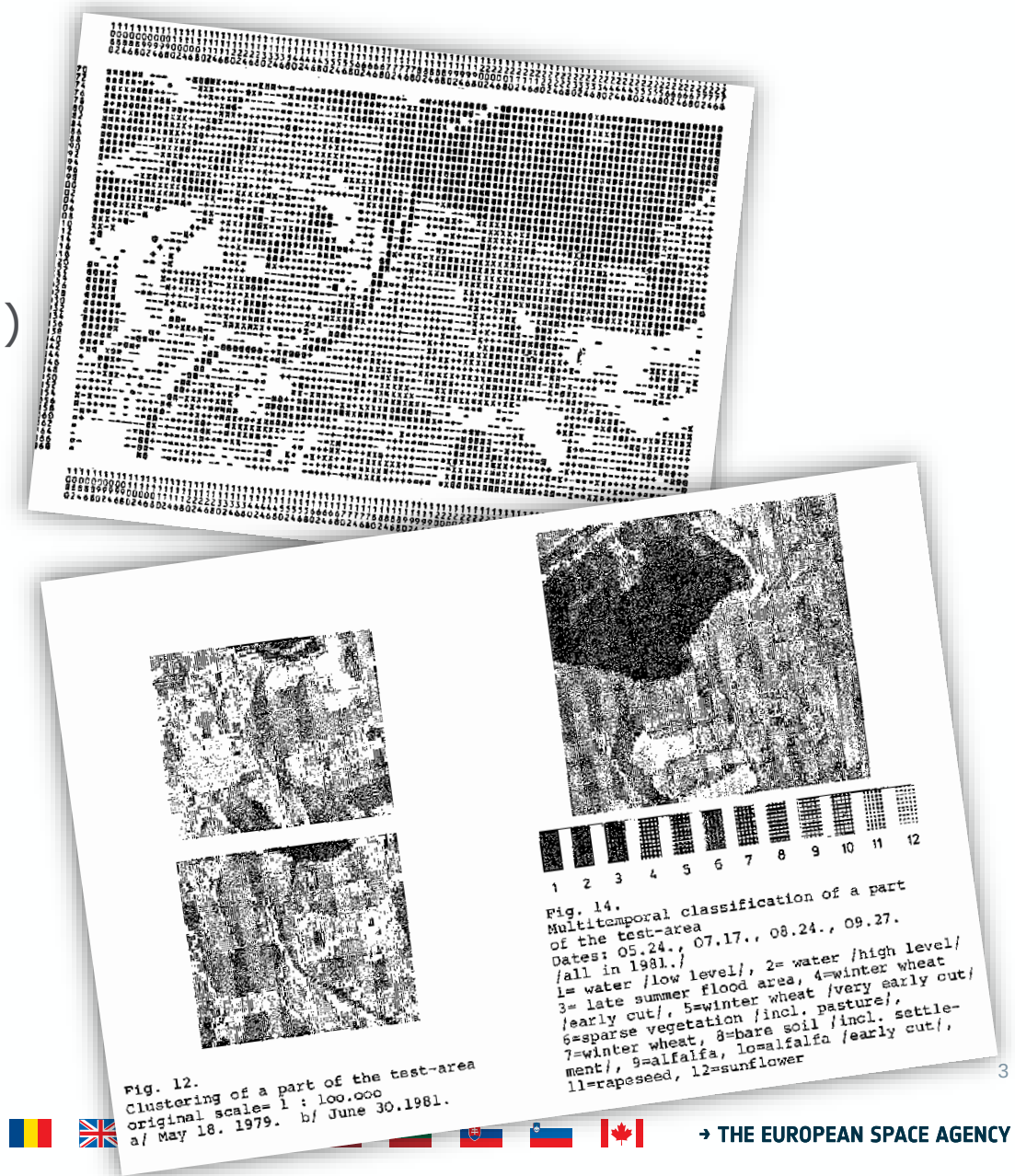
The beginnings

- Preparation of Hungarian cosmonauts for Earth Observation tasks (1978-80) at the Satellite Geodetic Observatory (SGO), Penc



Early developments

- 1980: FÖMI declared responsible for RS activities by law
  - For resolutions < 80m (below 50m: classified)
  - >80m: Hungarian Meteorological Service (OMSz)
- FÖMI Department of Remote Sensing
  - From former FÖMI / KGO personnel and other institutions (SZTAKI, ELTE)
  - Own developments - due to restrictions
- Long-term RS strategy, operational developments
  - Hungarian Agricultural Remote Sensing Program (MTP/HARSP)
  - Long-term contracts among FÖMI, Ministry of Agriculture and the Comm. for Technolog. Dev.

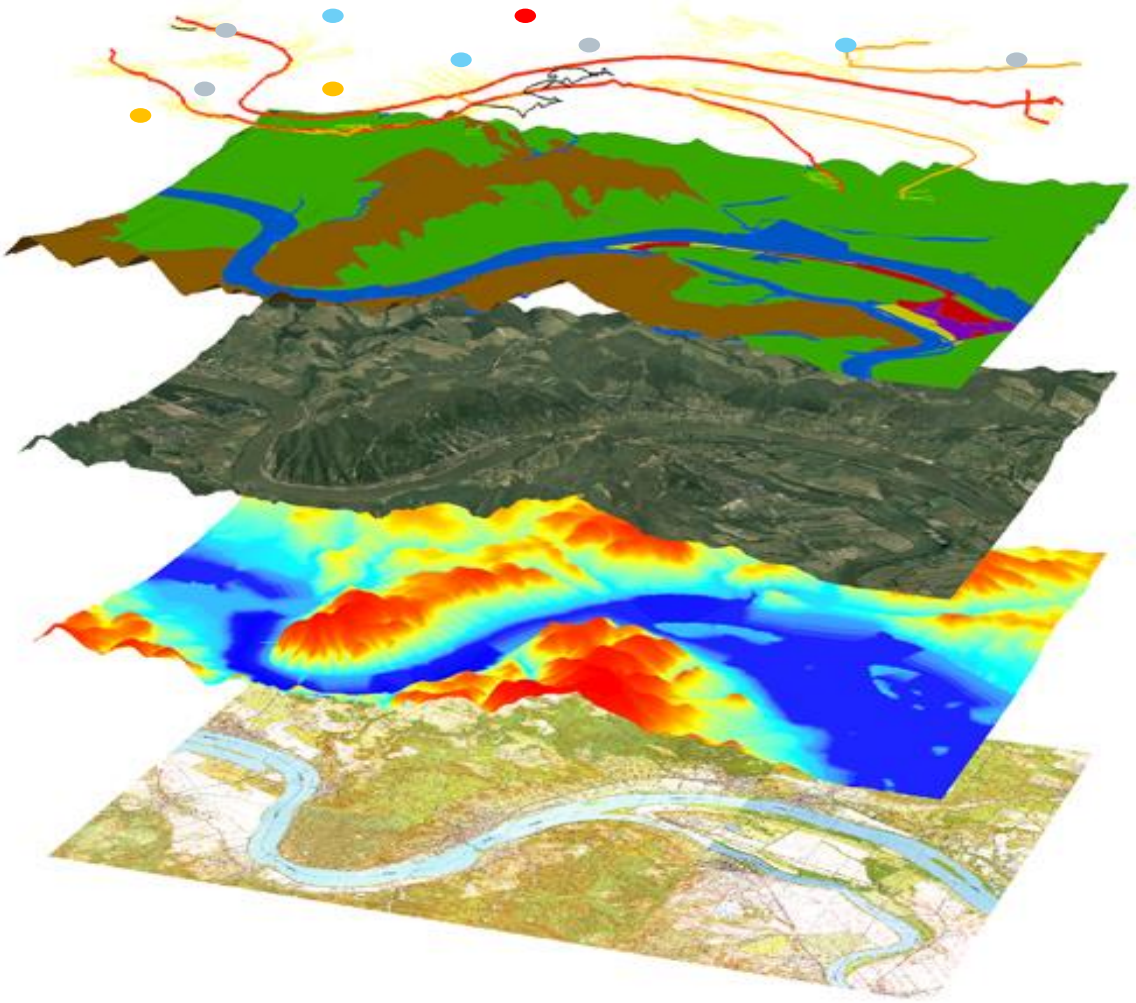


Today: EO community in Hungary

- Hungary is a full ESA Member State since 2015 (cooperation since 1991)
- Joined Earth Observation programmes in 2019
- Earth Observation Community
  - Science:
    - Important institutions and activities in basic research, e.g.: material science, physics, geodesy, geophysics, Earth system science
    - Large and heterogeneous landscape of applied research, e.g.: soil science, hydrology, ecology, plant science, forestry, agricultural sciences, meteorology, remote sensing, photogrammetry, AI / ML / information science
  - Industry:
    - Upstream: Important capabilities, some comapnies already internationally integrated as prime contractors or suppliers (material science, telecommunications, integrated systems, small sats / cubesats, etc.)
    - Downstream: Large number of copanies specialized in multiple fields (agriculture, civil engineering, ML/AI etc.)
  - Government:
    - EO solutions integrated in a number of govt. Sectors
    - Prime Minister's Office responsible for EO/RS, Ministry of Agriculture for agricultural EO/RS
    - Earth Observation Information System (EOIS/FIR) now operational (*see later*)

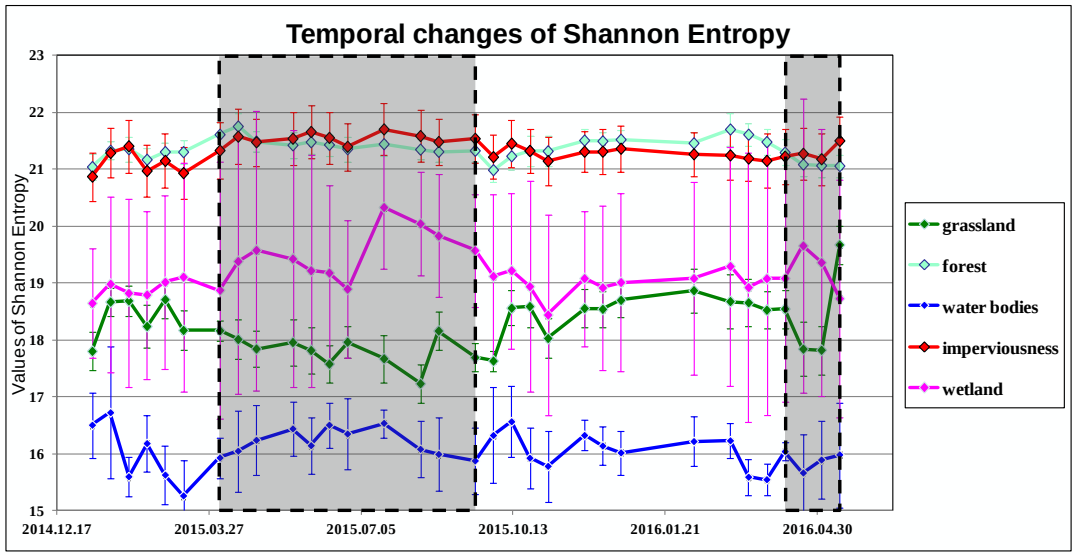
Today: Lechner Knowledge Centre (LTK)

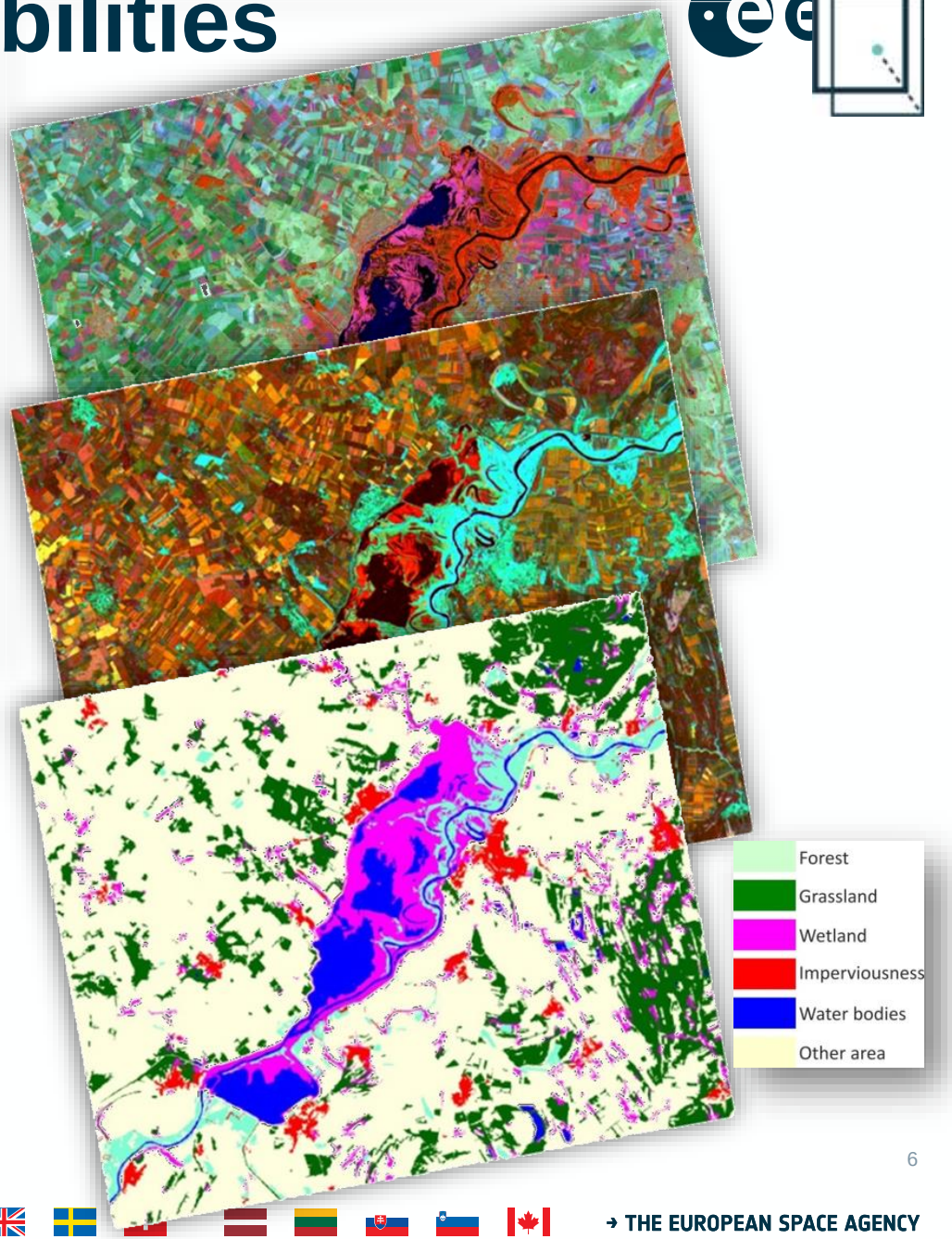
- background institution to the **Prime Minister's Office**
- managing the largest and **most complete collection of spatial data** sets in Hungary
- spatial data related to the **natural environment**
- official records related to the **built environment**
- tasks related to the protection of **cultural heritage**
- specific **processing, analysis and IT development** skills and activities in-house
- up-to-date **geospatial solutions** supporting government, authorities and the public
- **sharing** and **dissemination** of **knowlegde**



Remote Sensing capabilities

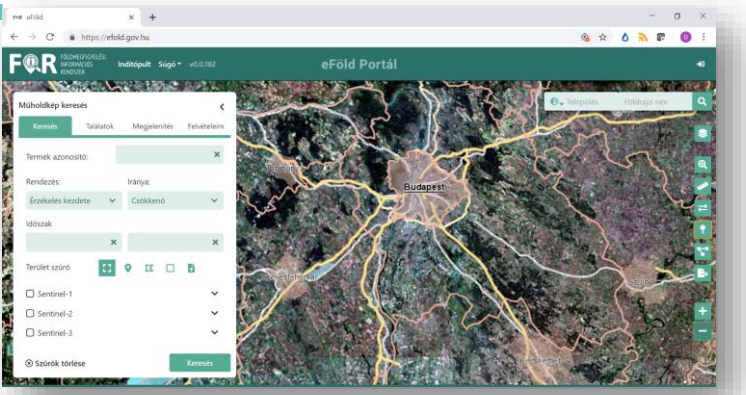
- Balanced use of quantitative and visual methods
- Combined use of different data sources
  - RS:
    - airborne/space-borne
    - optical and radar (**fusion, polarimetry**)
  - Field surveys
  - Official: LPIS, cadastre, topography
- Processing of big geospatial data (national, EU)

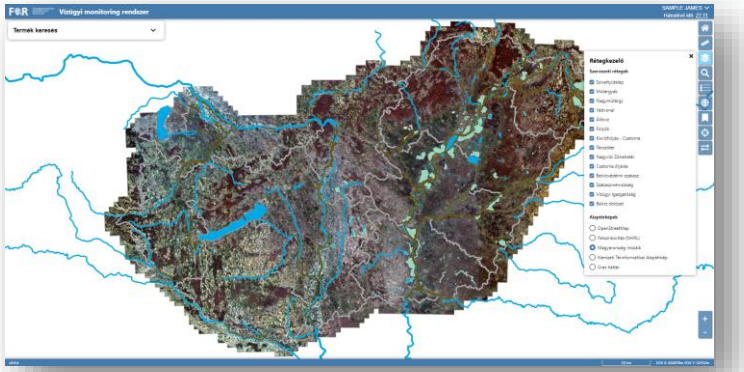


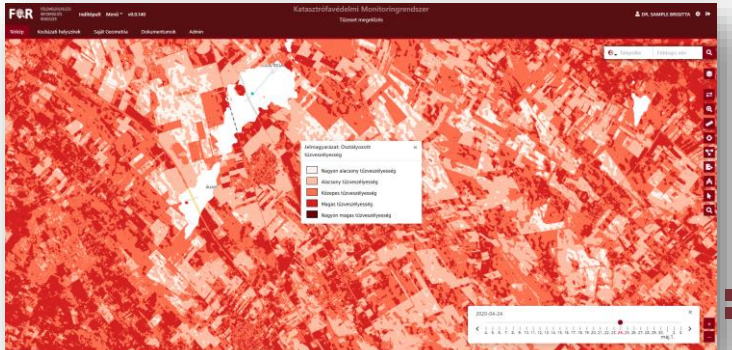


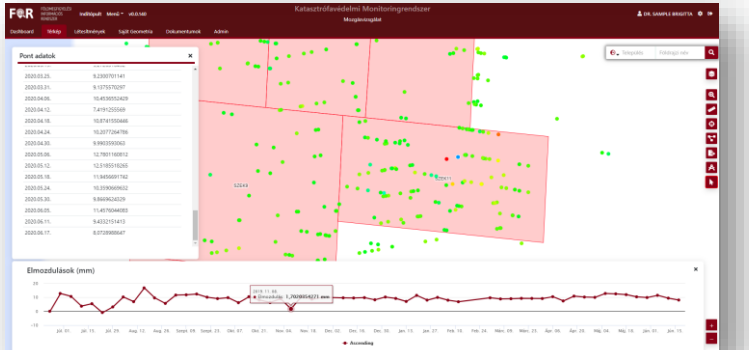
Earth Obervation Information System (FIR)

- Hardware and software infrastructure (HPC & cloud)
- Full online archive of Sentinel satellite over Hungarian territory
- Near-real time acquisition and processing of imagery
- Automated processing and analysis to support governmental decision making
- Specific EO subsystems:
  - Disaster management:
    - Fire investigation
    - Monitoring of critical water infrastructure (InSAR)
  - Water management
    - Flood and inundation monitoring
  - Forestry: detection of state, cuts, uninventoried forests
  - Agriculture: crop and pasture mapping, drought monitoring





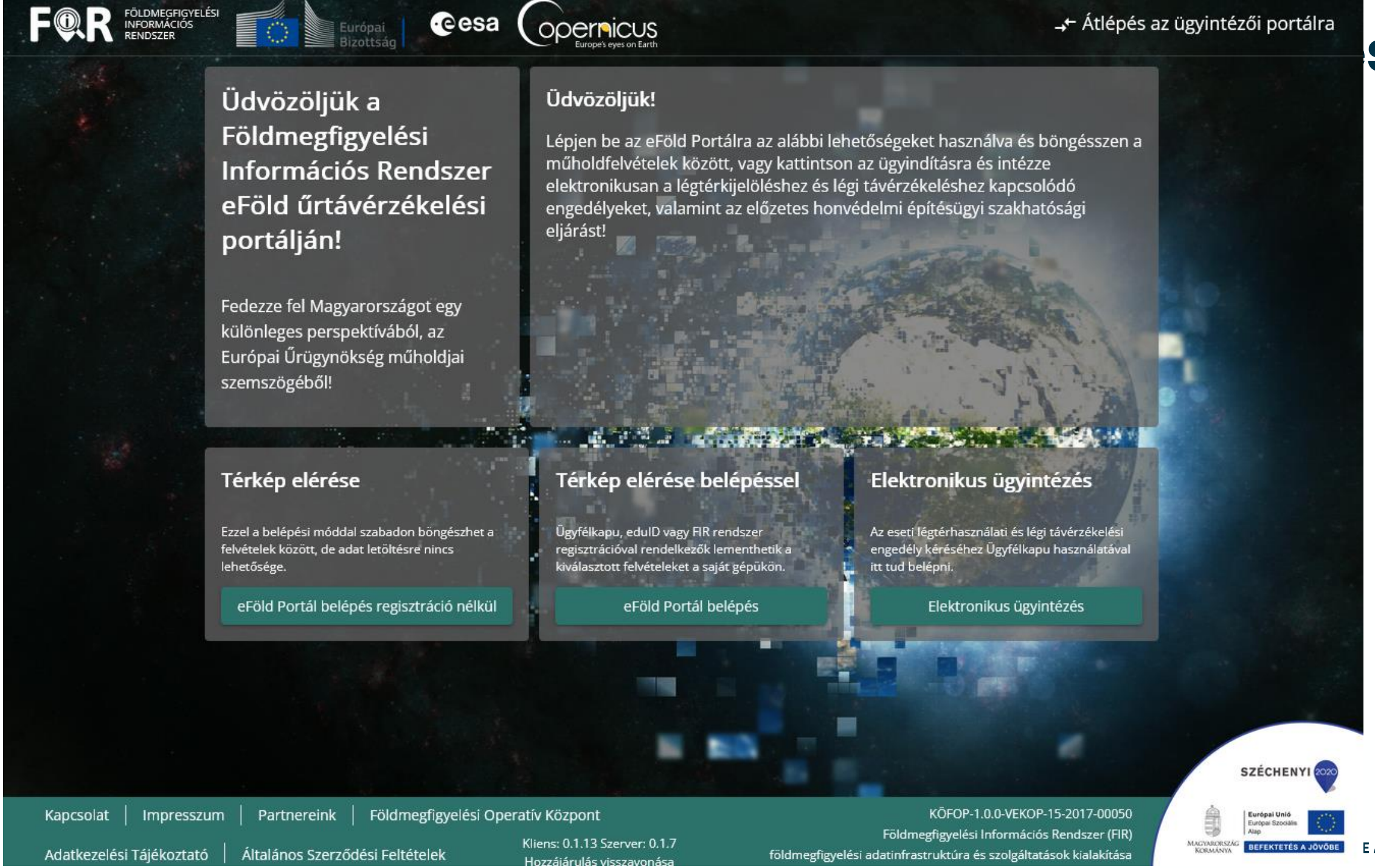




FÖLDMEGFIGYELÉSI
OPERATÍV KÖZPONT

Earth Observation Operations Centre (FOK)

- Activities:
  - Maintenance and operation of the Earth Observation Information System
  - Remote sensing processing and analysis
  - Coordination of application and service development
  - Professional coordination and consultancy
  - Education and dissemination
- Hosted by Lechner Knowledge Centre (LTK)
- Distribution of tasks:
  - Coordination, maintenance and operation of applications: LTK
  - Maintenance and operation of IT infrastructure:
    - Software: KIFÜ (Govt. IT development agency)
    - Hardware: NISZ (National Infocommunications Service Company)

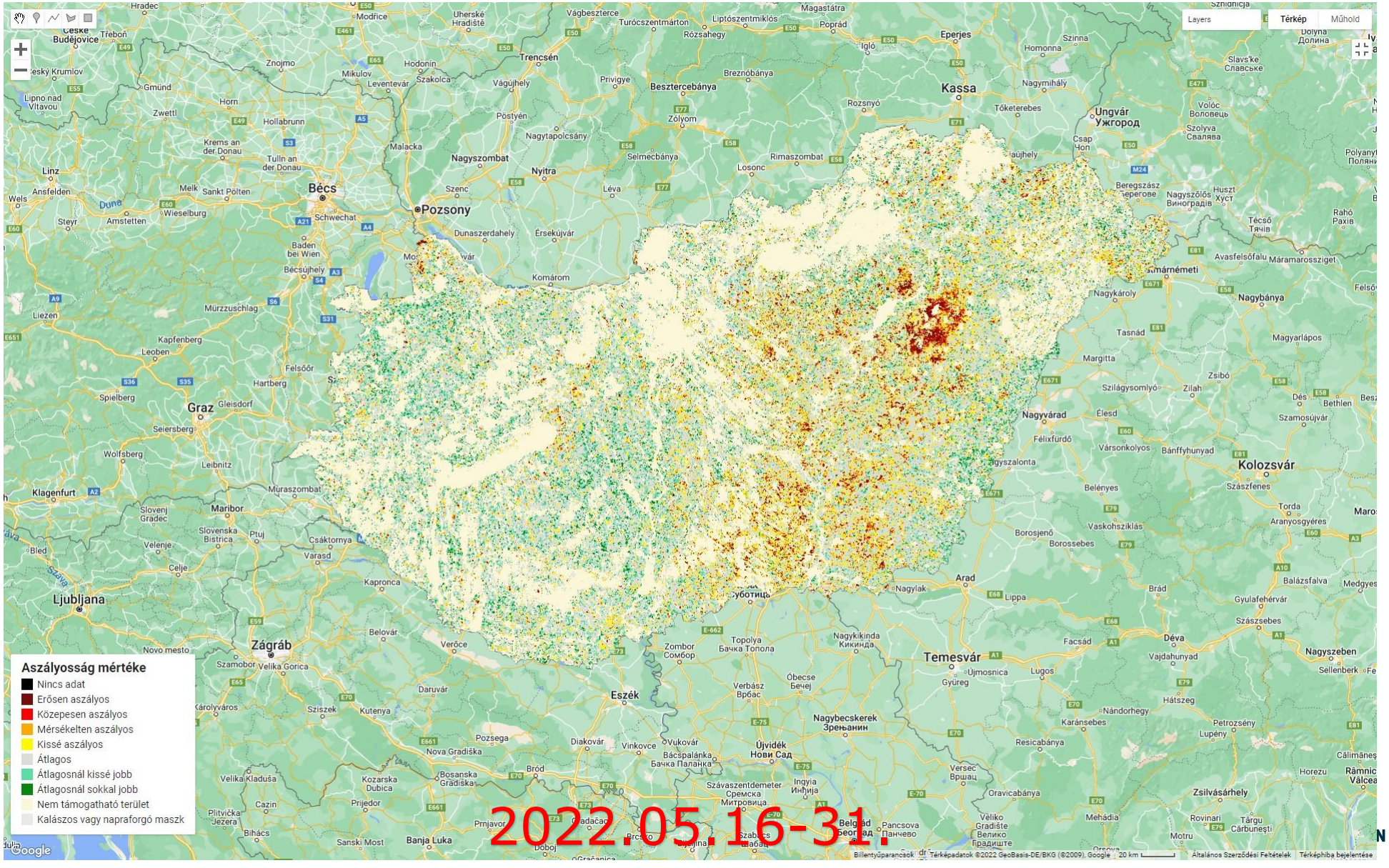

FÖLDMEGFIGYELÉSI INFORMÁCIÓS RENDSZER
Európai Bizottság
esa
Copernicus
Europe's eyes on Earth
Átlépés az ügyintézői portálra
Üdvözöljük a Földmegfigyelési Információs Rendszer eFöld űrtávérzékelési portálján!
Fedezze fel Magyarországot egy különleges perspektívából, az Európai Űrügynökség műholdjai szemszögéből!
Üdvözöljük!
Lépjen be az eFöld Portálra az alábbi lehetőségeket használva és böngésszen a műholdfelvételek között, vagy kattintson az ügyindításra és intézze elektronikusan a légtérkijelöléshez és légi távérzékeléshez kapcsolódó engedélyeket, valamint az előzetes honvédelmi építésügyi szakhatósági eljárást!
Térkép elérése
Ezzel a belépési móddal szabadon böngészhet a felvételek között, de adat letöltésre nincs lehetősége.
eFöld Portál belépés regisztráció nélkül
Térkép elérése belépéssel
Ügyfélkapu, eduID vagy FIR rendszer regisztrációval rendelkezők lementhetik a kiválasztott felvételeket a saját gépükön.
eFöld Portál belépés
Elektronikus ügyintézés
Az eseti légtérhasználati és légi távérzékelési engedély kéréséhez Ügyfélkapu használatával itt tud belépni.
Elektronikus ügyintézés
Kapcsolat | Impresszum | Partnereink | Földmegfigyelési Operatív Központ
Adatkezelési Tájékoztató | Általános Szerződési Feltételek
Kliens: 0.1.13 Szerver: 0.1.7
Hozzájárulás visszavonása
KÖFOP-1.0.0-VEKOP-15-2017-00050
Földmegfigyelési Információs Rendszer (FIR)
földmegfigyelési adatinfrastruktúra és szolgáltatások kialakítása
SZÉCHENYI 2020
MAGYARORSZÁG KORMÁNYA
Európai Unió
Európai Szociális Alap
BEFEKTETÉS A JÖVŐBE

Public portal: e-Föld („e-Globe”)

Exploring the 2022 drought with EO

Agricultural Risk Management System (MKR)

Country-wide drought mapping: MODIS NDVI anomaly



N SPACE AGENCY

Agricultural Risk Management System (MKR)

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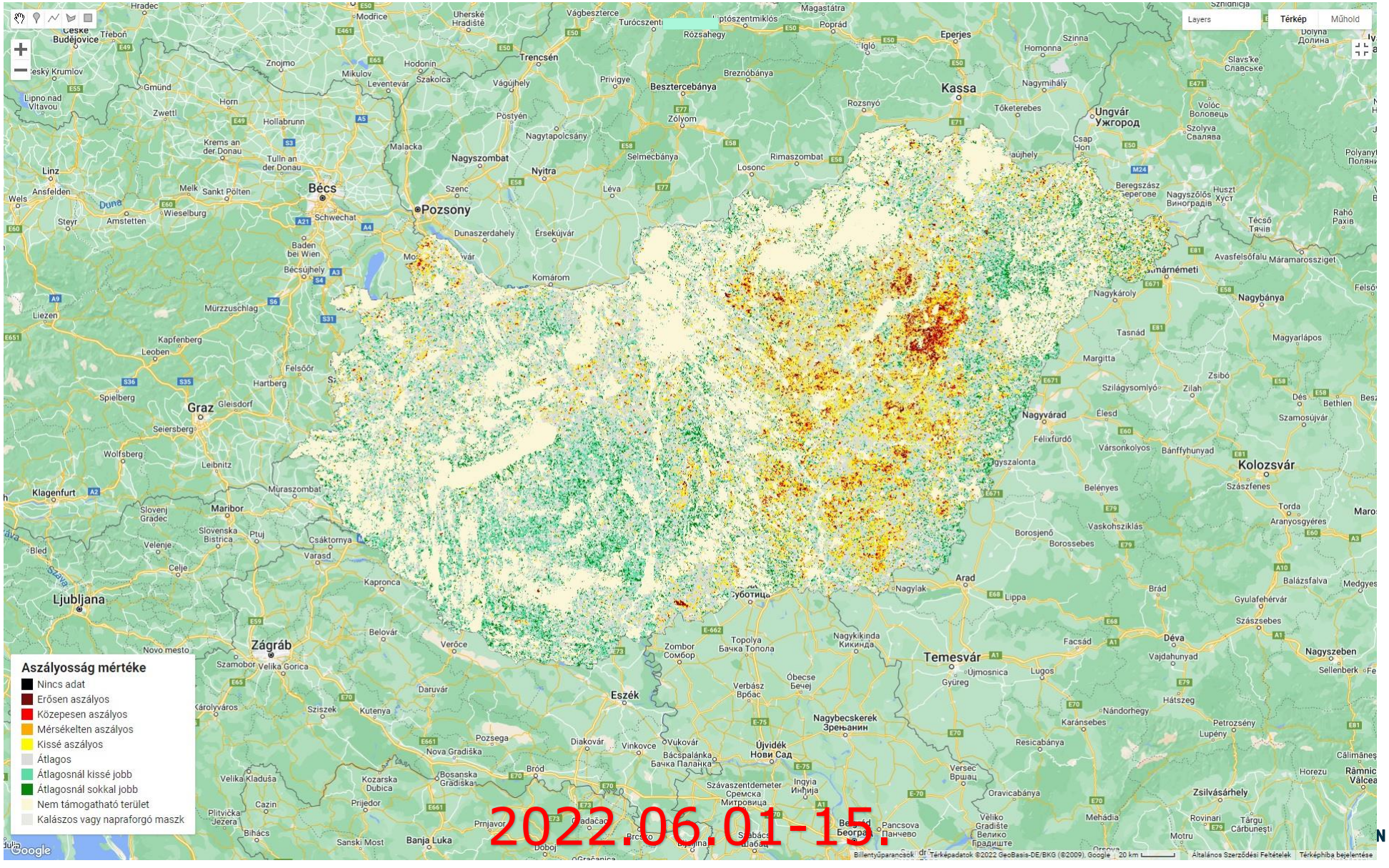

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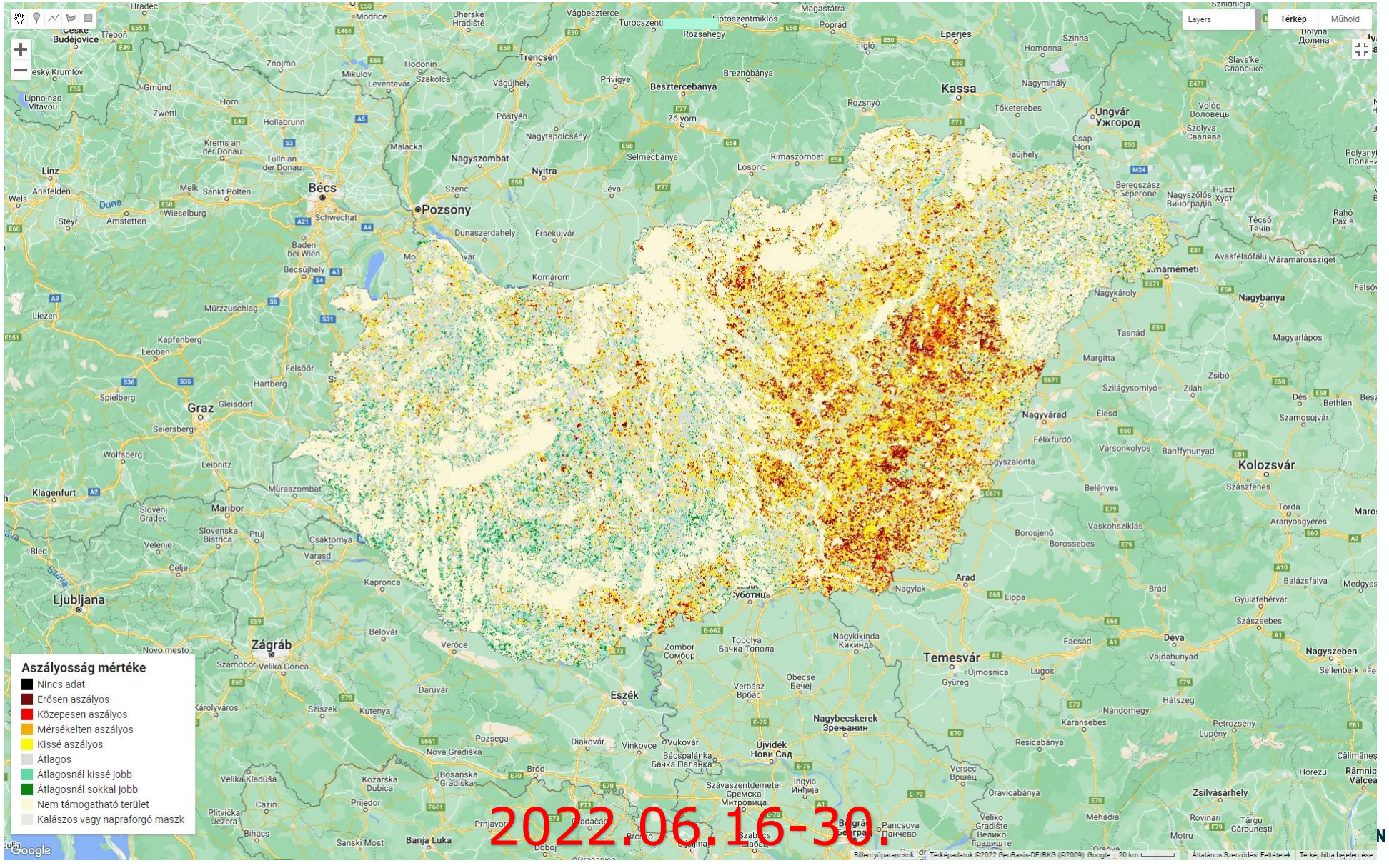

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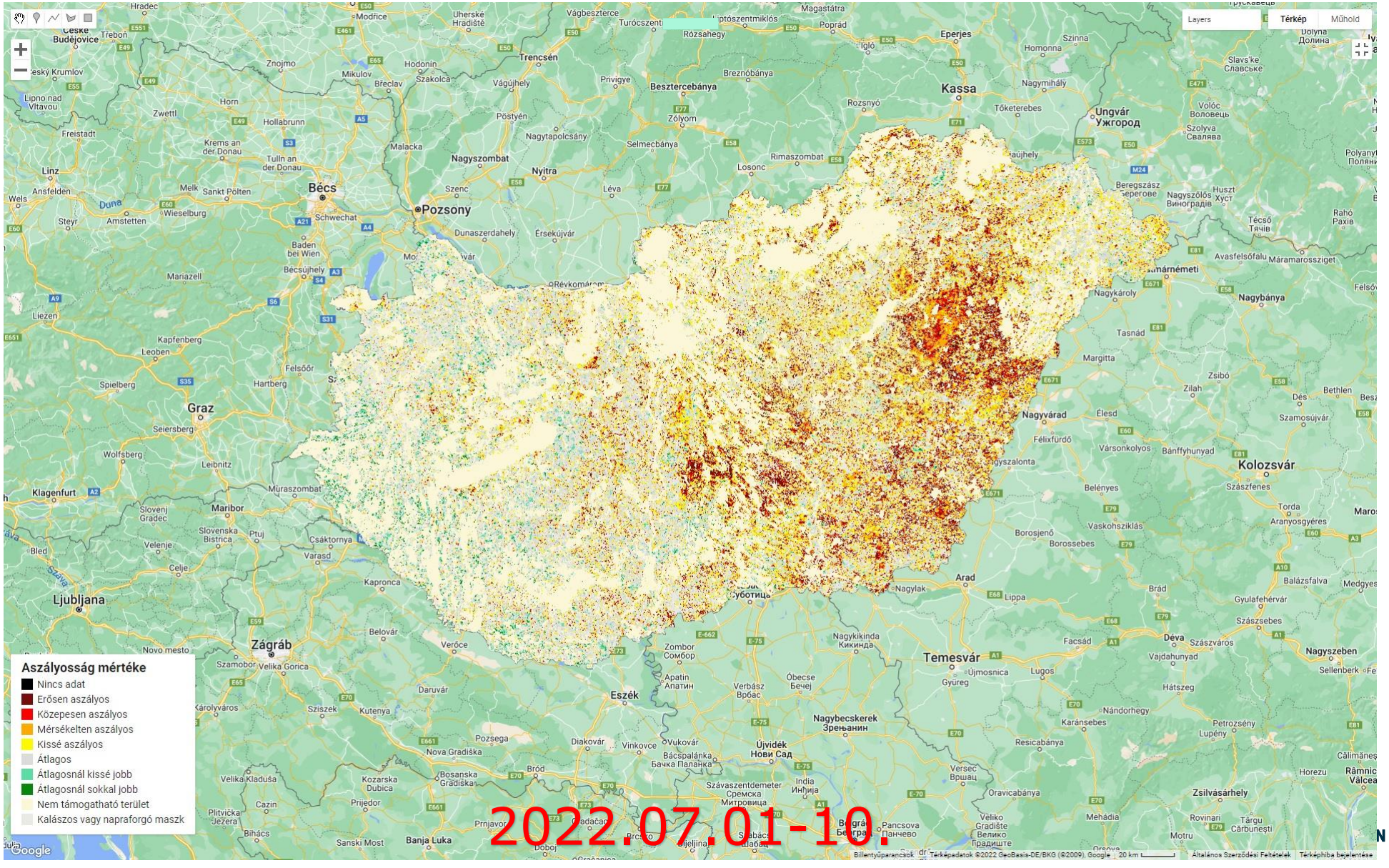

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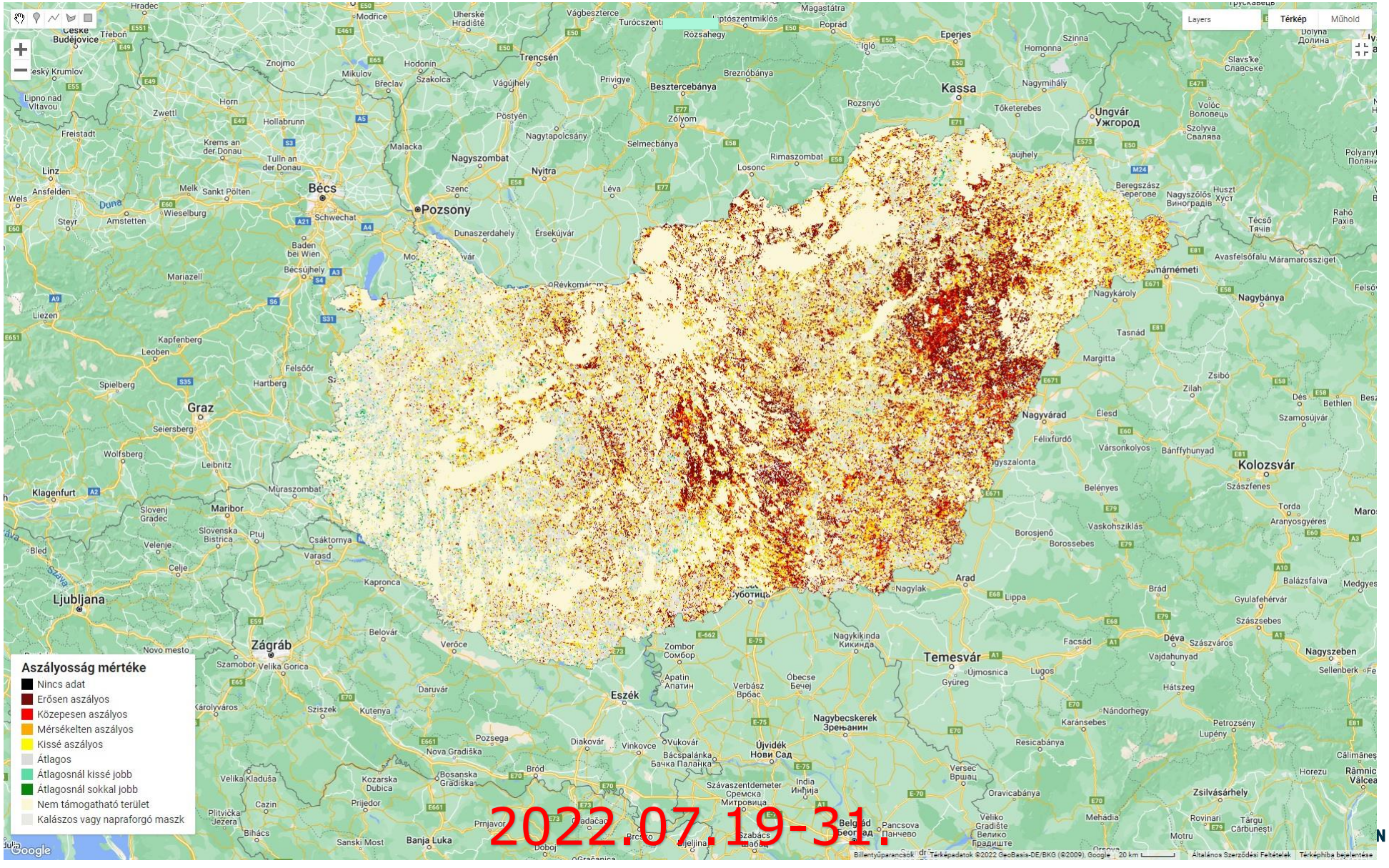
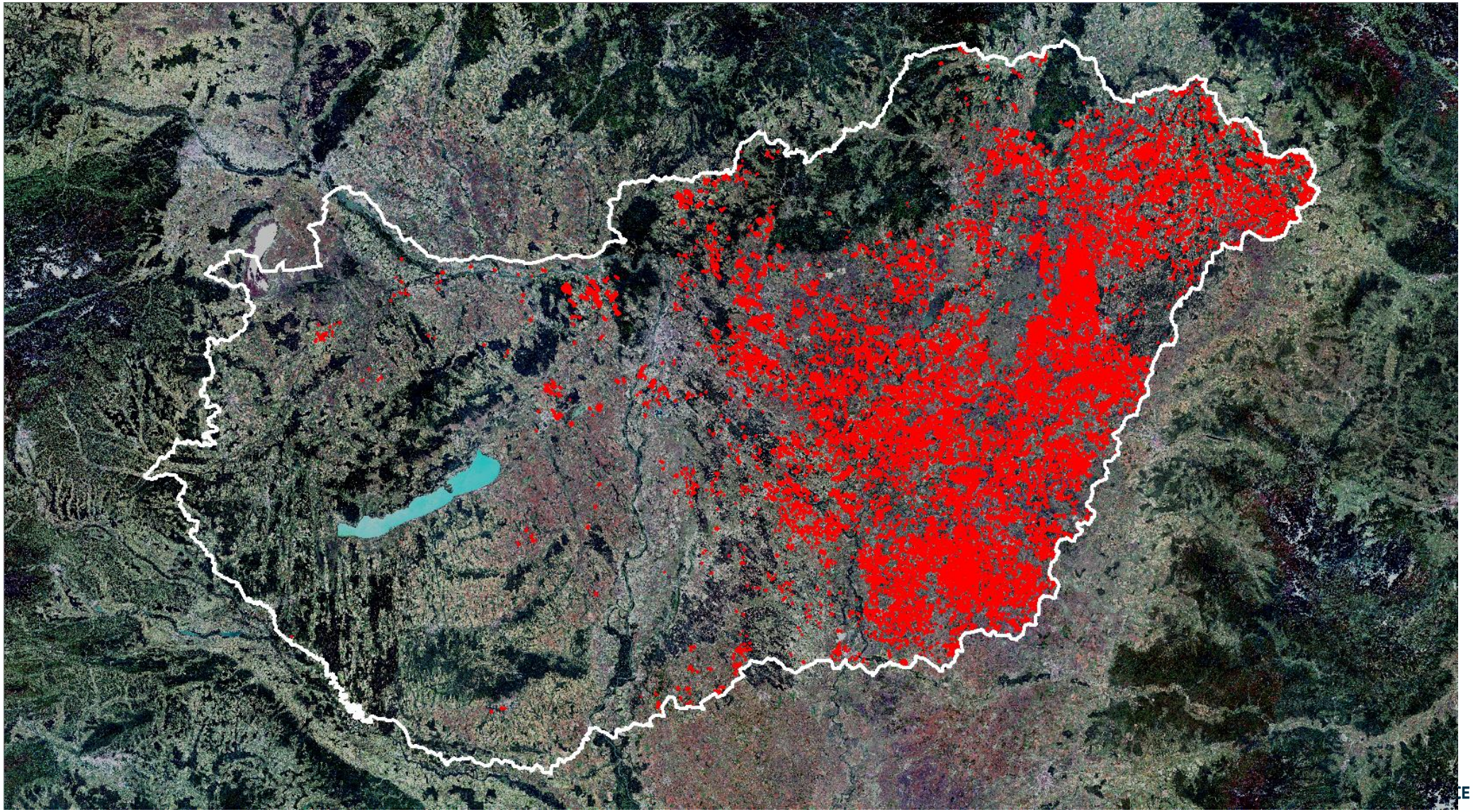


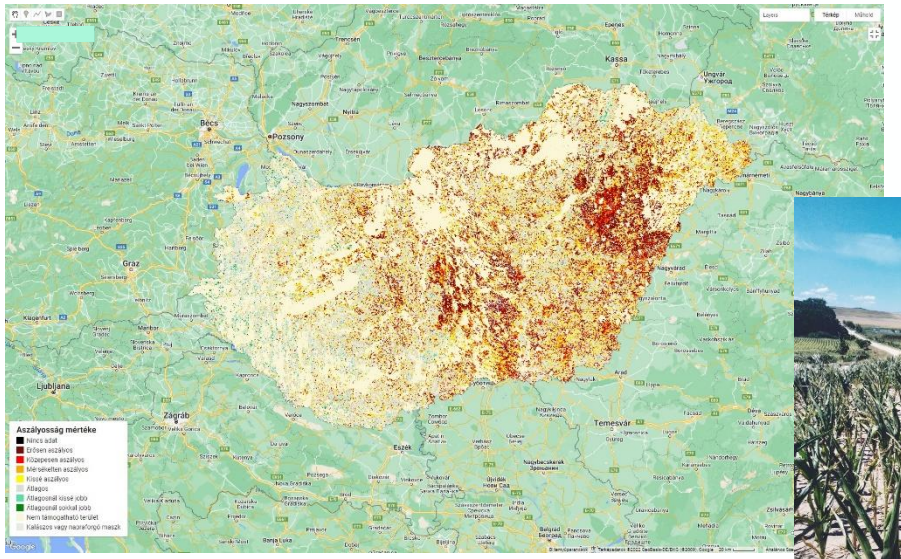
Agricultural Risk Management System (MKR)

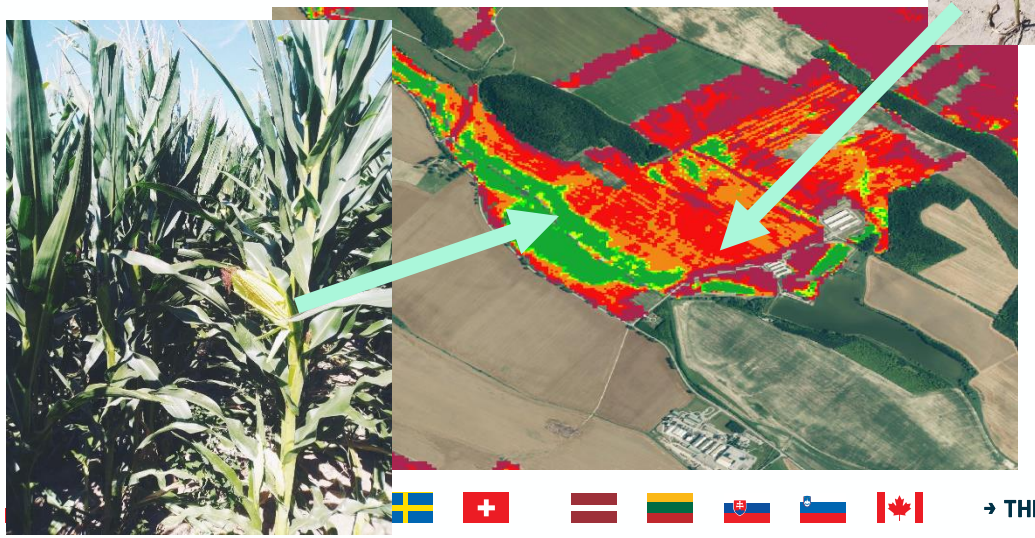
Farmers' drough compensation claims as of 30/07/2022



Agricultural Risk Management System (MKR)
High-resolution crop condition maps

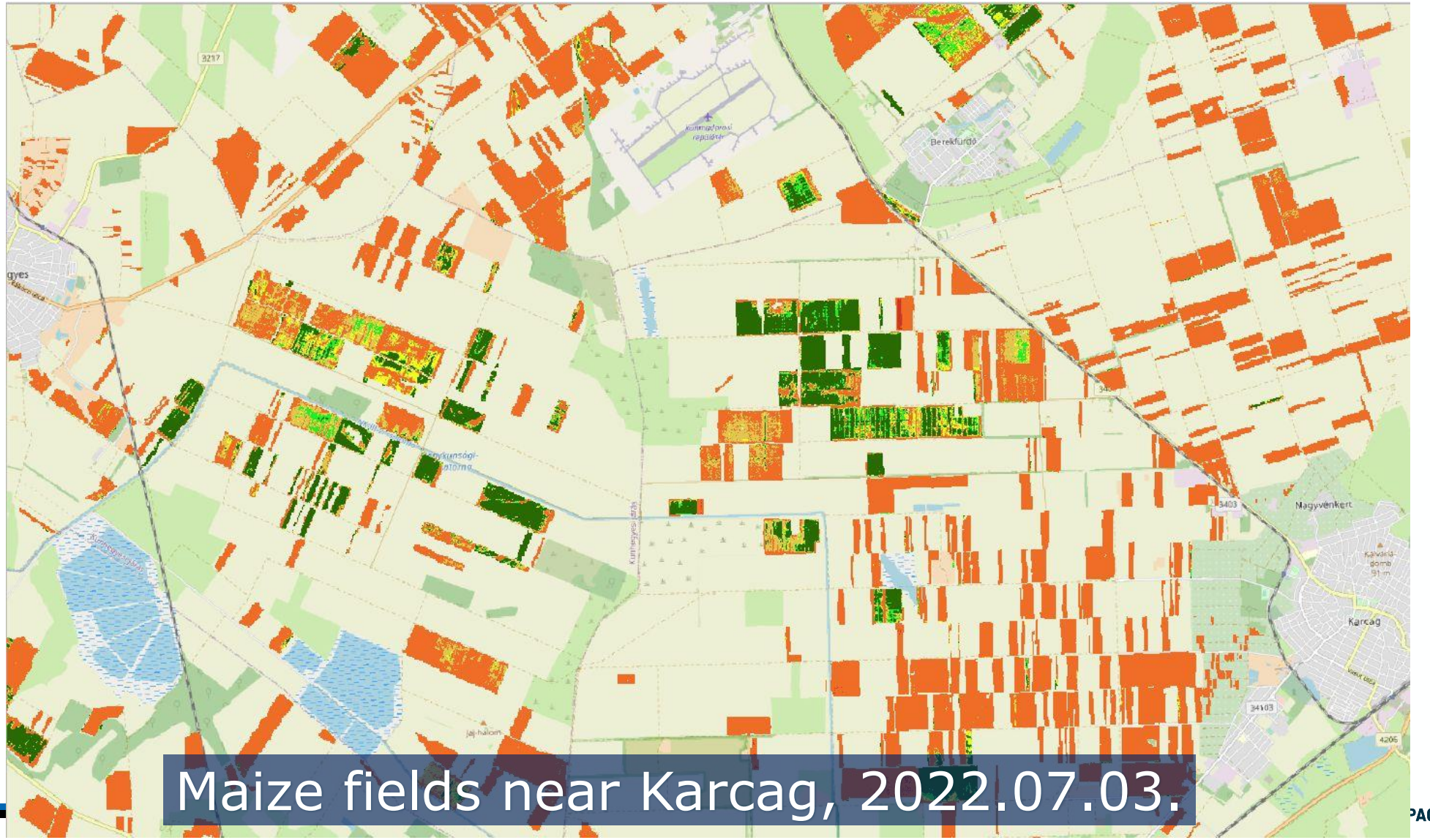
- Authorities asked for emergency help due to the huge number of compensation claims
- New methodology based on Sentinel-2 time series and spectral indices introduced
- Crop- and site-specific anomalies in vegetation vitality (kNDVI, NDVI, EVI), senescence (PSRI) and moisture (NDMI) for multiple time ranges
- Resulting maps instantly provided to authorities for decision support
- Complemented with in situ data collection
- Validation still ongoing, but very positive preliminary feedback from authorities and promising correlation with field results





Agricultural Risk Management System (MKR)

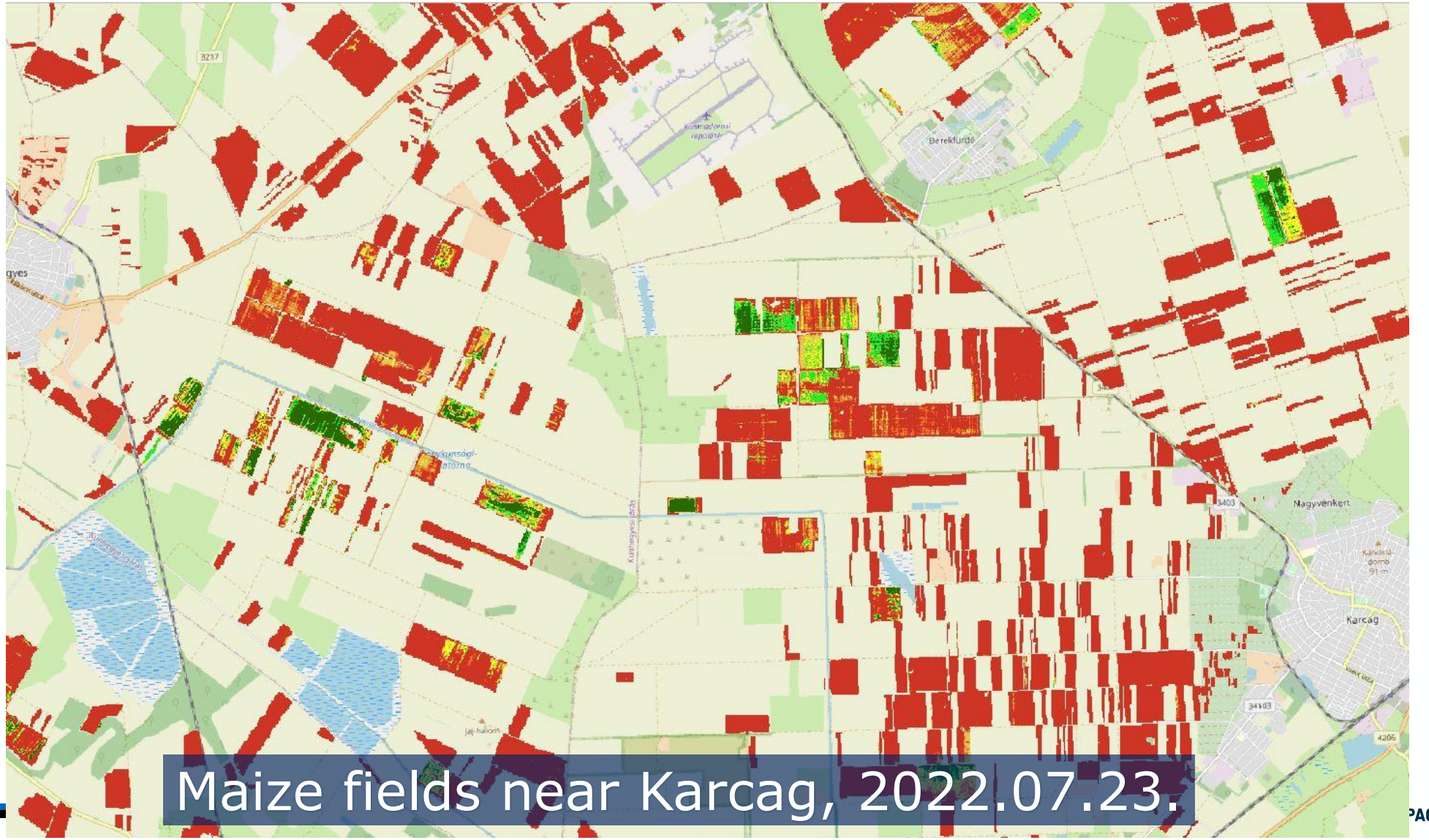
High-resolution crop condition maps



Maize fields near Karcag, 2022.07.03.

Agricultural Risk Management System (MKR)

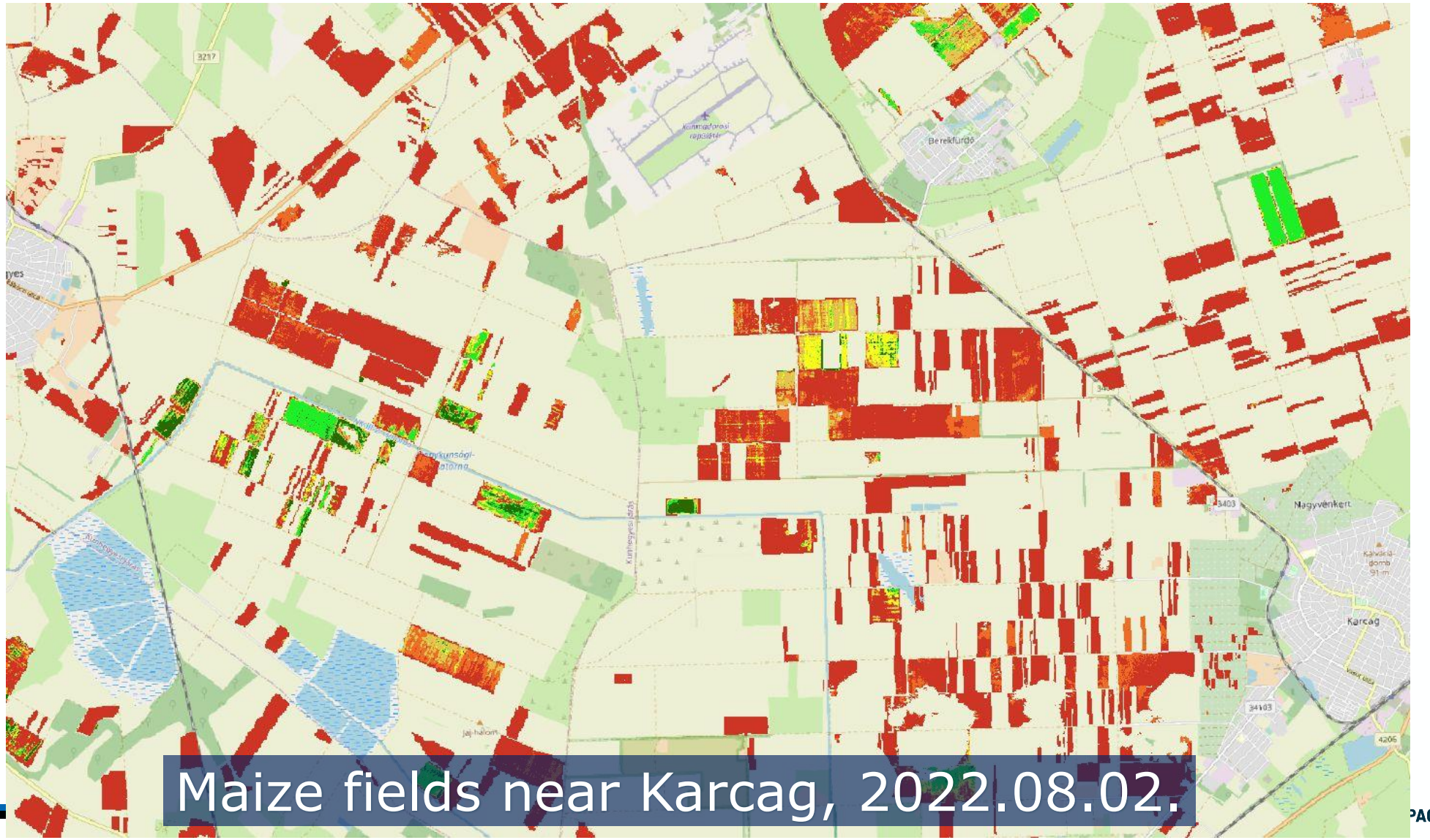
High-resolution crop condition maps



Maize fields near Karcag, 2022.07.23.

Agricultural Risk Management System (MKR)

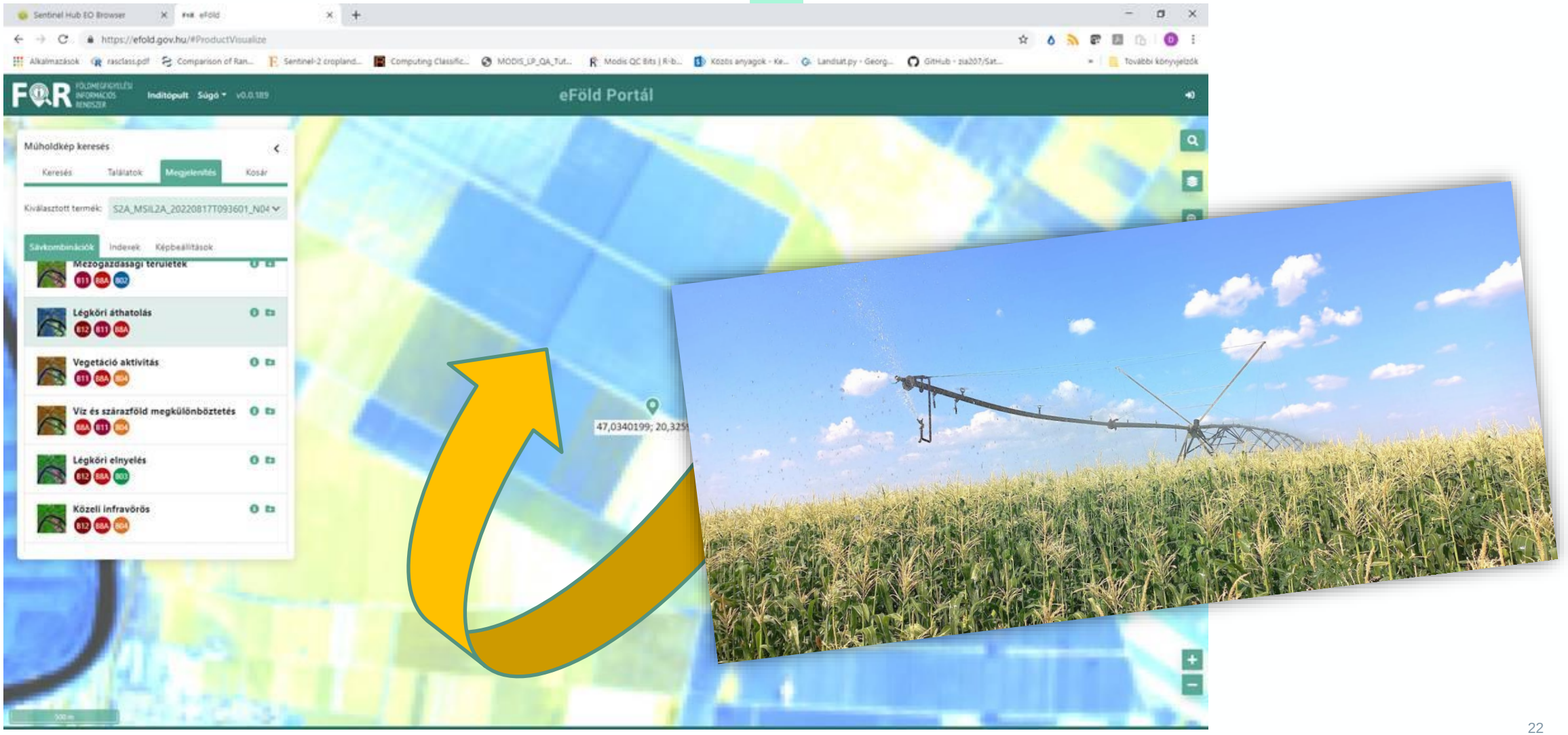
High-resolution crop condition maps



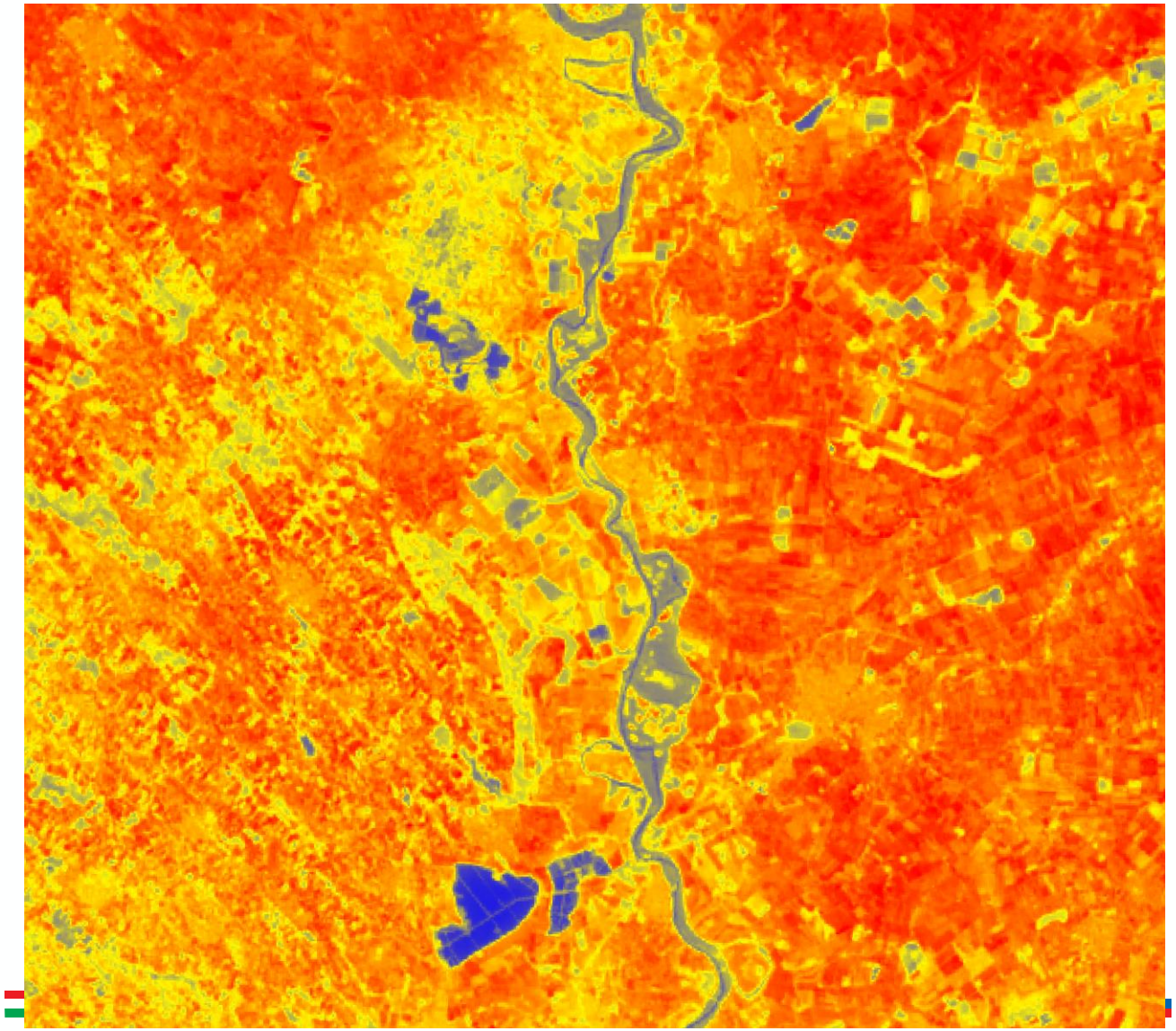
Maize fields near Karcag, 2022.08.02.

Agricultural Risk Management System (MKR)

Irrigation at the time of Sentinel-2 overpass



Land surface temperature from Landsat satellite image (2022.06.30.)



25 40 55

Felszíni hőmérséklet [°C]

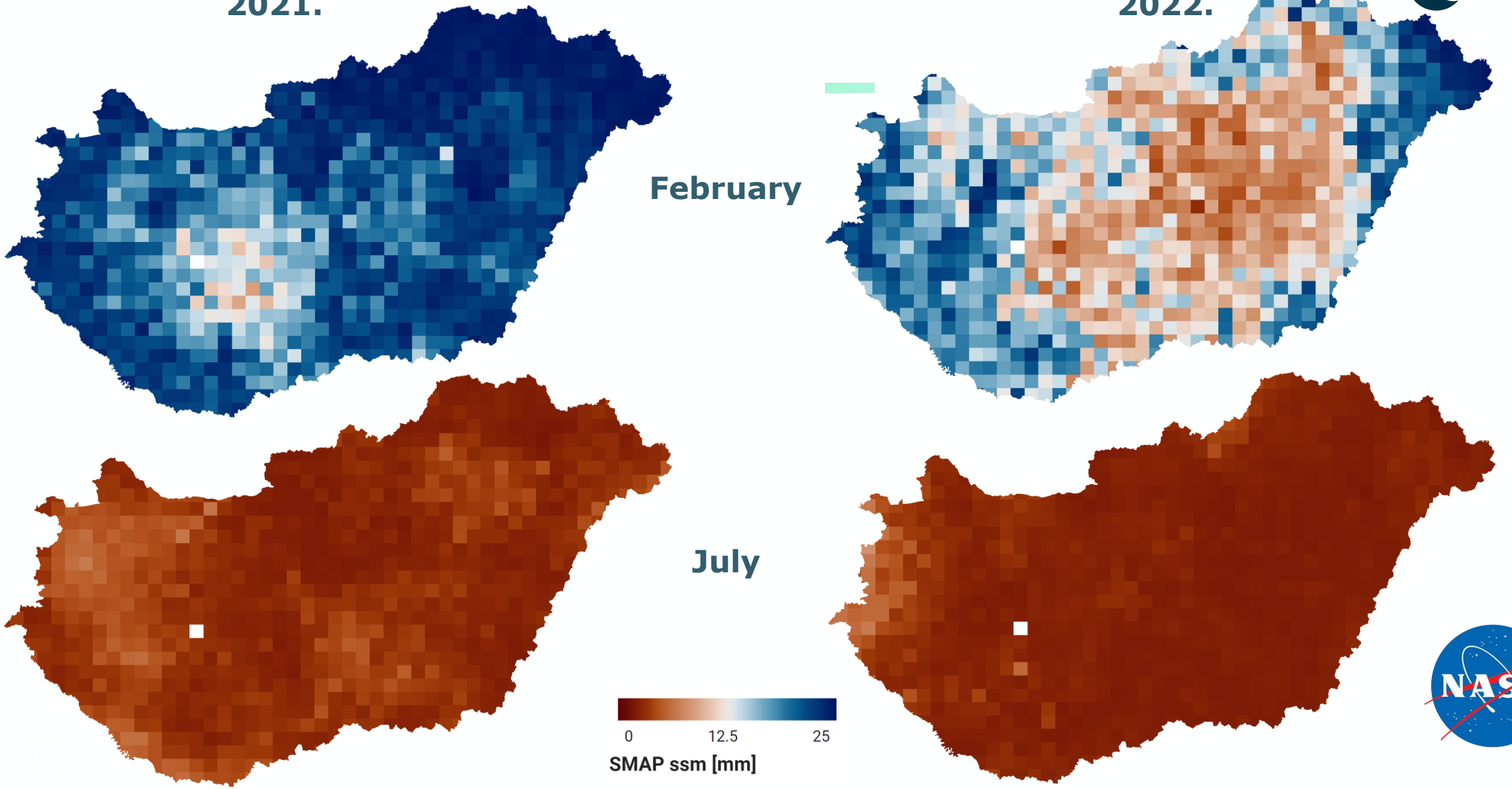
SMAP soil moisture

2021.

2022.

February

July



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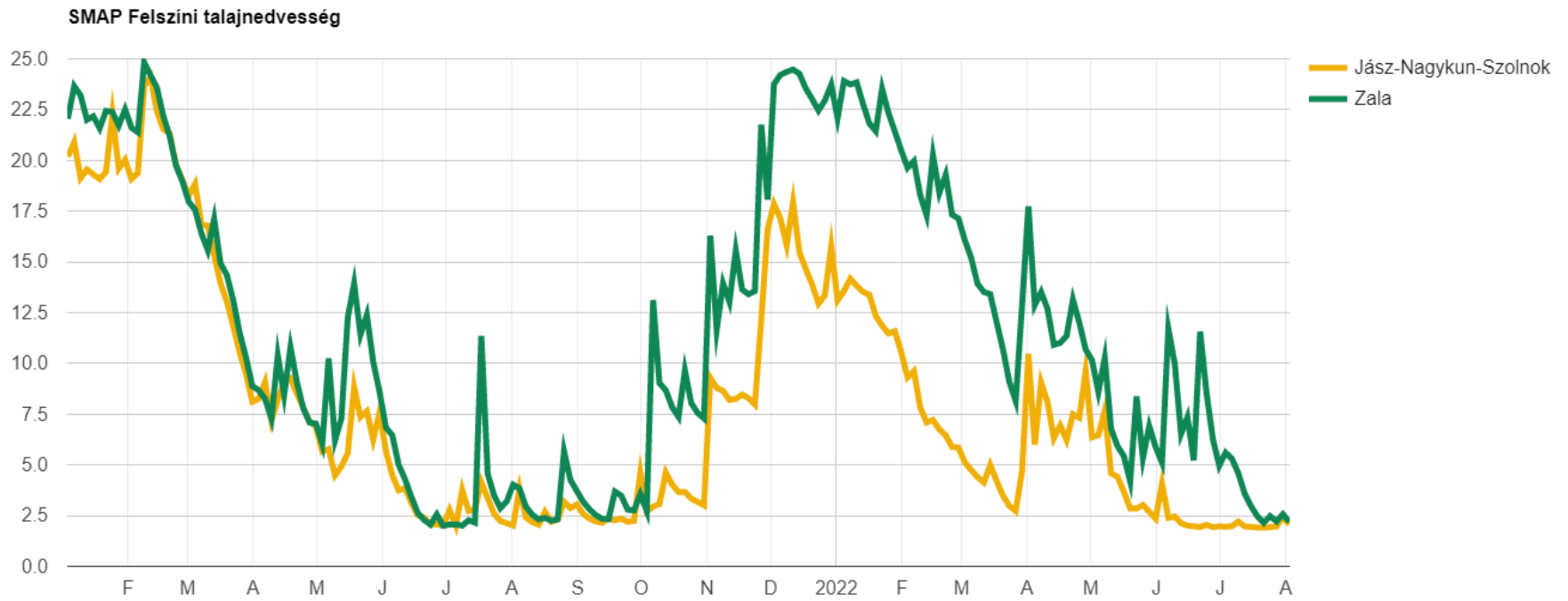
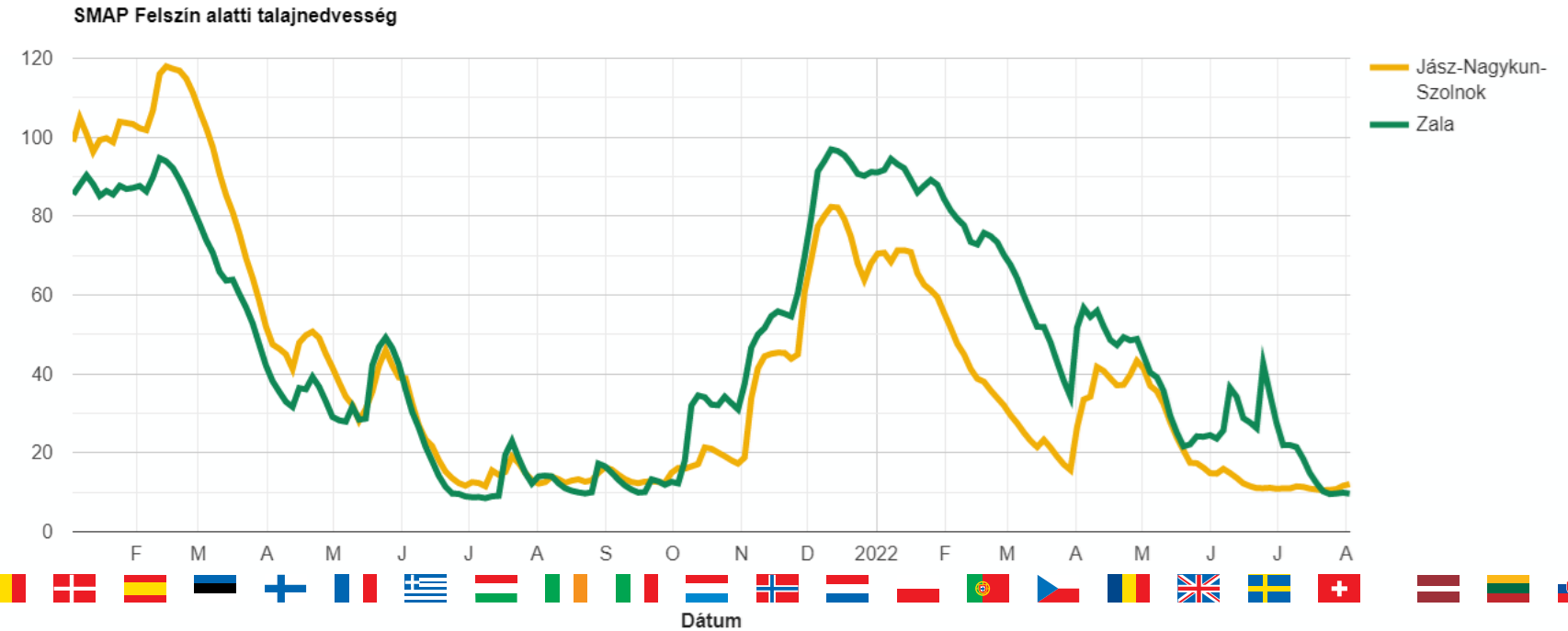




DANUBE DATA CUBE

A Regional Data Exploitation Platform

The DDC project

DANUBE DATA CUBE

www.danubedatacube.com

The Danube Data Cube consortium works as part of the Euro Data Cube project:

esa

EURO DATA CUBE

SINERGISE

Sinergise Ltd, Slovenia (Lead Partner EDC)

MATE

Hungarian University of Agriculture and Life Sciences, Hungary (Lead Partner DDC)

CropOM

CropOM, Austria

EOX

EOX IT Services, Austria

HUNGARIAN METEOROLOGICAL SERVICE

Hungarian Meteorological Service, Hungary

CAR | INSTITUTE FOR SOIL SCIENCES

Institute for Soil Sciences, Centre for Agricultural Research, Hungary

LECHNER TUDÁSKÖZPONT

Lechner Knowledge Centre, Hungary

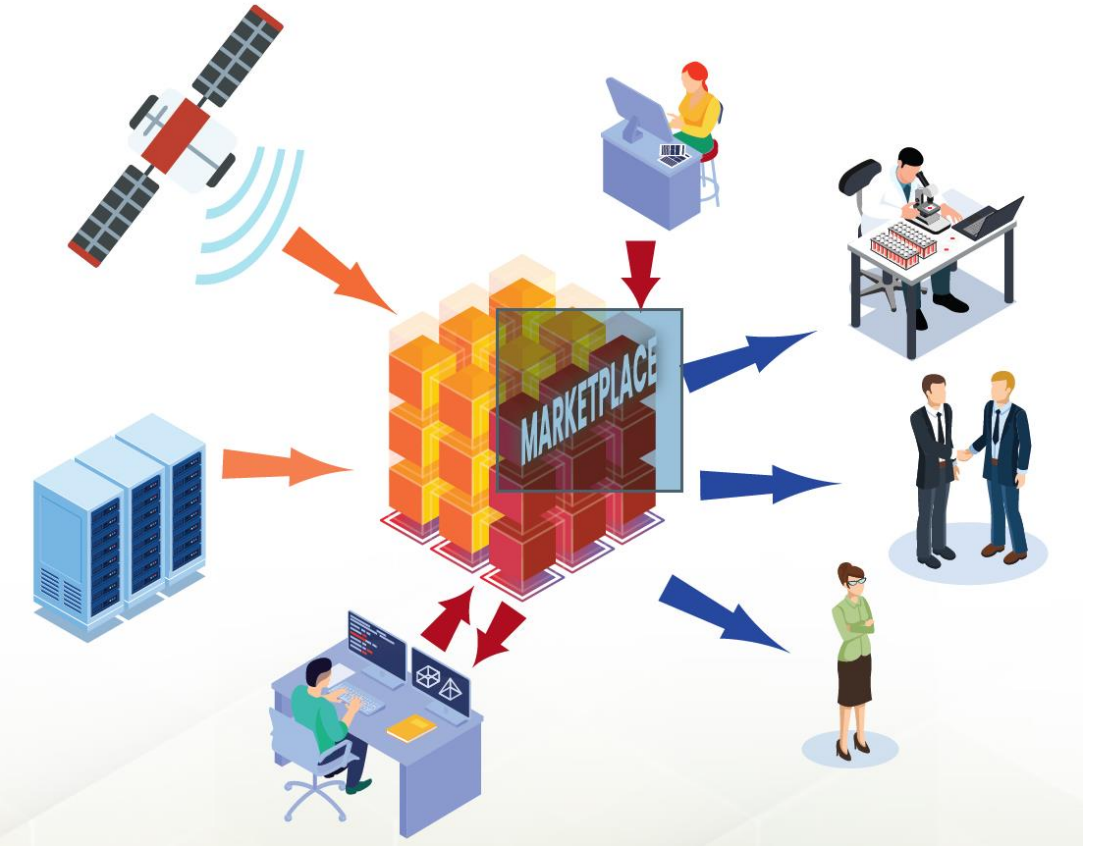
University of Szeged, Hungary

4iG

4iG, Hungary

What is Danube Data Cube?

- Cloud-based data exploitation platform with data, ML and analytical tools
- Data cube technology and synergy between EO, GIS and Geophysical data
- Reflects the Digital Twin Earth concept of ESA to support sustainable development
- Support for two types of users:
  - Users for value added information (agriculture, water management etc.)
  - Service developers deploying value-added services on the platform



DDC Services

Three main components:

1. Regional Data Service
2. Regional Use Case (Drought Explorer)
3. Field-level Use Case (AquaCrop)

The Regional Data Service

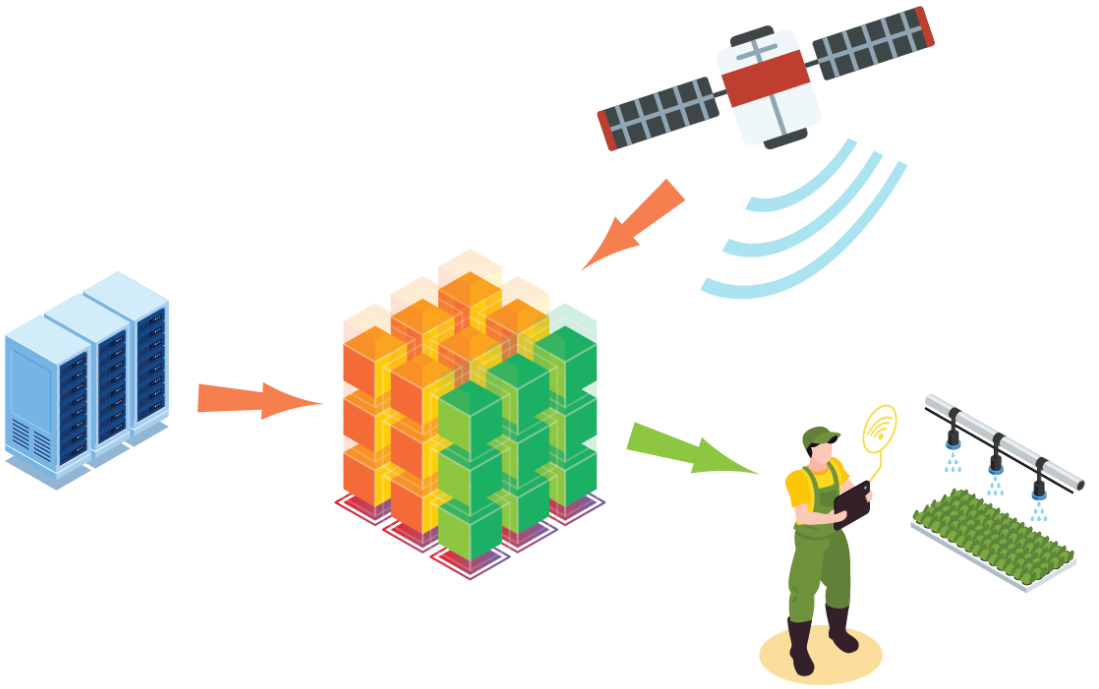
- Services for value adders and app developers for seamless data access, dynamic data gathering, storage & compute services, essential GIS functionalities
- **AOI Manager** for creating and storing custom geometries e.g. agricultural parcells
- **Dynamic Data Cube** for automatically gathering, storing and updating user defined data cubes
- **Third-party API services** for accessing sensitive data e.g. Cadastre geometries
- Users can focus on their domain and application rather than data gathering and processing
- **DDC Marketplace** for datasets and applications to be sold

The Regional Use Case – Drought Explorer

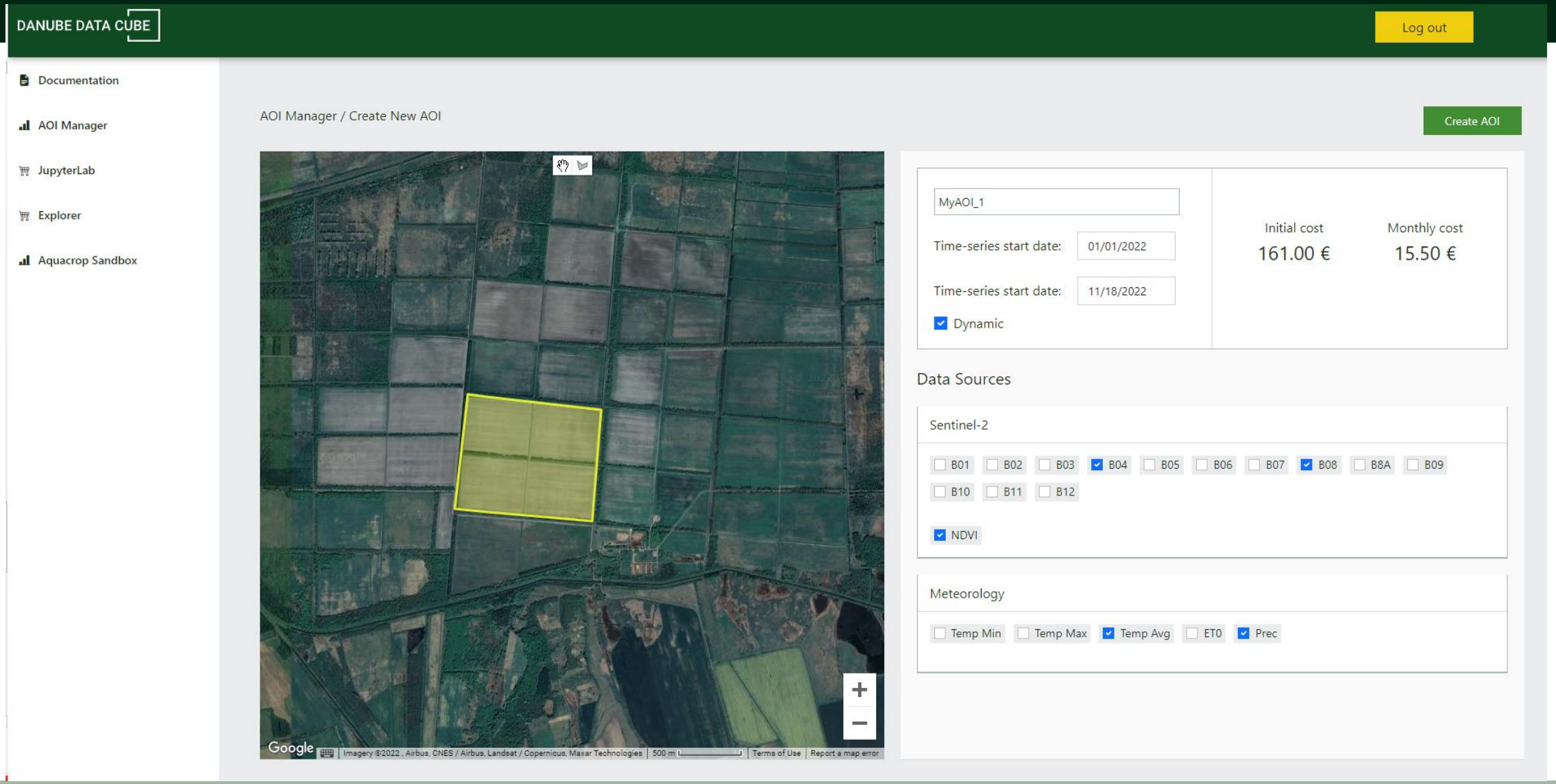
- A regional use case demonstrating the capabilities of apps deployed on DDC and also serving as a drought analysis tool
- Web GIS interface with satellite and meteorological time series and derived indices
- Interactive visualization
- Helps to investigate the development of drought over time and detect spatial and temporal patterns

The Field-level Use Case – AquaCrop Sandbox

- Online, interactive irrigation planning tool
- Historical and prediction data to test irrigation strategies
- Using the Dynamic Data Cube service and the FAO's AquaCrop model to run „what-if" scenarios
- The sandbox provides precise biomass and yield forecast based on the given irrigation schedule and user defined parameters

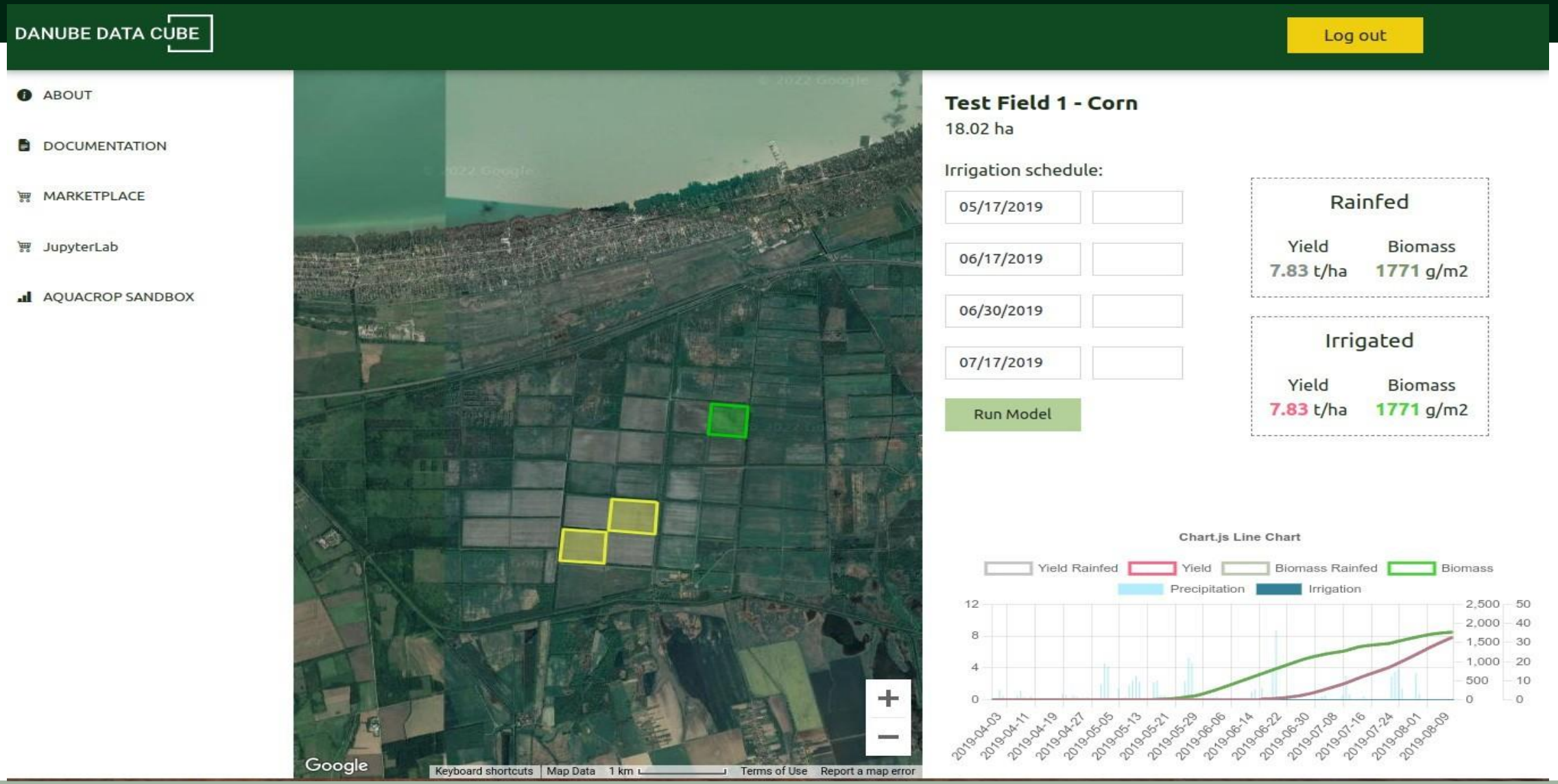


AOI Manager

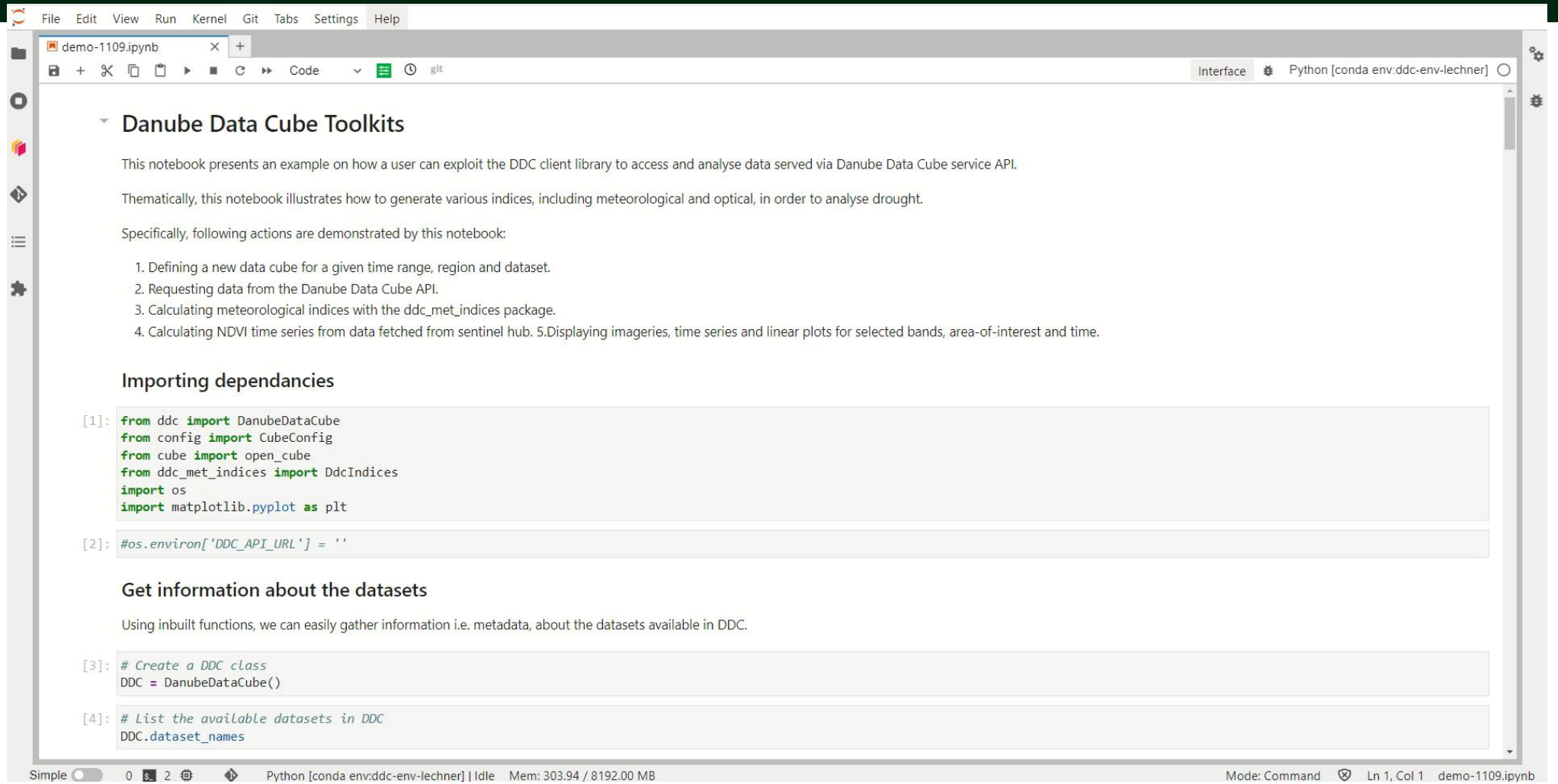


DDC

AquaCrop Sandbox



Integrated Jupyter Lab



DDC

THANK YOU!

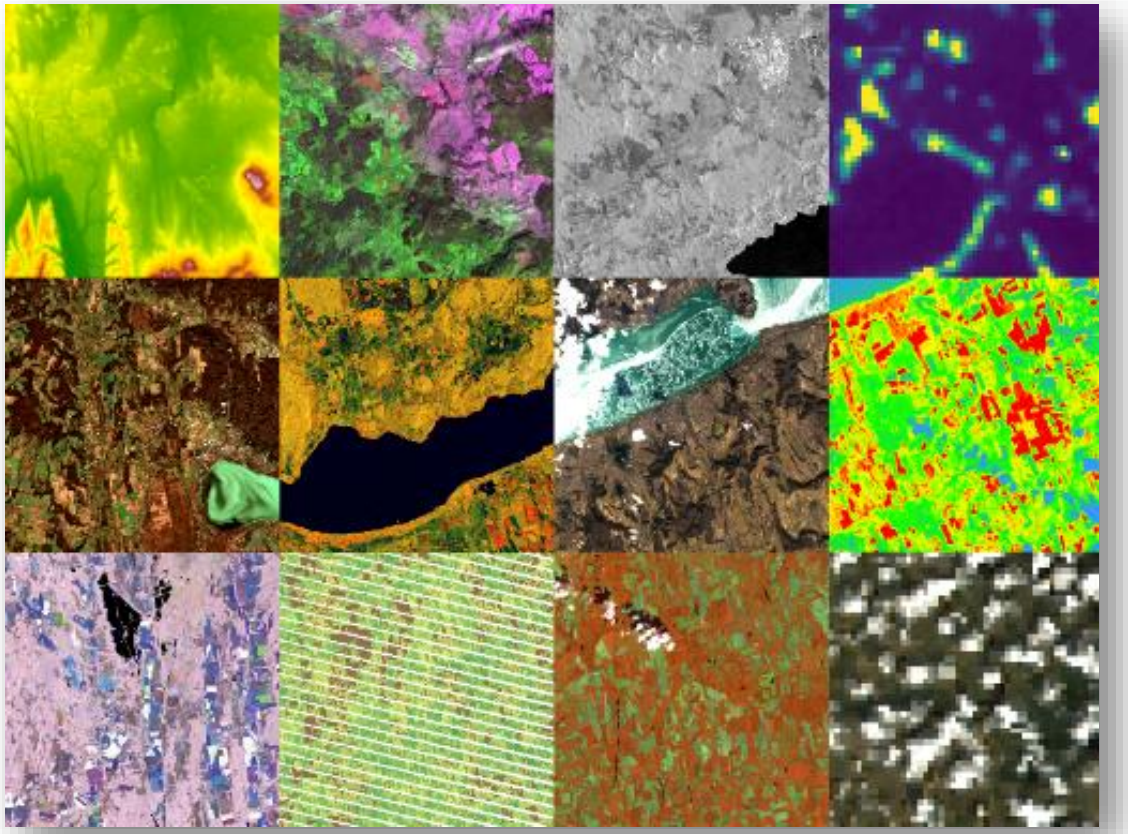
Dániel Kristóf

head of Earth Observation Department

Lechner Knowledge Centre

e-mail: daniel.kristof@lechnerkozpont.hu

mobile: +36 20 341 7079



Contributors: Edina Birinyi, Bálint Alföldy, Gábor Mikus, András Sik