Drought Monitoring in Hungary
Early Warning and Decision Support

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(OVF)
Hungary

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Kick-off meeting of the Network of Drought Observatories in the EU

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CLIMATE CHANGE – DROUGHT Tendencies

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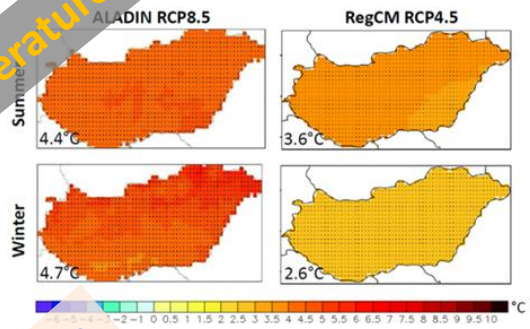
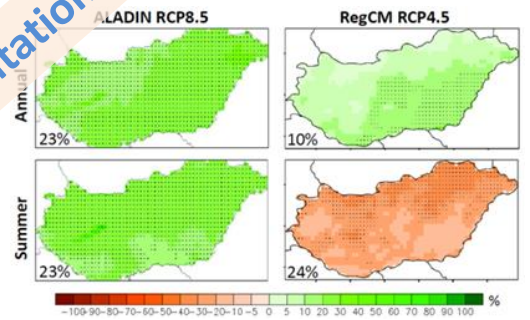
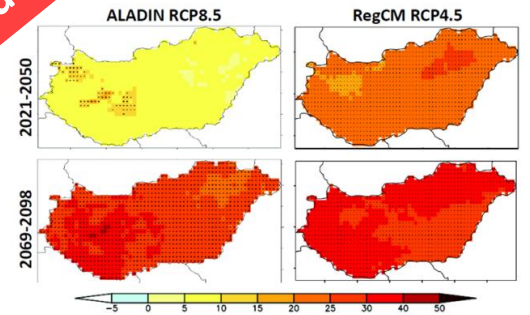
temperature

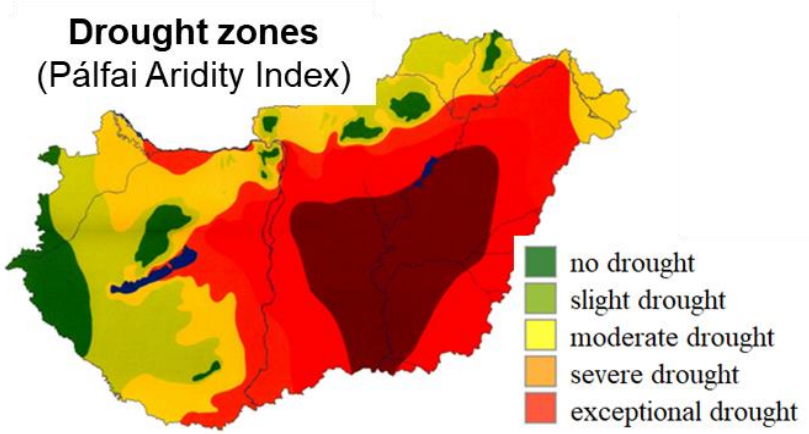


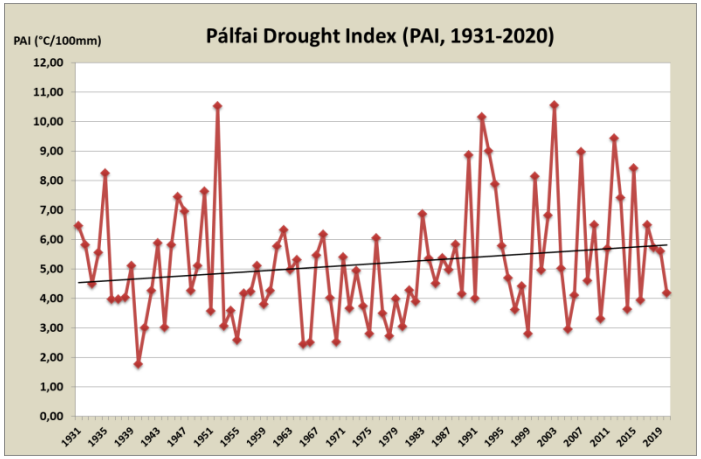
precipitation



hot days







frequency
severity
duration

of droughts
&
drought damage

PROBLEMS and ANSWERS

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- Increasing drought damage in agriculture
- Increasing competition for water among sectors
- Lowering of groundwater levels
- Decreasing water flow in rivers, water courses – degradation of ecosystems, water quality problems
- Irrigation from groundwater resources

- **drought monitoring**
- regional water transfer
- water retention
- water storage (reservoirs, rivers, watercourses etc.)
- water saving technologies
- protection of groundwater resources
- irrigation development
  - restoration of irrigation systems
- agricultural risk management system
- farmers' irrigation associations
- increase water efficiency
- soil protection, fight against erosion by cover crops, water storage in the soil
- reuse of treated wastewater
- …

Act on water management – task sharing

Water management (OVF and 12 regional directorates)
- water service, regional water transfers, inventory of water resources, determining available water resources, operating and maintenance of irrigation systems, damage control

Water authority (Directorate of Disaster Management)
- licensing, control, sanction and administration of water resource fee

Damage control

- lack of water or surplus of water - responsibility of the state
- among others: irrigation water demands, drought prevention and management.

10/1997 regulation on excess water and flood control
After amendment in 2021:

- water shortage management plans – obligation and content for directorate and districts
- criteria for ordering levels of damage prevention,
- measures to be taken at each level

DROUGHT MANAGEMENT CONCEPT

OPERATIONAL DROUGHT AND WATER SCARCITY MANAGEMENT SYSTEM

Observation/measurement

- Monitoring network
- GPRS remote system
- Database (OVF)
- Web-based platform, queries

Evaluation

- Daily drought index (HDI)
- Measured soil moisture
- Evaluation of water shortage based on measured data

Interventions

- Government assistance
- Preventive interventions (water damage control)
- Alarm system (I., II., III. levels + extreme)
- Water restrictions, water regulation, irrigation support

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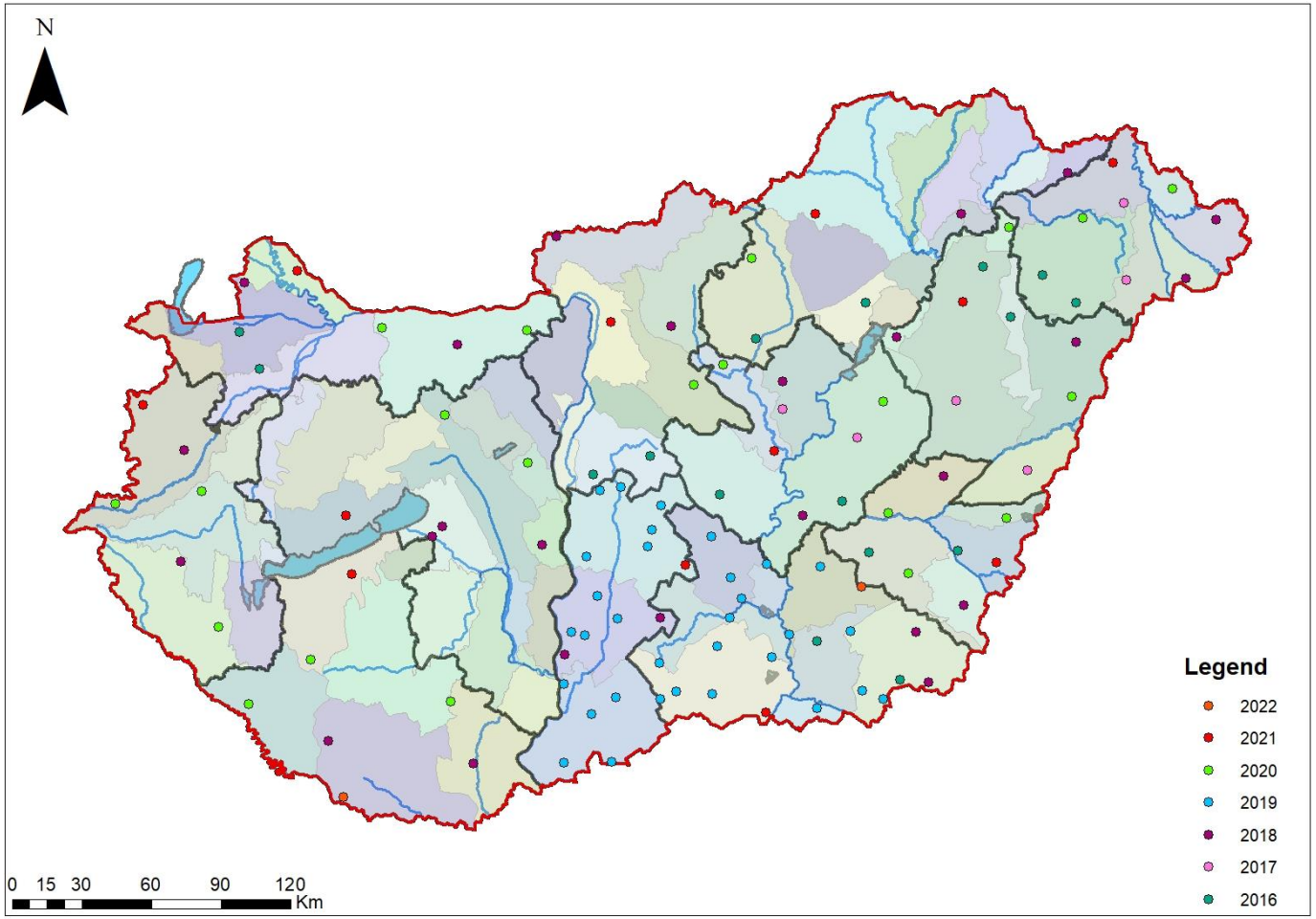
MONITORING NETWORK - DEVELOPMENT



YR	Nr	Status
2022	14	PLANNED
Current	**114**	OPERATING
2022	2	
2021	12	
2020	21	
2019	32	
2018	25	
2017	6	
2016	16	

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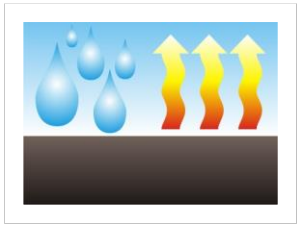
HUNGARIAN DROUGHT INDEX

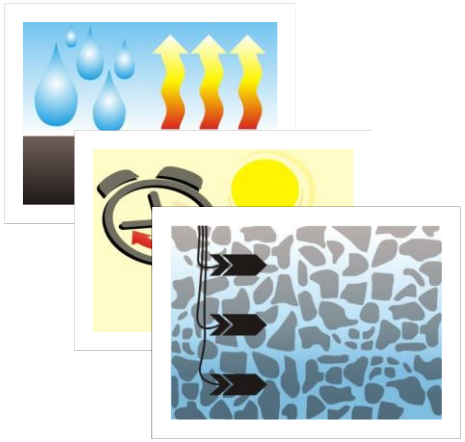


HDI_0

$HDI_0 * S$

HDI_S

$HDI_S * K$



HDI

- <u>water balance calculation</u>
- actual (daily)
  - ✓ precipitation sum
  - ✓ mean temperature
- and their long time average

meteorological/hydrological index

- <u>length of extreme periods</u>
  - actual (daily)
    - ✓ precipitation sum
    - ✓ mean temperature

meteorological index

- <u>soil moisture condition</u>
- actual (daily)
  - ✓ soil moisture
  - ✓ soil parameters
- **combined index**

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MEASUREMENTS, SERVICES

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	Above soil		In soil		Comm/power		Services
	air temperature		soil moisture		Core unit		**HDI, HDI0, HDIs (drought indices)**
	precipitation		Soil temperature		GSM/GPRS		**Evaporation**
	leaf surface moisture		in 6 depth (10, 20, 30, 45, 60, 75 cm)		Solar panel		**Field capacity**
	relative humidity						**Water deficit / surplus**

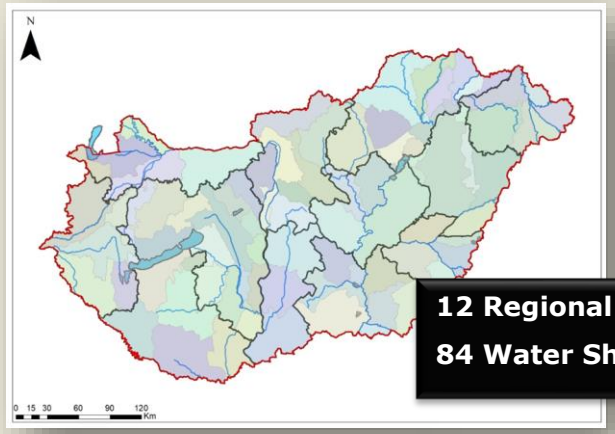
DAMAGE PREVENTION

DROUGHT DATA FROM DWMS

- **Hungarian drought index corrected with stress factor HDIs**

ADD. INFO OF WATER DIRECTORATE

- **hydromet**
- **water resources**
- **water demand**
- **forecast**

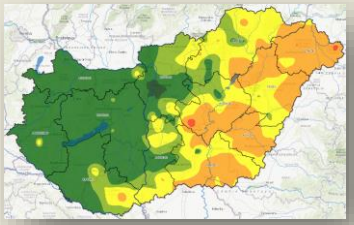


12 Regional Water Directorates

84 Water Shortage Districts

DROUGHT LEVEL

- **no drought**
- **mild drought**
- **moderate drought**
- **severe drought**
- **extreme drought**



DROUGHT DAMAGE PREVENTION LEVEL

- **alert level I.**
- **alert level II.**
- **alert level III.**
- **exceptional**

- **removing obstacles to the free flow of water**
- **water pumping by pumping stations/mobile pumps**
- **water retention**
- **water transfer**
- **water restrictions**
- **etc**

MEASURES

approval by OVF

APPROVAL OF FINANCE

- **Ministry of Interior**
- **Ministry of Finance**

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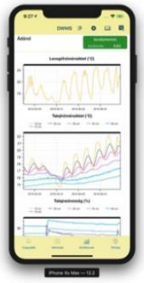
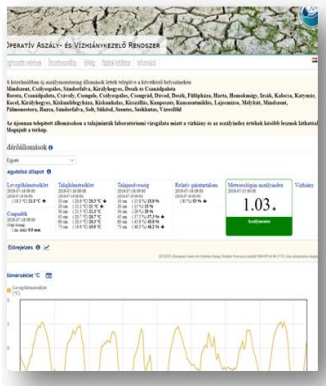
DATA MANAGEMENT

Data management

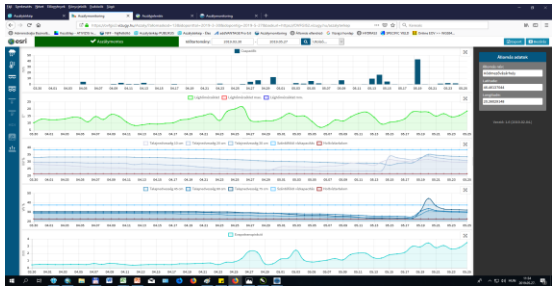
- **Data policy:** Providing measured and calculated data free of charge
- **Hungarian Hydrological Database, Hungarian Hydrological Forecasting Service**: regular data check, validation, controlling absence of data, alarm maintenance

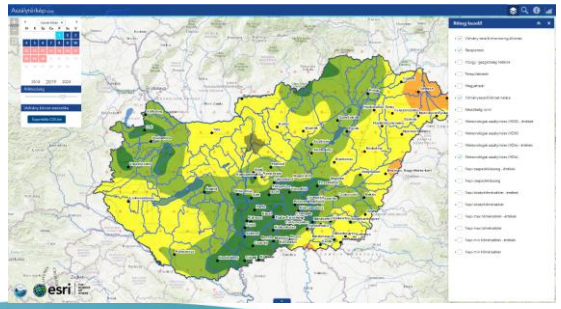




Publication

- https://vizhiany.vizugy.hu/
- http://aszalymonitoring.vizugy.hu/
- DWMS mobile app





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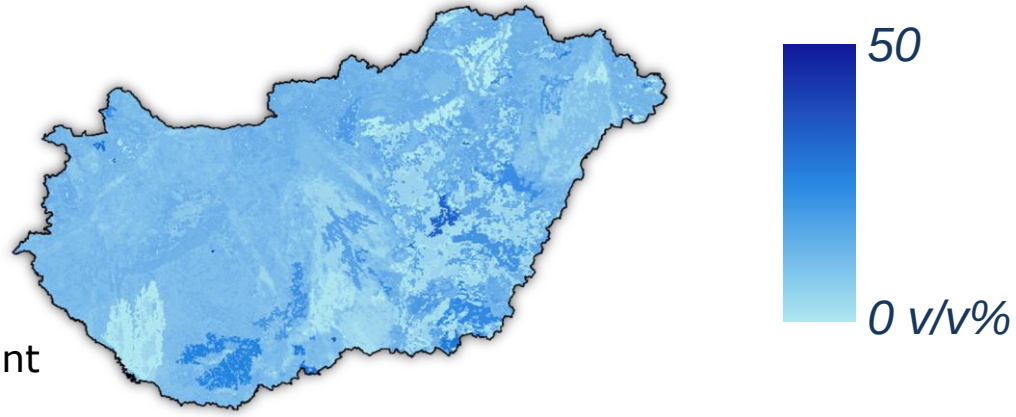
FUTURE DEVELOPMENTS

- **Further development of monitoring network**
  - State network
  - Potential additional stations (farmers)
- Further integration into current legislation
- Facilitating further national and international cooperation, relations
- Upgrading the software
  - Dynamic queries
  - International indices
  - Remote sensing indices
  - **Soilmoisture model**
    - Drought monitoring
    - Irrigation support
    - Water resource management
    - Excess water forecasting



National soil moisture map (1x1 km)

Variable input parameters: precipitation, temperature, evaporation
Fixed input paameters: terrain, saturation, field capacity, wilting point
Resolution: 1x1 km
Software: MIKE SHE
Control data: ***112 monitoring stations (672 sensors)***

Planning early is key to achieving drought resilience

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