Monitoring vegetation activity in Hungary using Direct Broadcast MODIS data

Anikó Kern[1]

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[3] MTA-ELTE Research Group for Geology, Geophysics and Space science

The HRPT - MODIS receiving station at Budapest

Foundation: 2002

Location: Eötvös Loránd University, Budapest, Hungary

Since 2004:

⇨ Direct Broadcast MODIS data of satellite Terra and Aqua

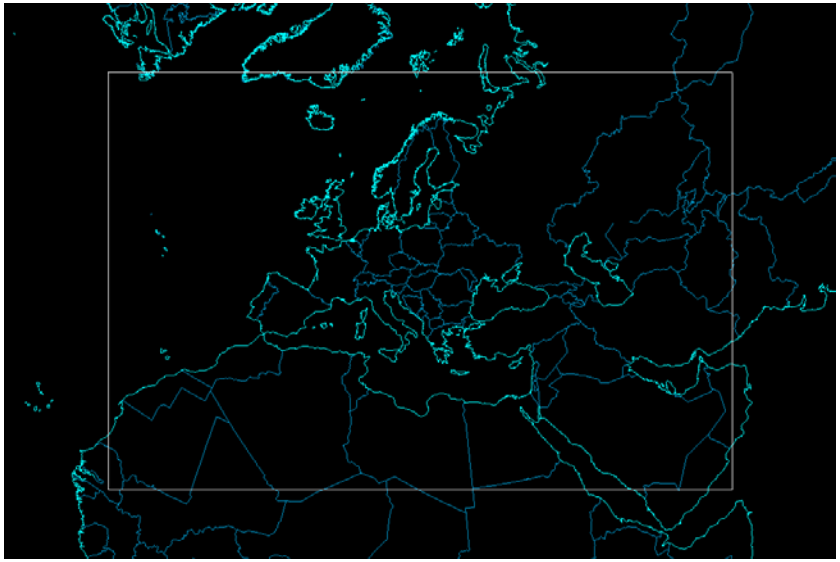
(+ earlier: data of Chibis and Relec measuring electromagnetic waves of megnetosphere)

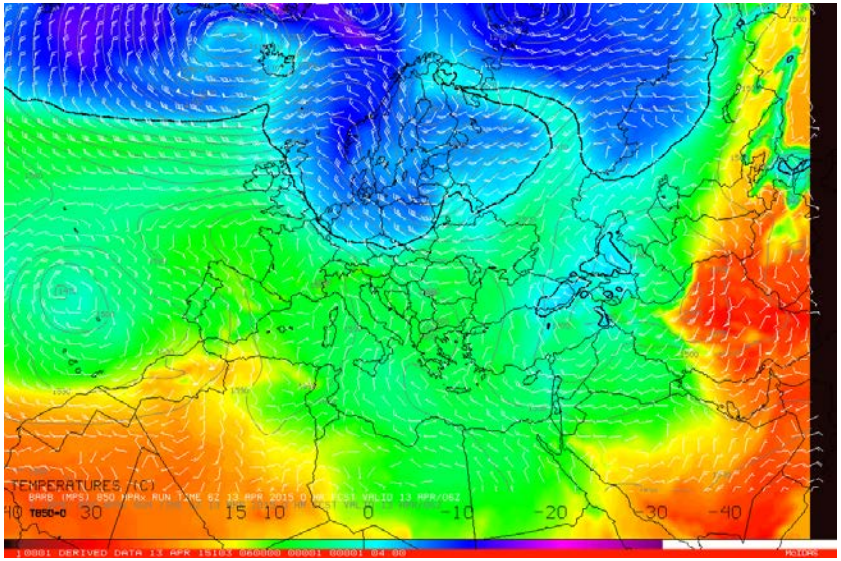
Automatic processing chain for the DB MODIS data

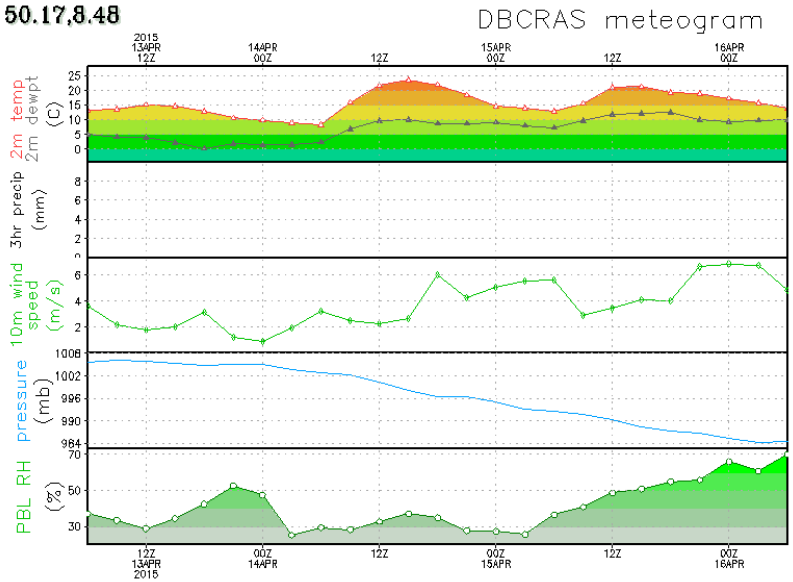
The applied MODIS related software:

(1) SeaDAS MODIS Level1DB Software Package (v1.8)
(2) MODIS Destripe Direct Broadcast Software
(3) IMAPP MODIS Level2 (v3.0)
(4) DBCRAS numerical weather prediction software
(5) + Nested DBCRAS
(6)
(7)
(8)
(9)
(10)

DBCRAS & NDBCRAS







Since 2009…

http://nimbus.elte.hu/kutatas/sat/dbcras-en.html

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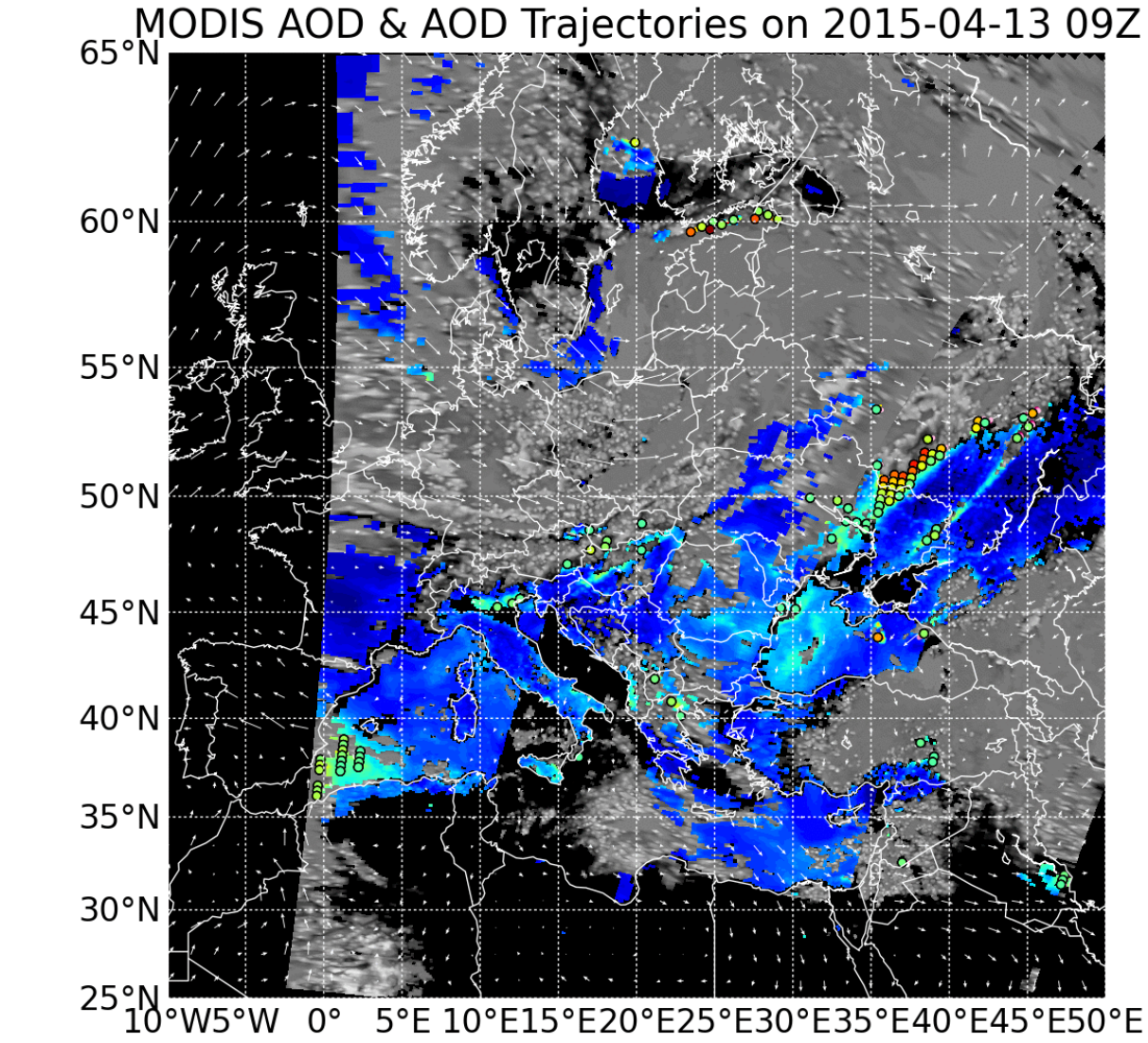
(6) IDEA-I air quality forecast (v1.1)
(7)
(8)
(9)
(10)

IDEA-I



Since 2009…

http://nimbus.elte.hu/kutatas/sat/idea-en.pl

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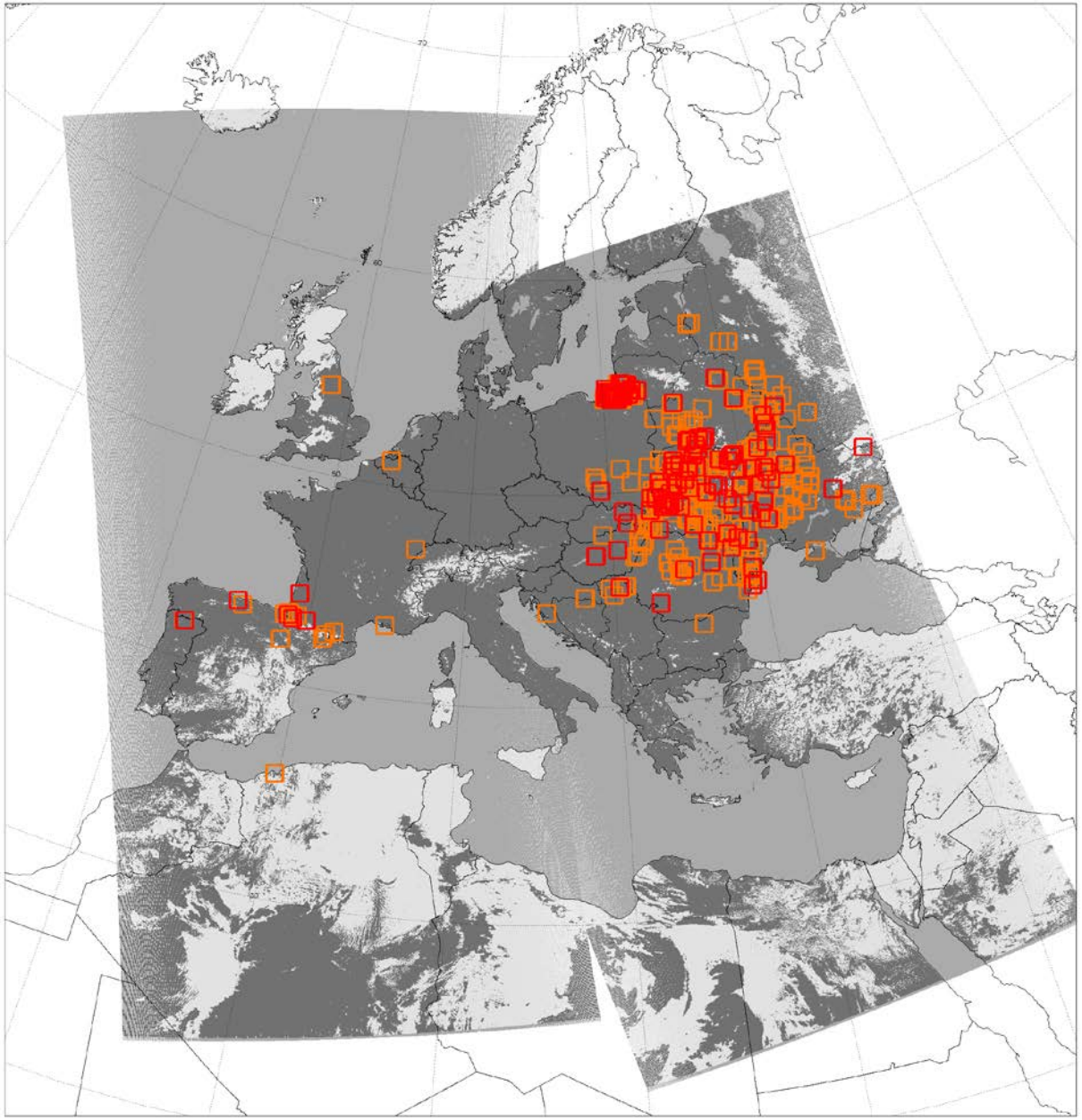
(7) MOD14 DB software, Identification of fire and thermal anomalies
(8)
(9)
(10)

MOD14 DB – Identification of thermal anomalies



Fire (high confidence)
Fire (nominal confidence)
Fire (low confidence)
Clouds
Water
Cloud-free land

Since 2009…

13.03.2014. Aqua/MODIS

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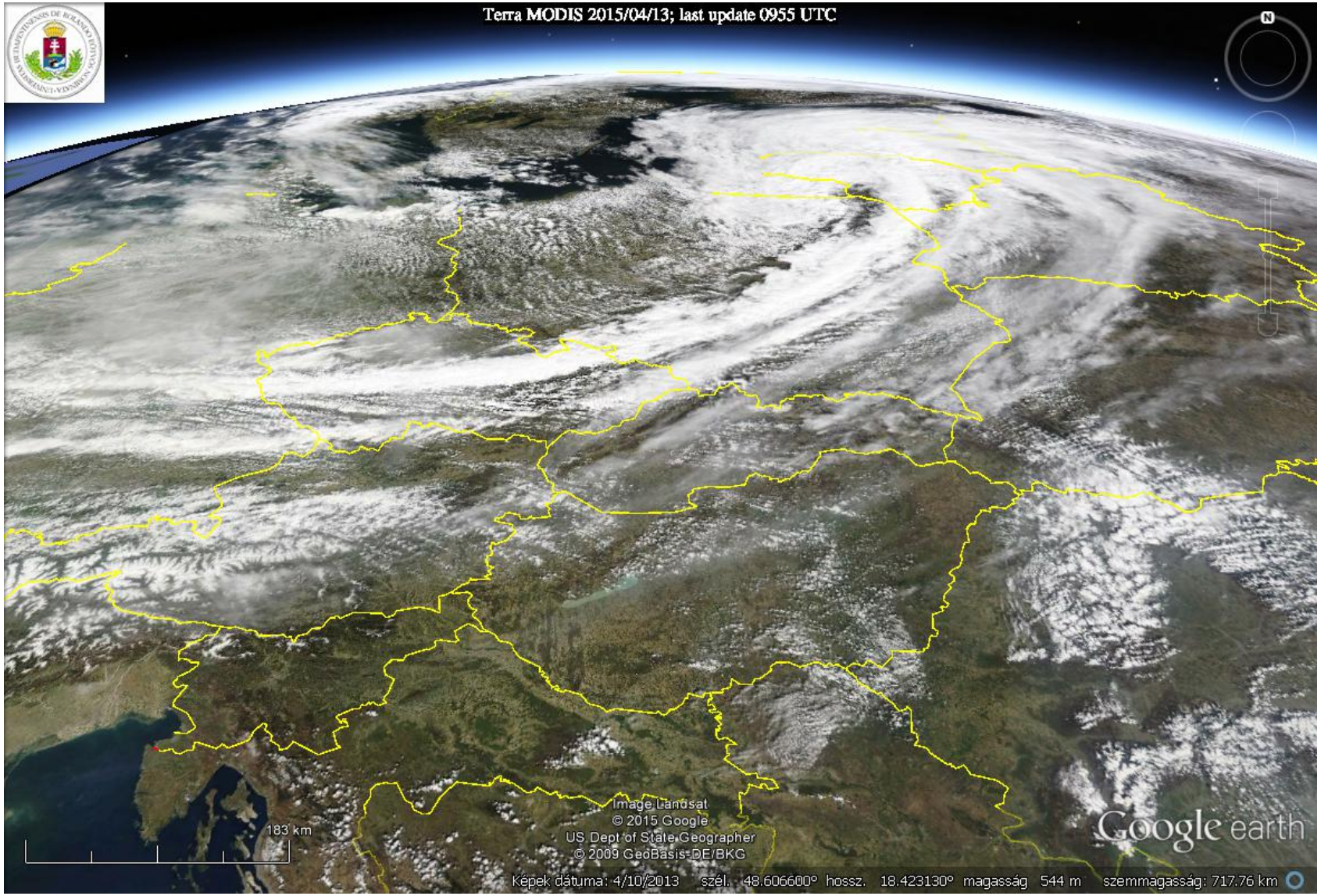
(8) MODIS True Color software
(9) Direct Broadcast Google Earth software (v1.2)
(10) Polar2grid & IMAPP MODIS GeoTIFF Web Mapping Service (WMS)

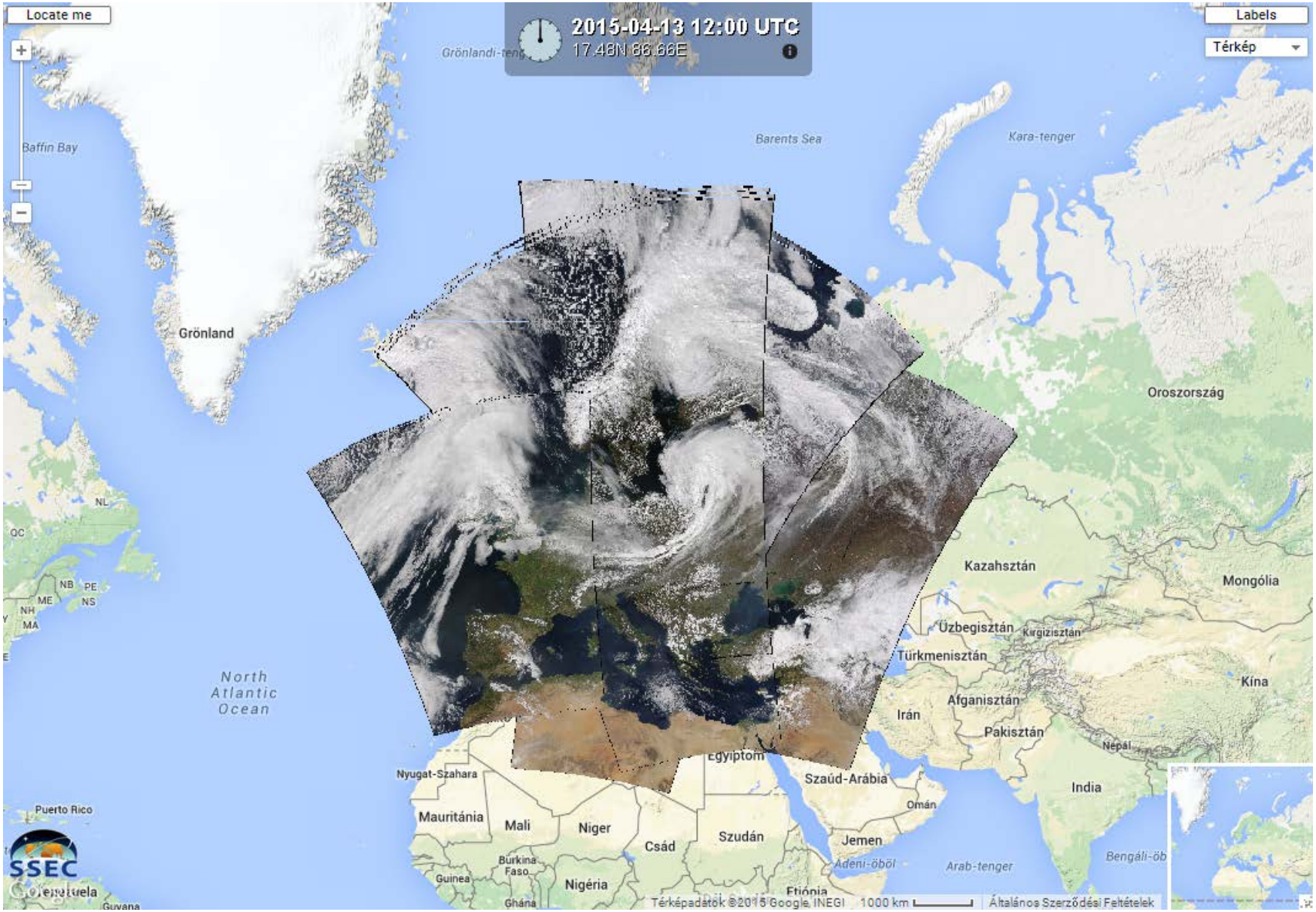
Direct Broadcast Google Earth



Since 2009…

http://nimbus.elte.hu/kutatas/sat/modis-en_latest.pl

IMAPP MODIS GeoTIFF Web Mapping Service



Since 2014…

http://regcm.elte.hu:8001/

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(10) Polar2grid & IMAPP MODIS GeoTIFF Web Mapping Service (WMS)
+ DB MODIS Surface Reflectance software

Monitoring Vegetation Activity

Aim of the research: study the state and behaviour of the vegetation within Hungary based on:

- MOD13, MOD17 data
- 10 years long received DB data between 2005 – 2014
  + Level1b data for 2003 – 2004 downloaded from NASA/Reverb Echo

→ Calculating atmospherically corrected surface reflectances using the DB MODIS Surface Reflectance software package

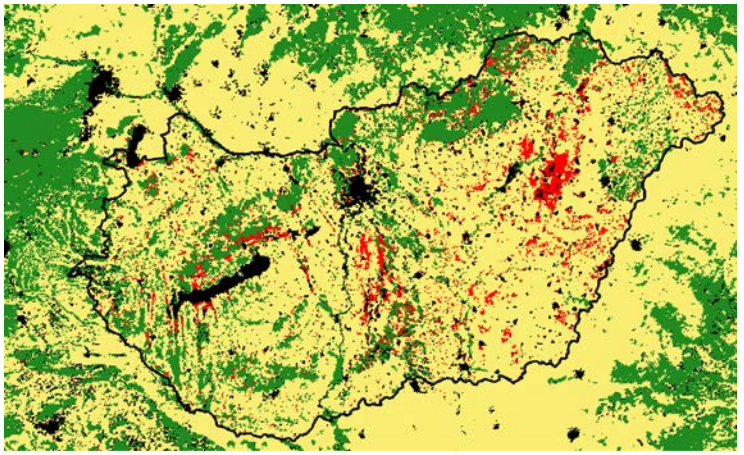
→ Determining the cloudmask using the IMAPP Level2 software package

→ Calculating country-averaged NDVI values for Hungary

Monitoring Vegetation Activity

Using the IGBP MODIS land cover classification (included in the MOD12 product) with enhancements by the CORINE land cover 2000 database

→ the main land cover types (croplands, grasslands and forests) were distinguished



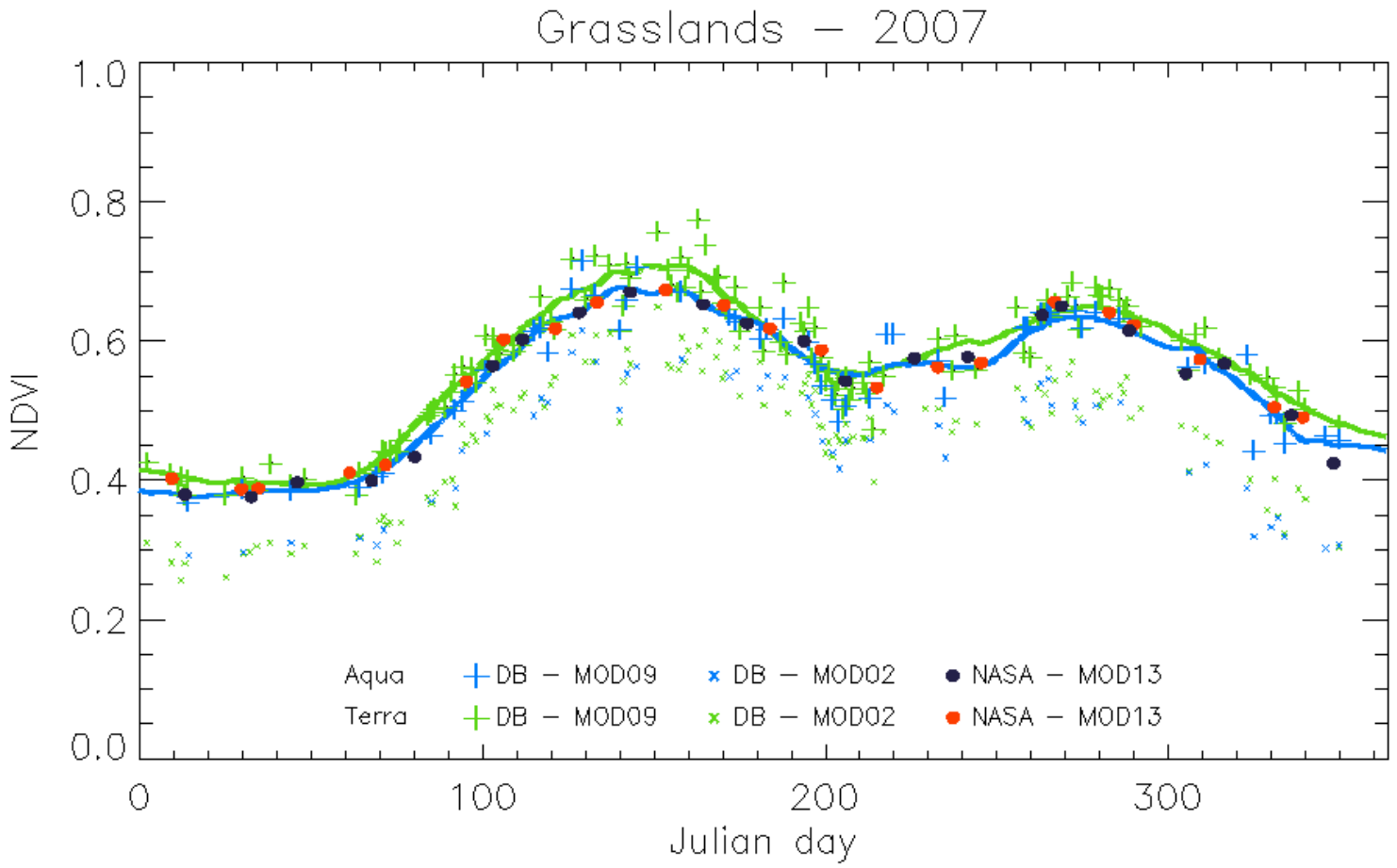
Using the MOD13 product (EVI & NDVI)

→ comparison with the DB NDVI

Using archive meteorological database (daily data with 1/6 grid resolution)

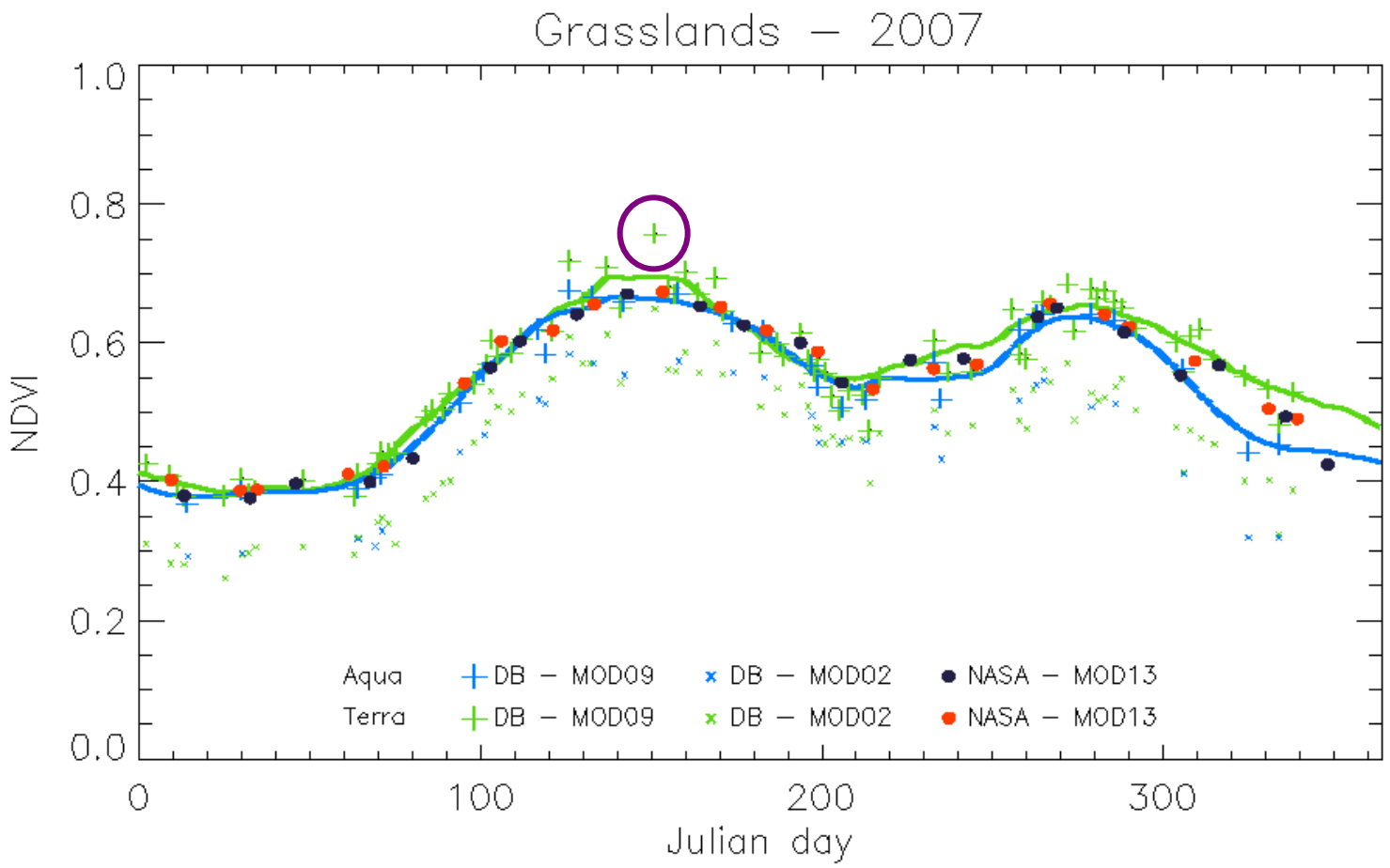
→ the effects of weather on vegetation activity and growth were also investigated

Monitoring Vegetation Activity



Data shown: - all

Monitoring Vegetation Activity

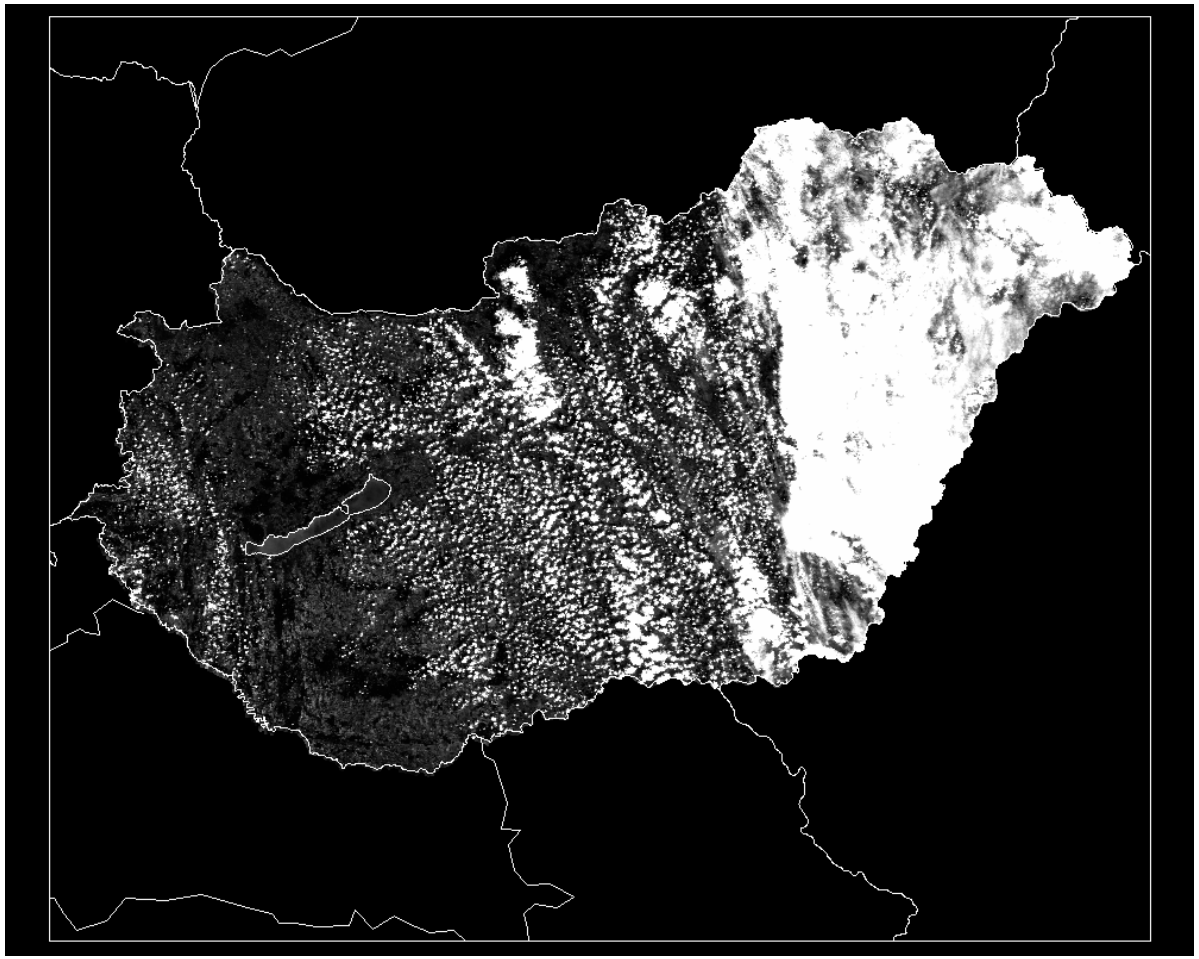


Data shown: - only with sensor senith angle lower than 35°

- data coverage of the country is higher than 25%

Monitoring Vegetation Activity

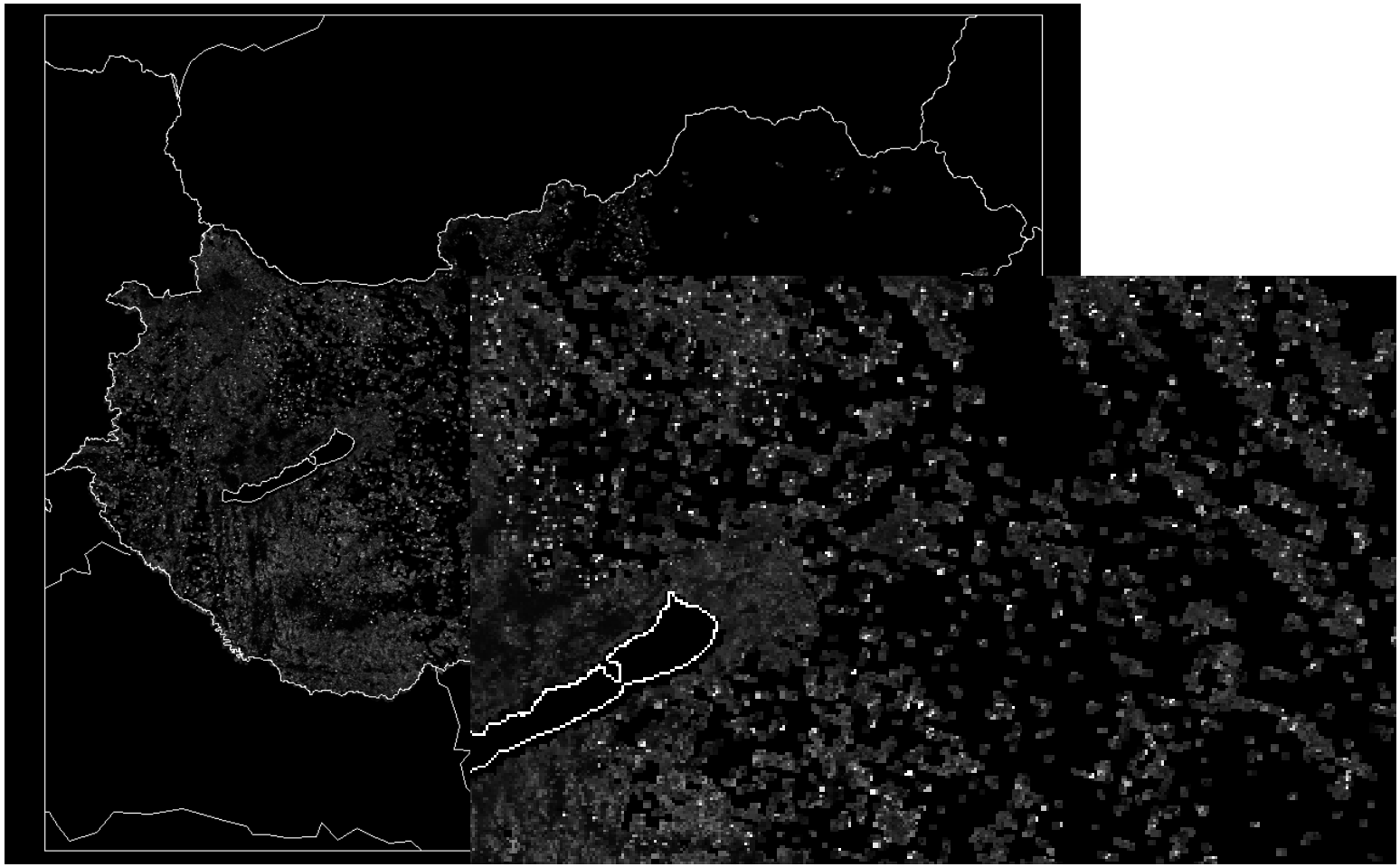
Small cumulus clouds remain after cloudscreening



2007.06.01. 10:00 Terra

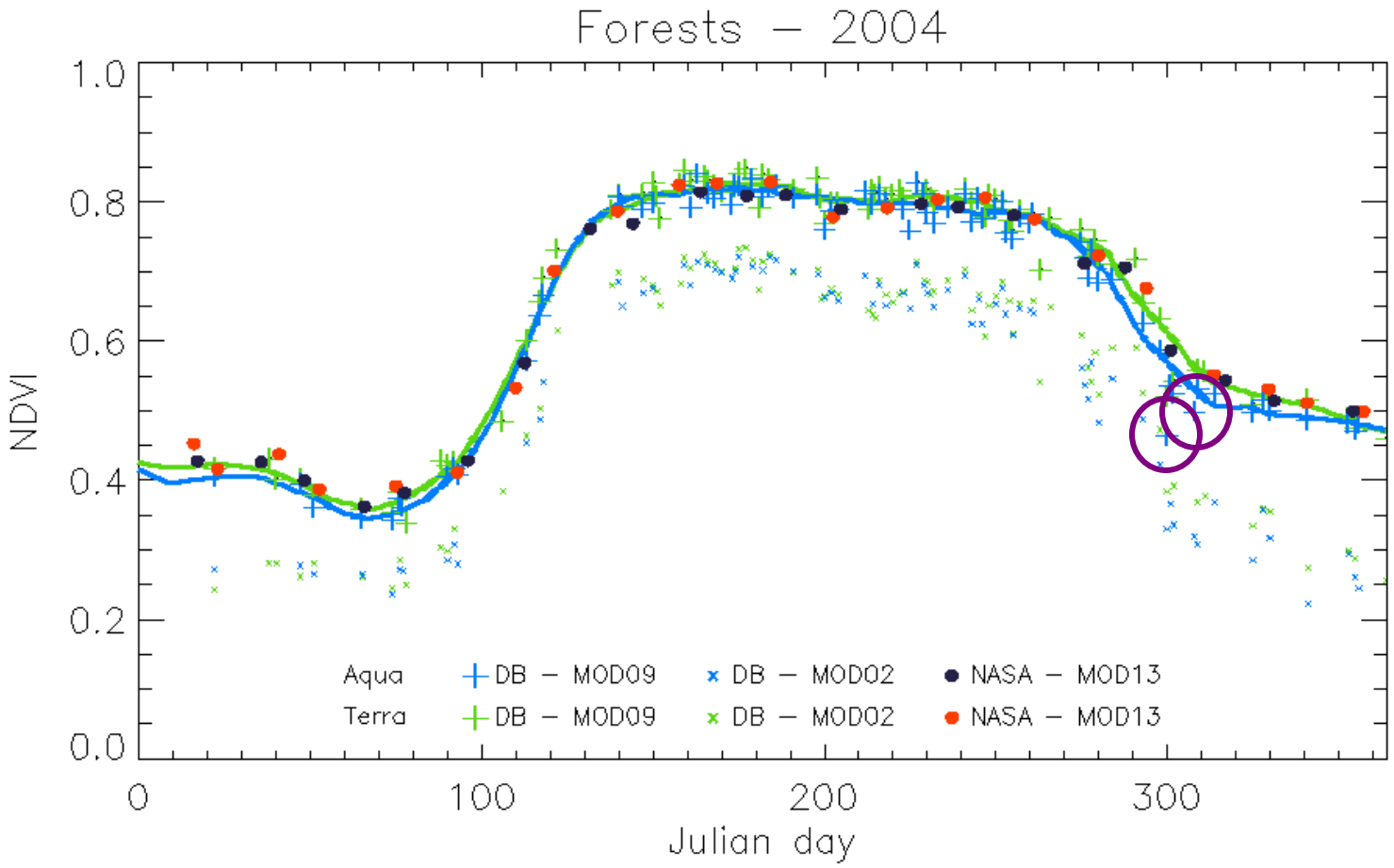
Monitoring Vegetation Activity

Small cumulus clouds remain after cloudscreening



2007.06.01. 10:00 Terra

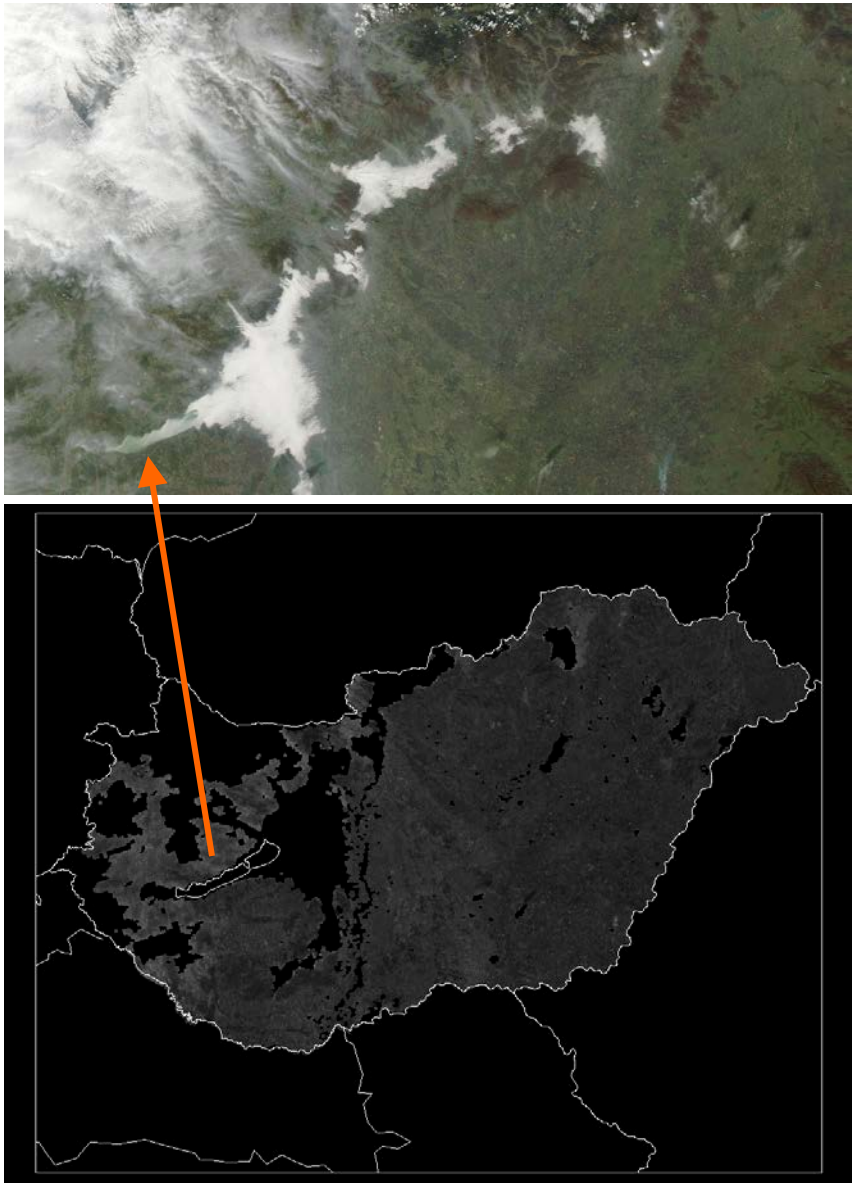
Monitoring Vegetation Activity



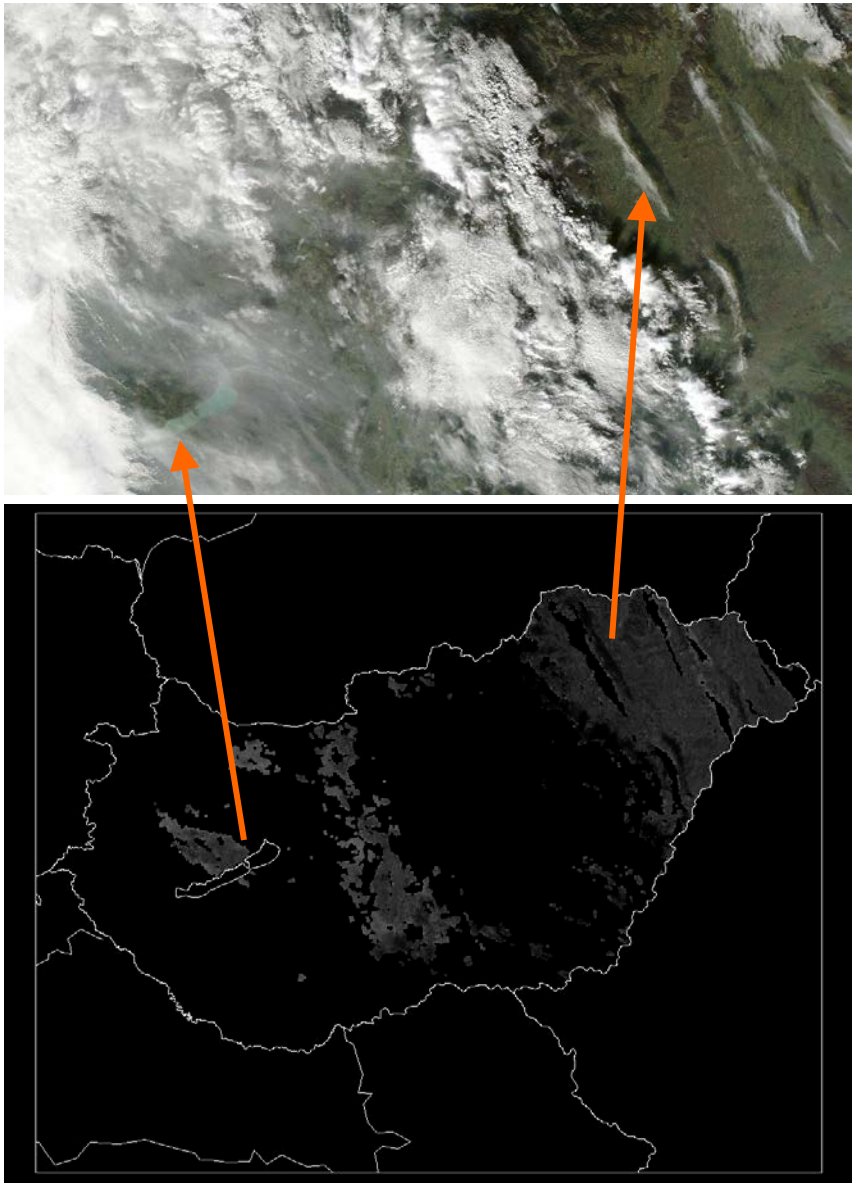
Data shown: - only with lower sensor senith angle than 40°

- data coverage of the country is higher than 25%

Monitoring Vegetation Activity



Aqua, 2004.10.27. 11:15



Aqua, 2004.11.03. 11:25

Monitoring Vegetation Activity

Unresolved source of errors on corrected reflectances:

- Cloud shadows
- Remaining small cumulus clouds
- Cirrus clouds
- High atmospehric water vapor content

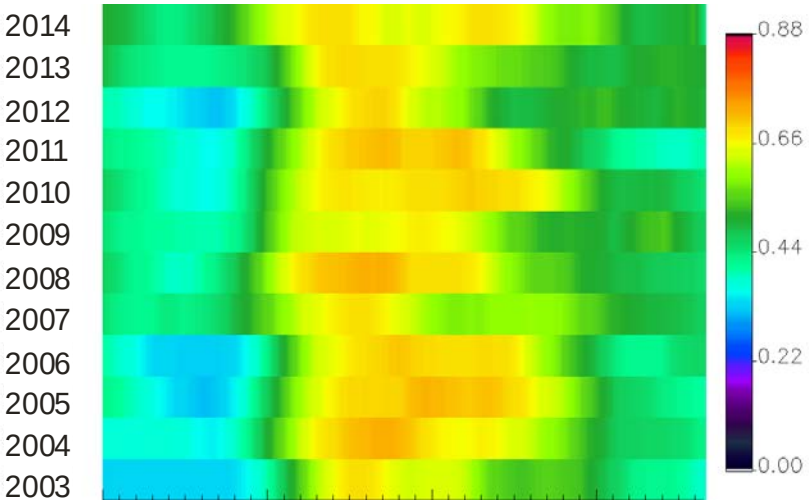
→ Creating monthly mean NDVI values

Correlations between monthly mean DB NDVI & MOD13 NDVI (12 years):

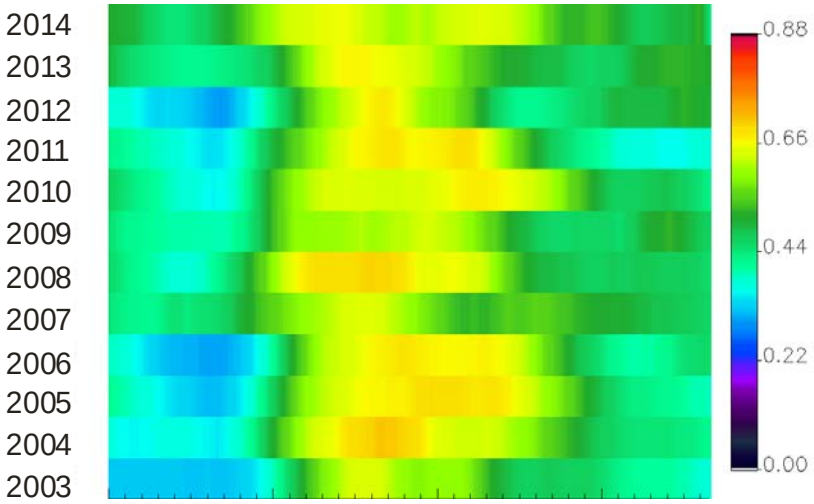
	Croplands	**Grasslands**	**Forests**
Bias:	0.0026	0.0064	0.0034
RMSE:	0.0230	0.0205	0.0198
R^2:	0.9572	0.9723	0.9854

2D plots of mean NDVI for Hungary – DB data

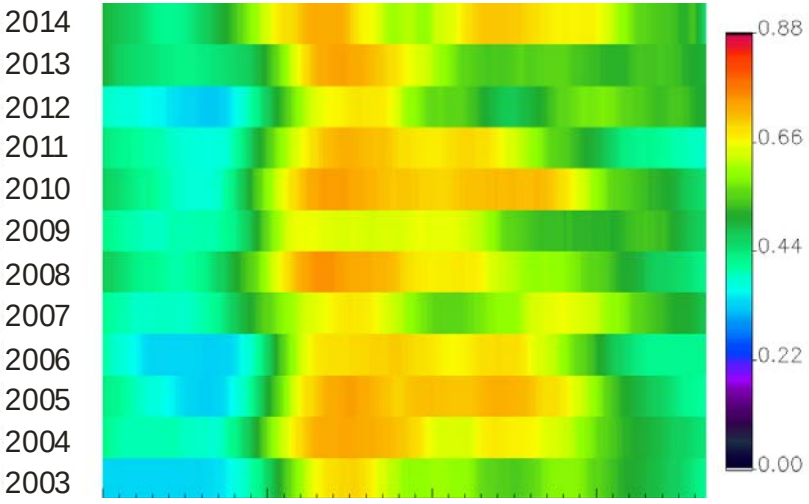
Entire Hungary



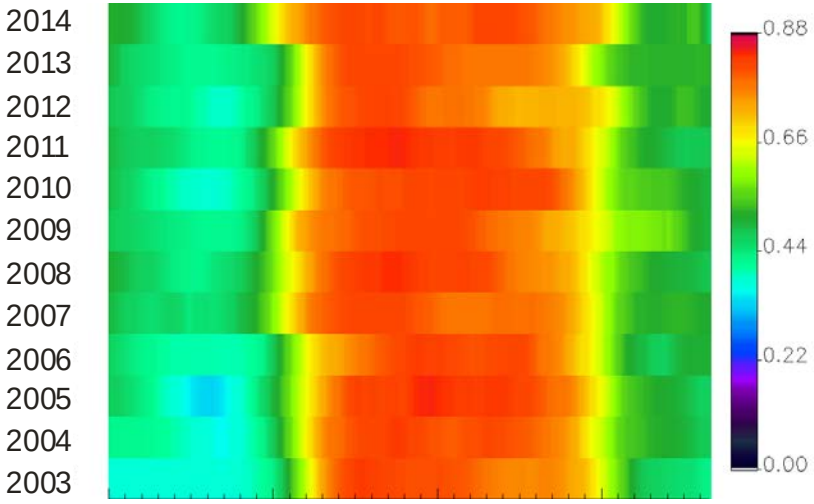
Croplands



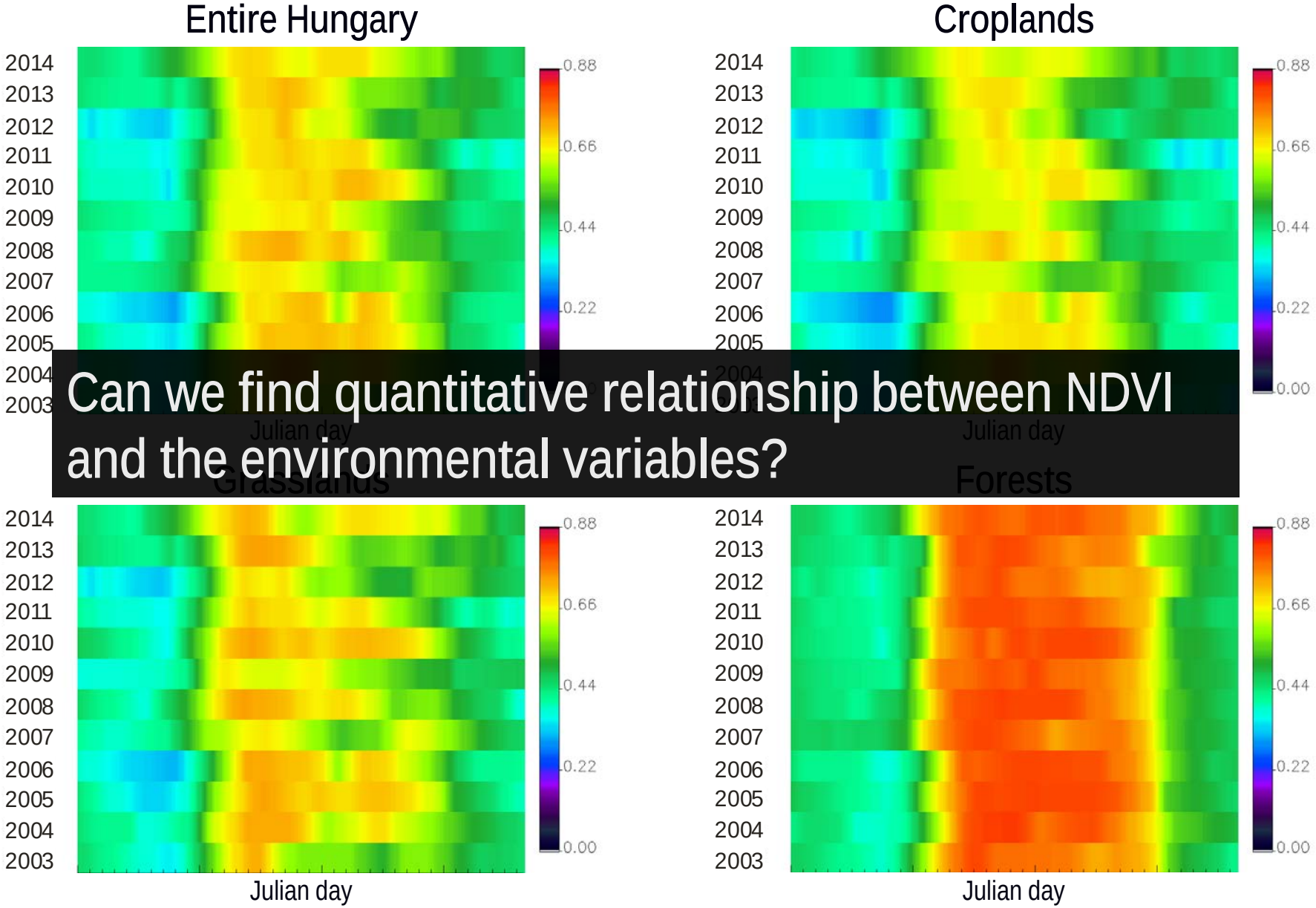
Grasslands



Forests



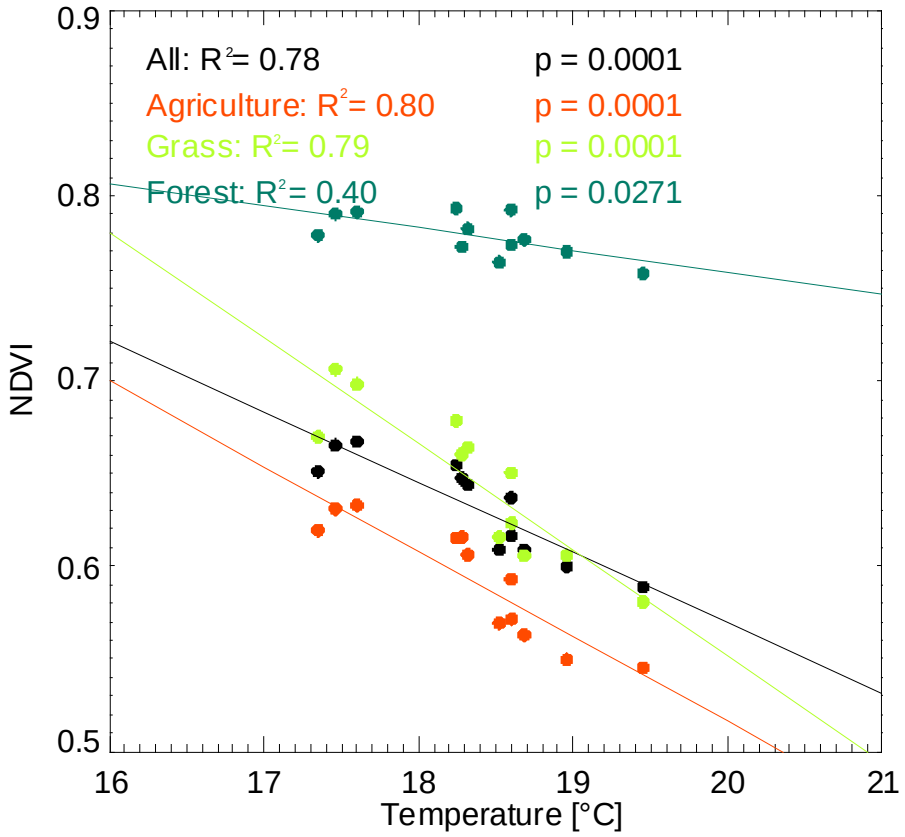
2D plots of mean NDVI for Hungary – MOD13



Can we find quantitative relationship between NDVI and the environmental variables?

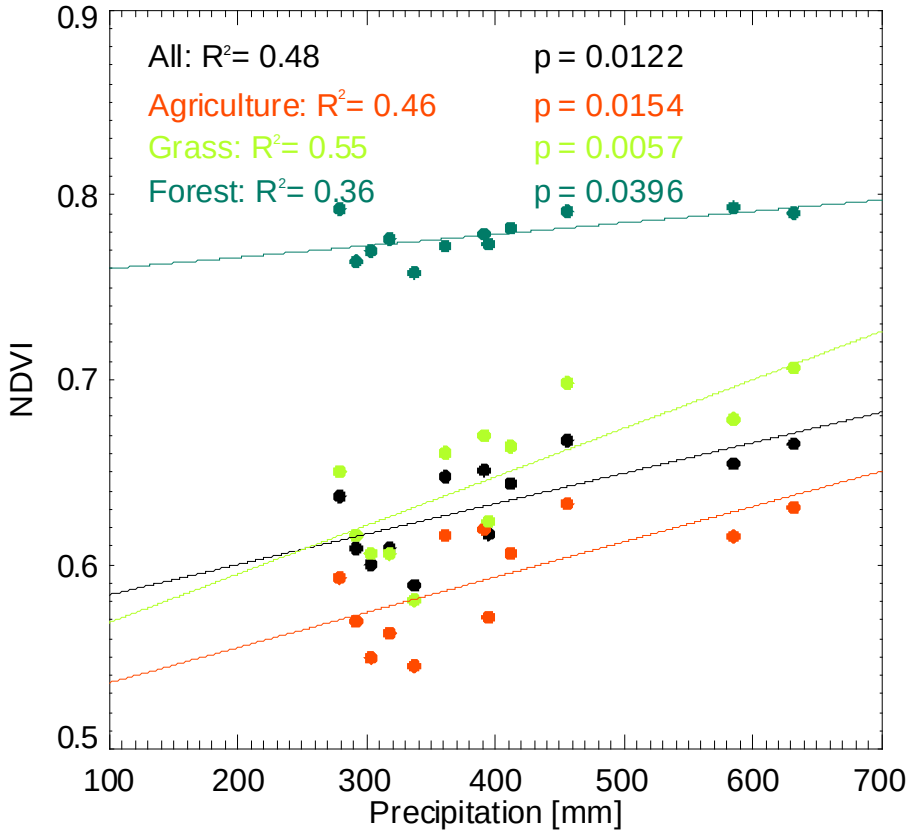
Monitoring Vegetation Activity

Relationship between the mean temperature of the period May-October and the land cover specific mean NDVI values of the period May-October for Hungary based on DB NDVI data



Monitoring Vegetation Activity

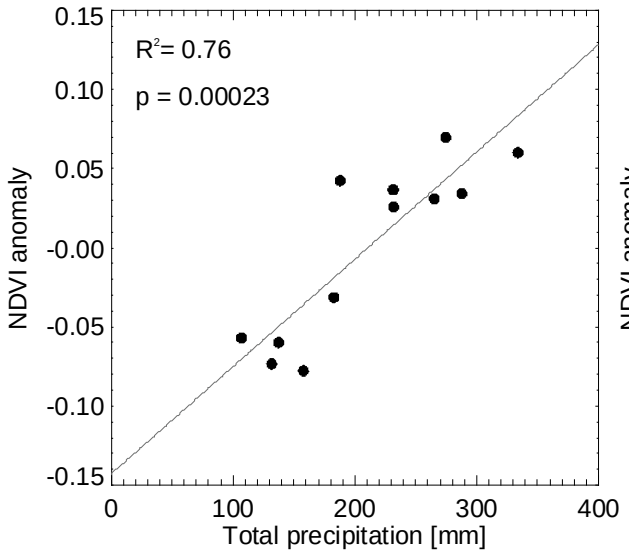
Relationship between the precipitation sum of the period May-October and the land cover specific mean NDVI values of the period May-October for Hungary based on DB NDVI data



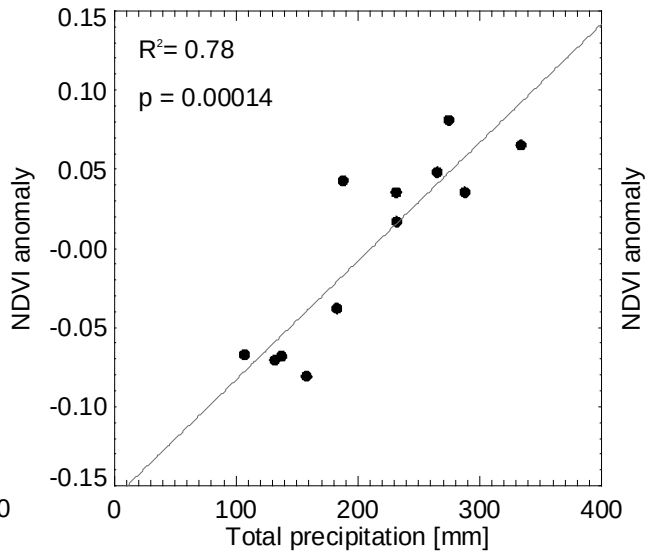
Monitoring Vegetation Activity

Relationship between the precipitation sum of three consecutive months and the NDVI anomaly of the period's last month separately for the different land cover types for June-August

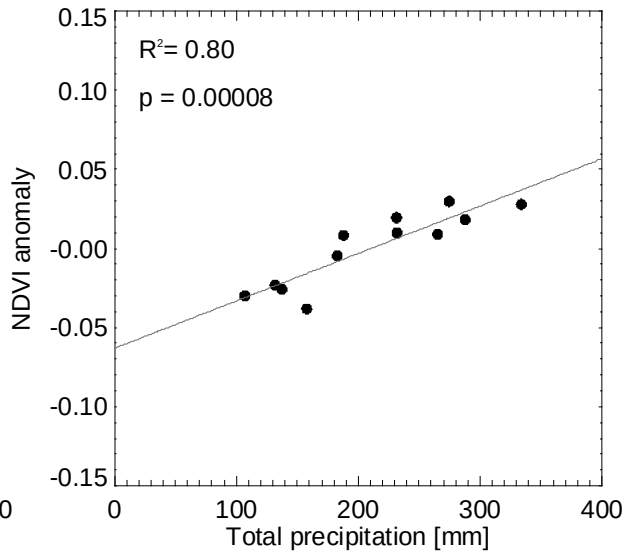
Croplands



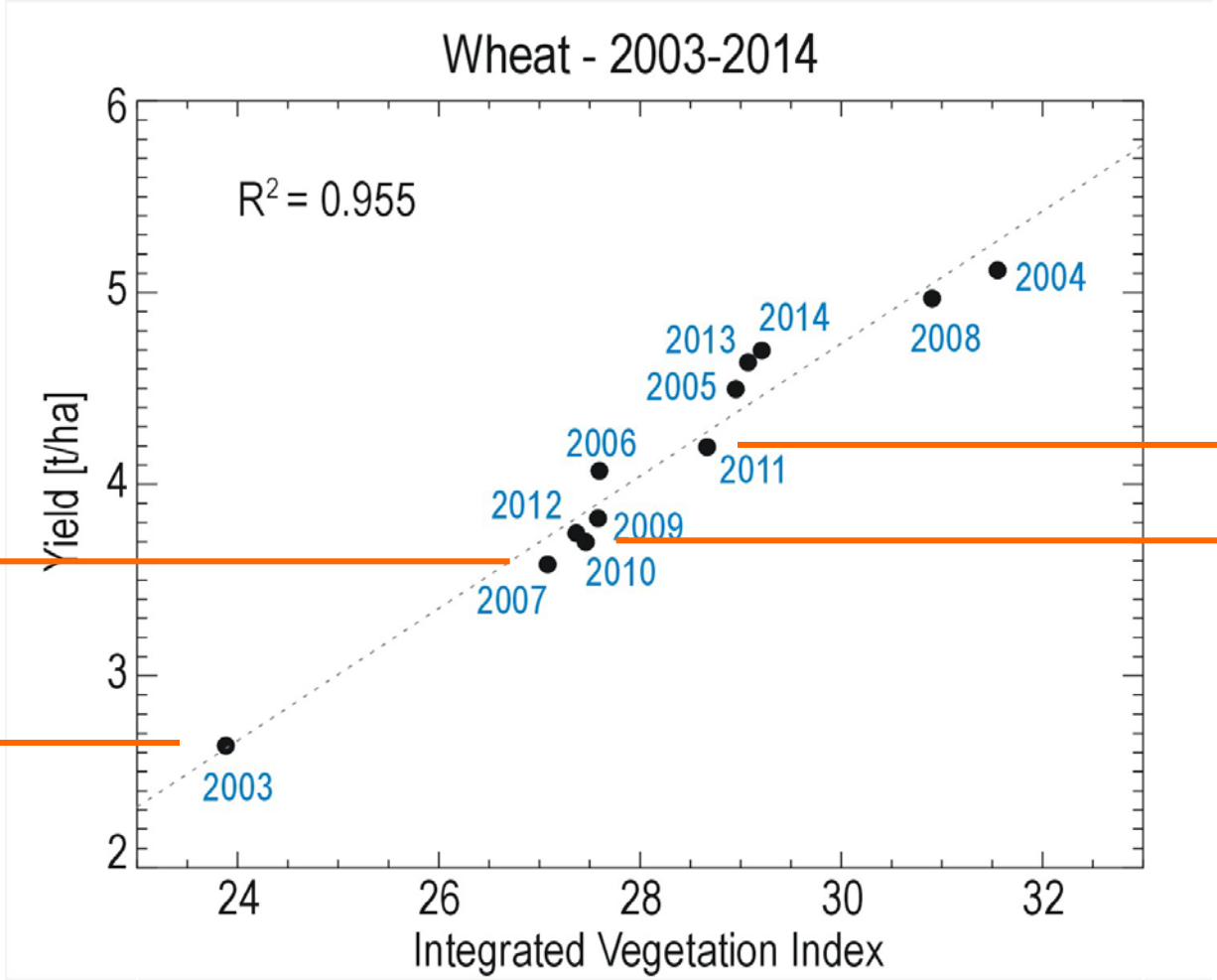
Grasslands



Forests



Crop yield estimations based on DB NDVI data



Heat wave in July in Hungary

Heat wave in Europe

Lowest yearly precipitation

Highest yearly precipitation

Based on the crop yield data of Hungarian Statistical Office

Thanks to…

Kathy Strabala

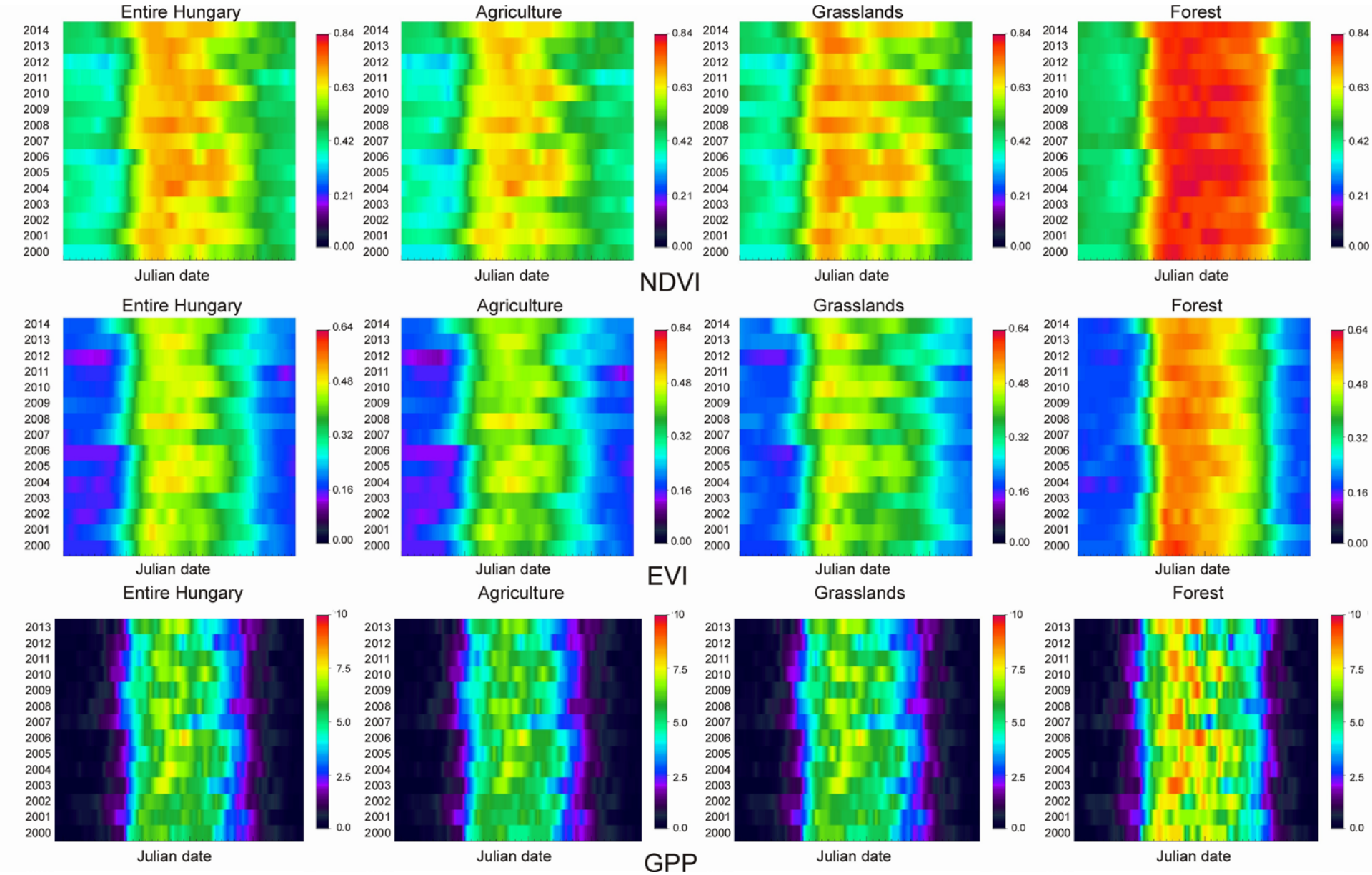
Liam E. Gumley

And The Imapp-Team

Nasa & Eosdis For The Mod12, Mod13

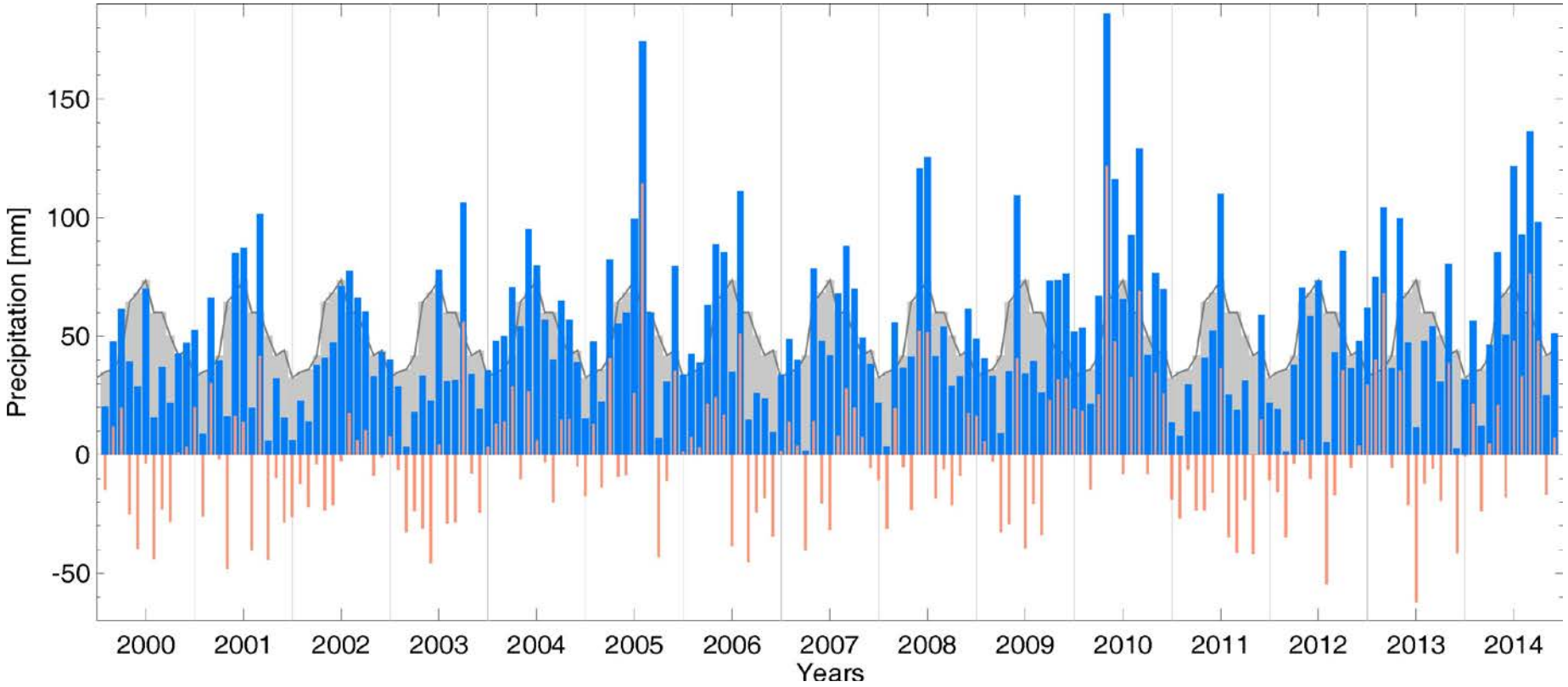
Hungarian Scientific Research Fund
(OTKA PD-111920 & K-104816)

2D plots of mean NDVI, EVI and GPP for Hungary



Precipitation conditions in Hungary (2000-2014)

The monthly precipitation amounts and its anomaly



Temperature conditions in Hungary (2000-2014)

The monthly maximum, mean and minimum temperatures and the anomaly of the mean temperature