Crop Monitoring using agro-meteorological models in Europe

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- EU and agriculture
- MARS background and objectives
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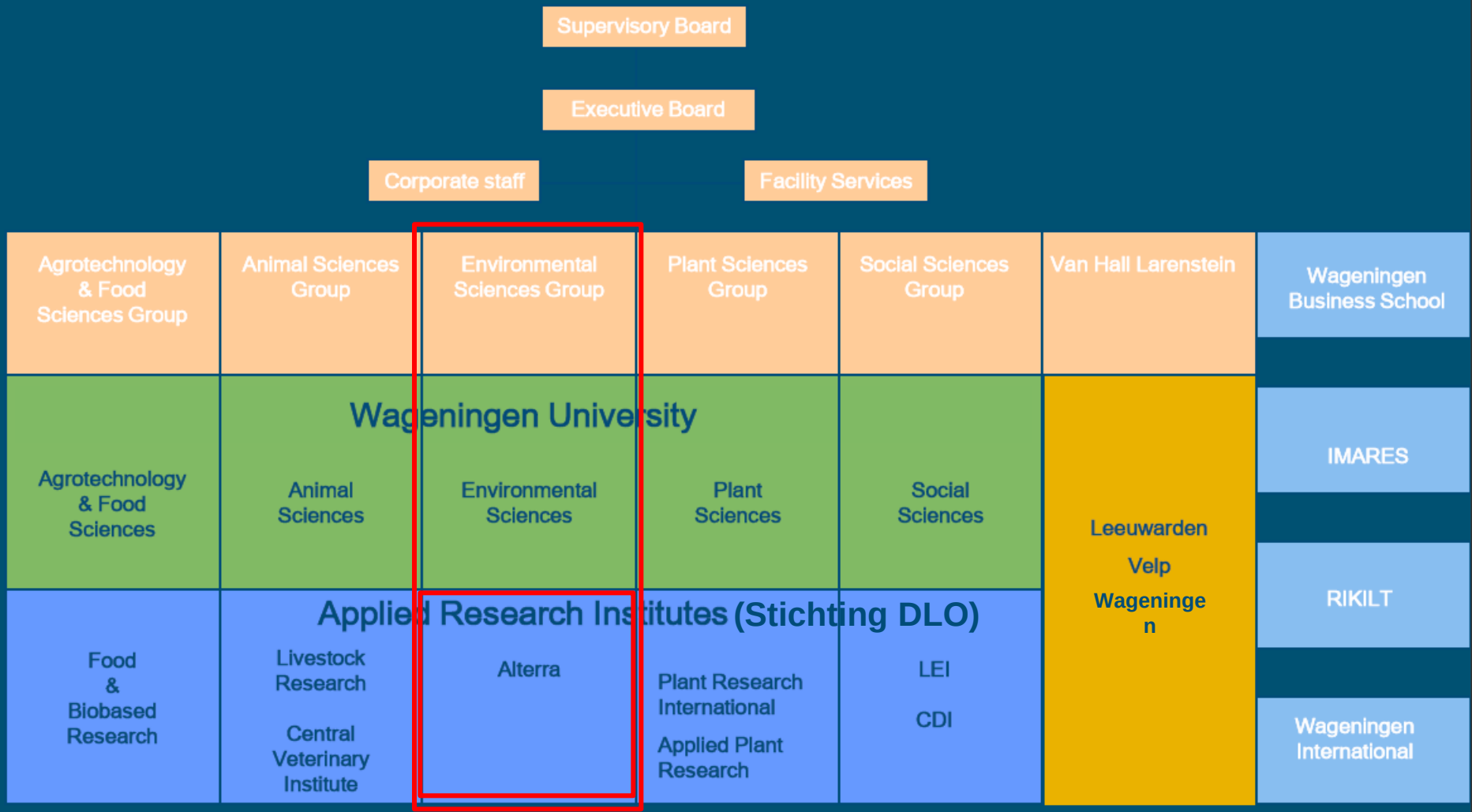
What is Wageningen?

- Wageningen in is a town in the Netherlands (45,000 inhabitants)
- Home to the Wageningen University and Research Centre (Wageningen UR)
- Specialized in life sciences (plant, animal, environment, Agro-Food, rural economy & social sciences)
- Total staff: 6000
- Total students: 6500

Organisational structure



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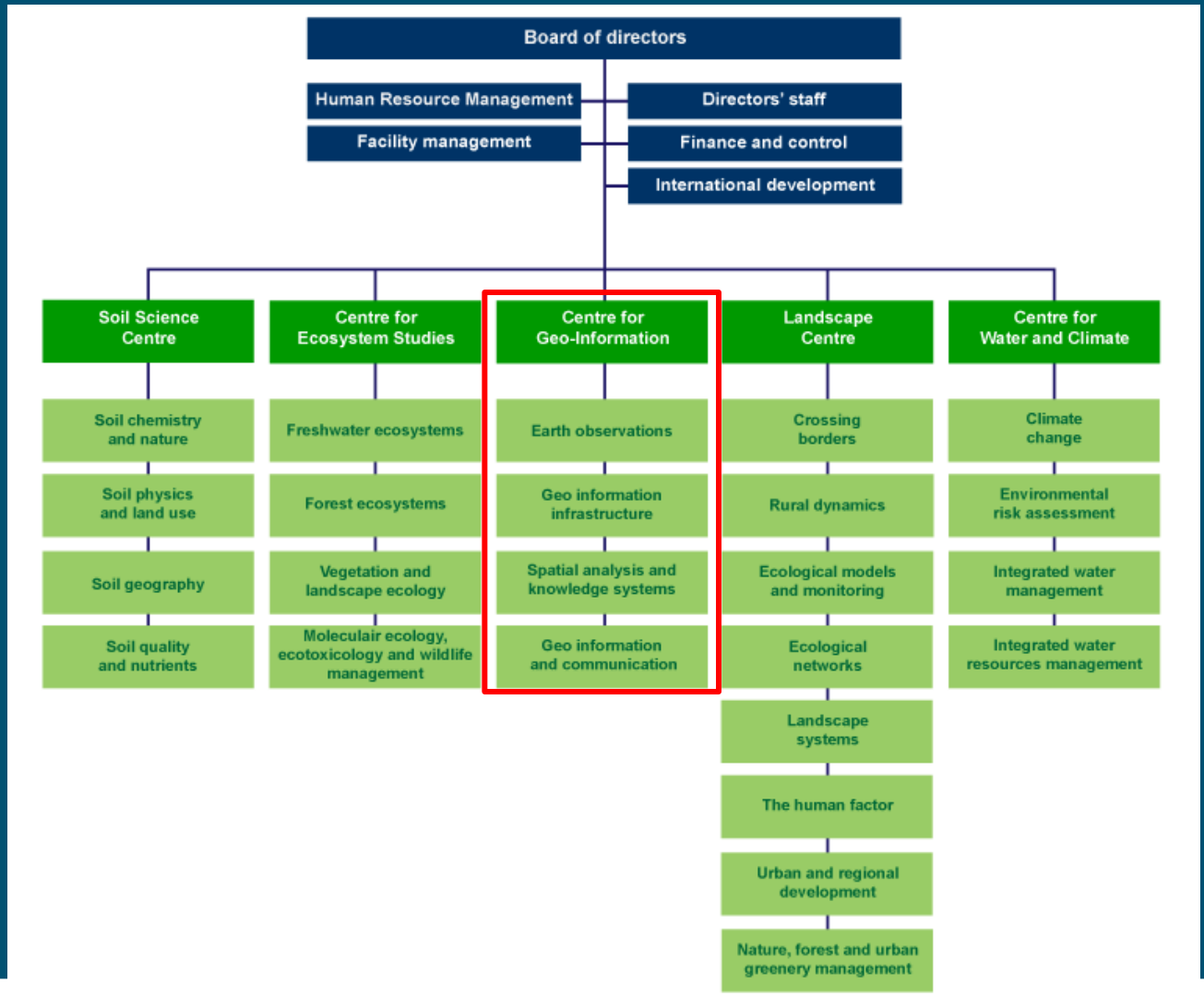
For quality of life

Alterra: the institute



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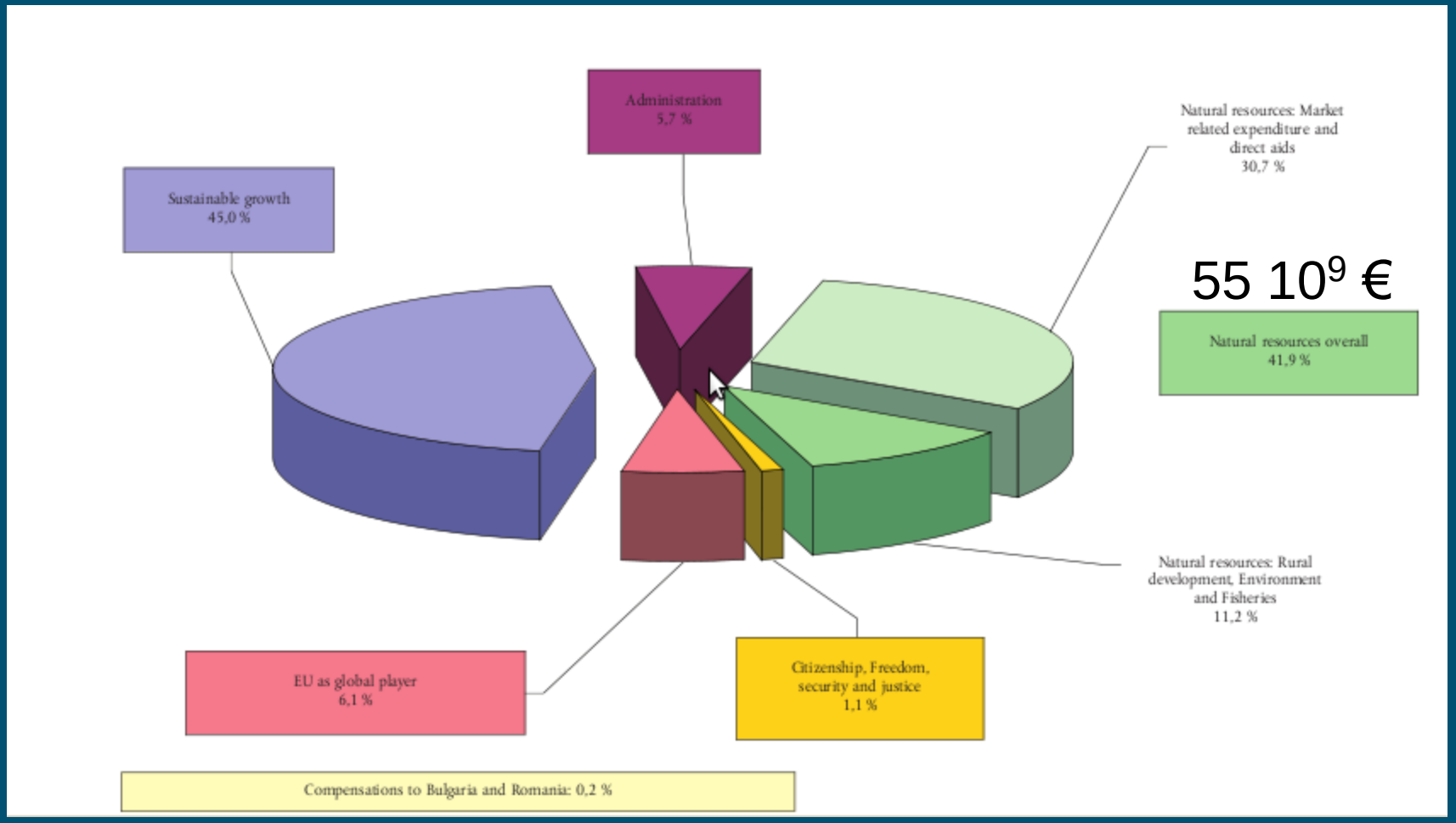
The EU and agriculture



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EC's policy issues

- Market interventions and their follow up:
  - stock interventions and management
  - support to EU markets
- Budgetary forecasts and follow up of expenditures
- Decisions on food aid
- To make effective/efficient decisions situation of current crop season is important

MARS background

- Infrastructure for crop monitoring, yield and production forecasting
- Goal: estimates of crop yield/production before the end of the growing season
- Coordinated by EC Joint Research Centre
- Operational since 1994
- Most important clients: DG-AGRI, EUROSTAT (nowadays including DG-AIDCO, RELEX + external users)

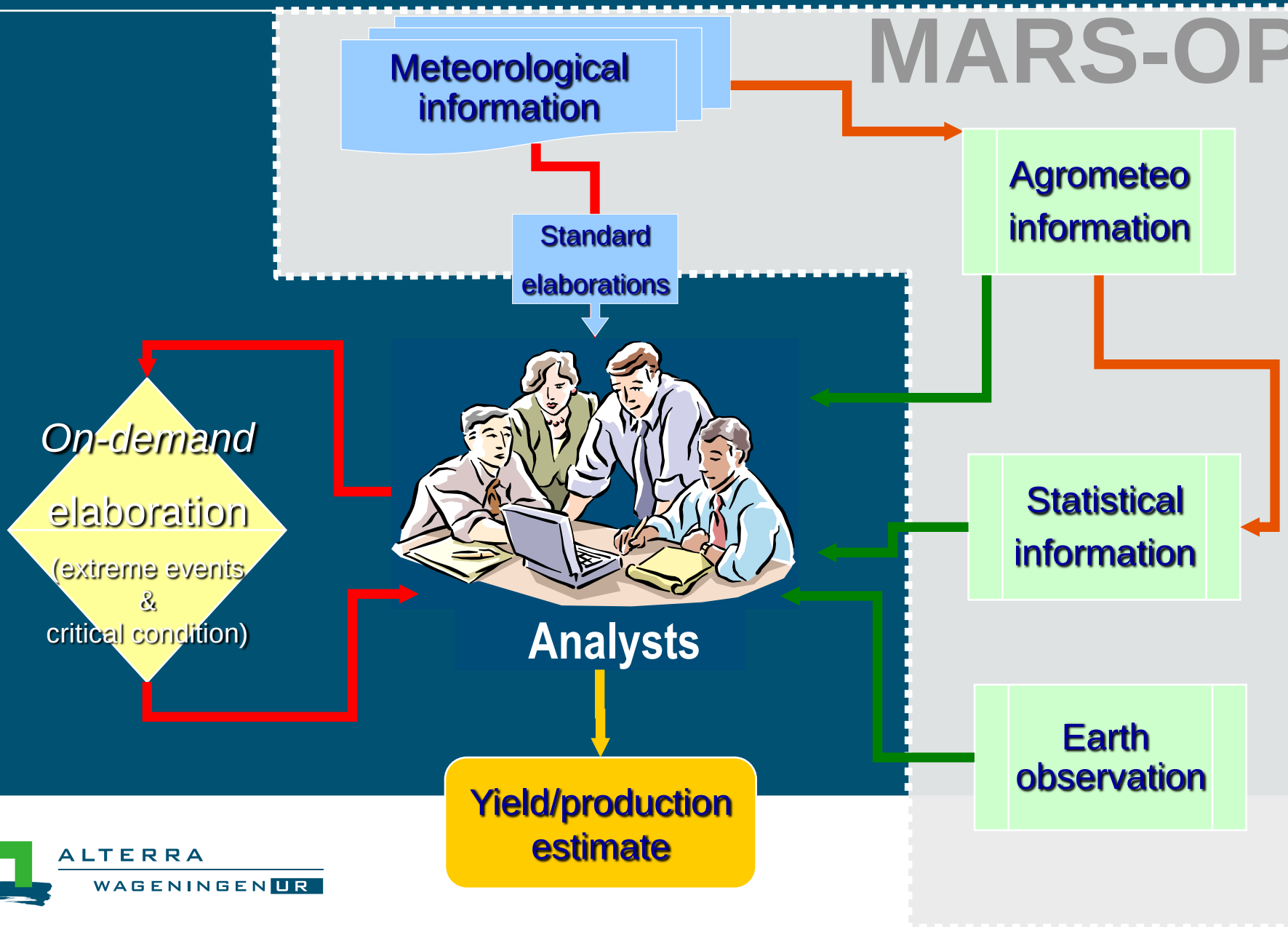
Original MARS components

- Meteorological data collection (weather stations) and interpolation
- Crop modelling for yield/biomass estimation (WOFOST model)
- Low-res. satellite data collection & processing (e.g. NOAA-AVHRR)
- Area frame sampling (SPOT) - *Cancelled after a few years*
- Statistical framework for yield forecasting

Alterra's role in MARS

- 1988-1992: Alterra is awarded a contract to build an agro-meteorological information system (e.g. CGMS)
- 1992-1994: CGMS operational and installed at JRC, Alterra does maintenance
- 1994-2000: No involvement
- 2000: EU decides to outsource operational MARS activities (MARSOP)
- 2000-2008: Alterra leads MARSOP1&2 contracts
- 2008-2014: Alterra leads MARSOP3 contract

How does MARS work



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Dissemination of MARS products

MARS bulletin

Printed 1995-1998

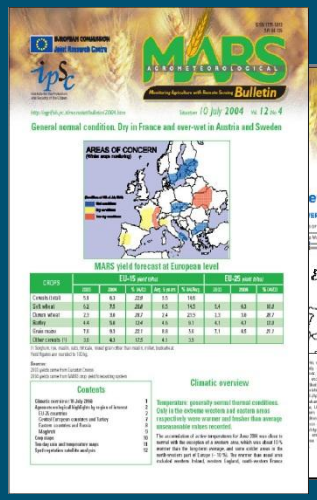
Since 2005 as pdf

about 20 times a year on Europe

http://mars.jrc.it/mars/Bulletins-Publications

http://www.marsop.info

2004

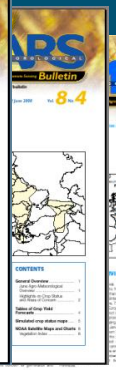


2003

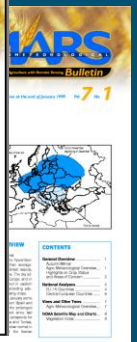
2002

2001

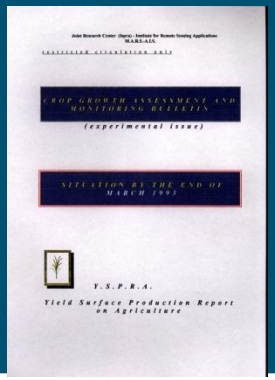
2000



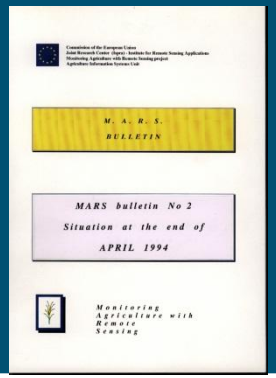
1999



1993



1994



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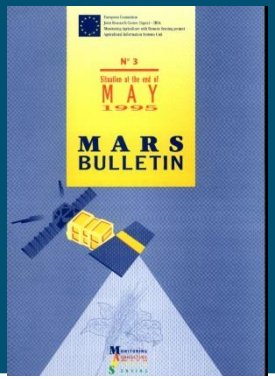

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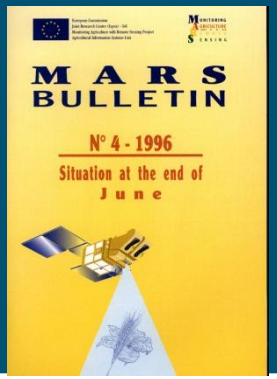
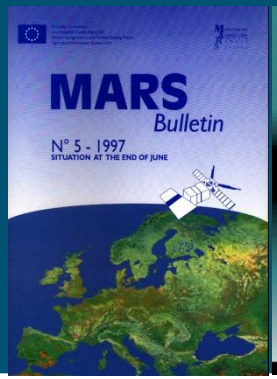
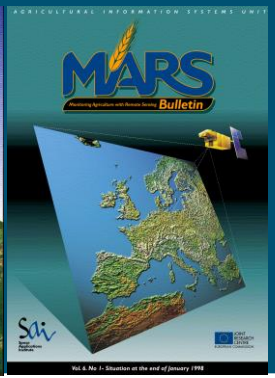


1997



1998



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Processing chains in MARSOP3

- Meteorological data collection and interpolation
- Crop modelling for relative yield estimation
- Low-res. satellite data collection & processing
- Statistical framework for yield forecasting
- Consortium:

MARSOP3: operational services

weather monitoring based on interpolated station data	pan-Europe
weather monitoring based on ECMWF deterministic forecast	pan-Europe and Asia
weather monitoring based on ECMWF ensemble models	pan-Europe
crop monitoring based on interpolated station data	pan-Europe
crop monitoring based on ECMWF deterministic forecast	pan-Europe and Asia
crop monitoring based on ECMWF ensemble models	pan-Europe
crop yield forecast based on interpolated station data	pan-Europe
crop yield forecast based on ECMWF deterministic forecast	pan-Europe and Asia
crop yield forecast based on ECMWF ensemble models	pan-Europe
weather monitoring based on ECMWF deterministic forecast	global
crop specific drought monitoring	global
vegetation indices based on SPOT-VEGETATION sensor	global
vegetation indices based on NOAA-AVHRR sensor	global
vegetation indices based on METOP-AVHRR sensor	pan-Europe
vegetation indices based on MODIS-250m sensor	pan-Europe and Horn of Africa
weather and vegetation indices based on MSG-SEVIRI	pan-Europe
rainfall estimates based on MSG and observed rainfall	Africa

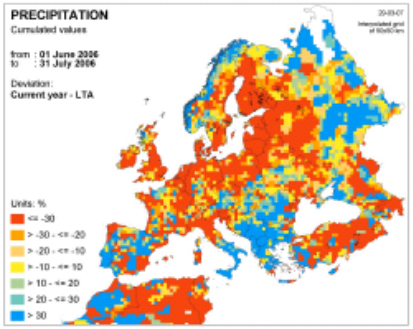
Level 1: Weather monitoring over Europe

Weather

± 2000 stations

Daily values 1975-today

Data quality checking and interpolation to agro climatic zones



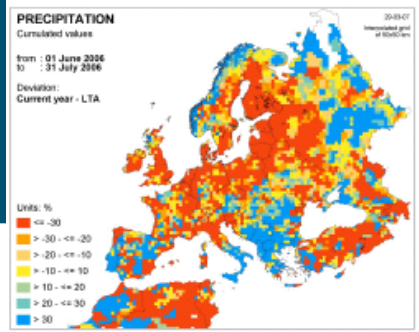
Level 2: Crop monitoring over Europe

Weather

± 2000 stations

Daily values 1975-today

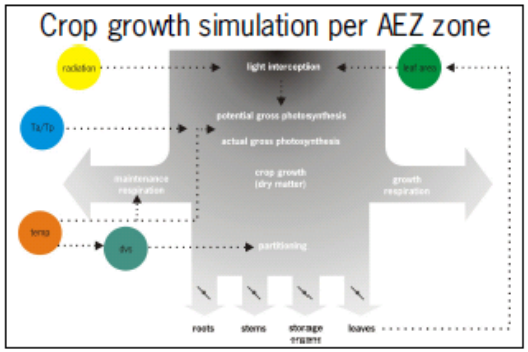
Data quality checking and interpolation to agro climatic zones

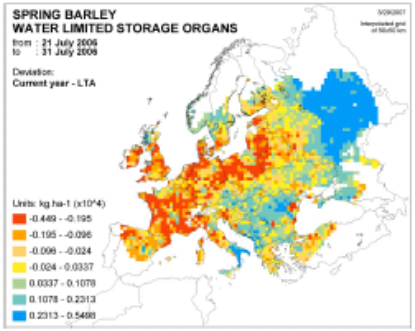


Crop, soil, land use

AEZ zone (combination of agro climatic zones and soil mapping units)

Crop growth simulation per AEZ zone





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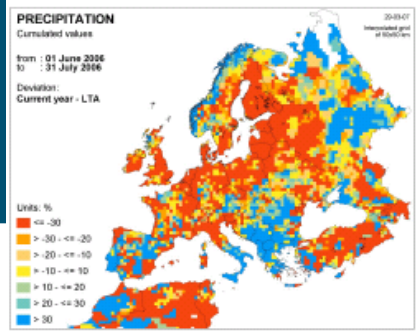
Level 3: Analysis and yield forecasting

Weather

± 2000 stations

Daily values 1975-today

Data quality checking and interpolation to agro climatic zones



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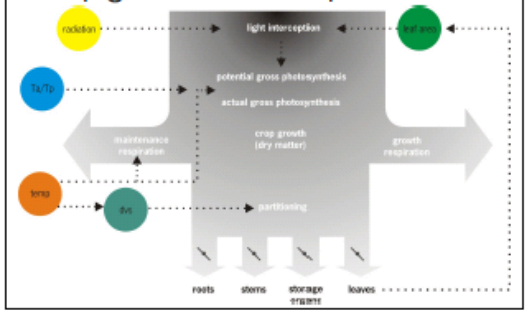
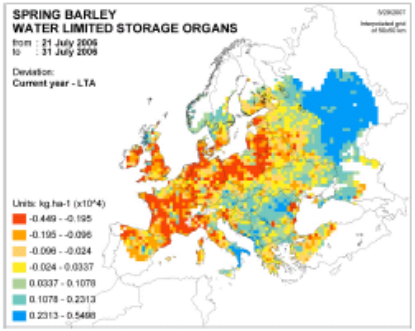




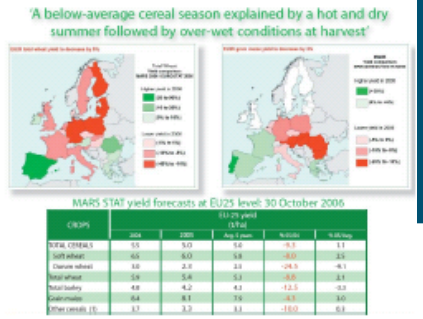
Official harvested yields

Administrative regions

1975-last year

Estimate current year's crop yield based on regression analysis of historic simulated indicators and yield statistics

$$stat\_yield = trend + f(sim\_yield)$$



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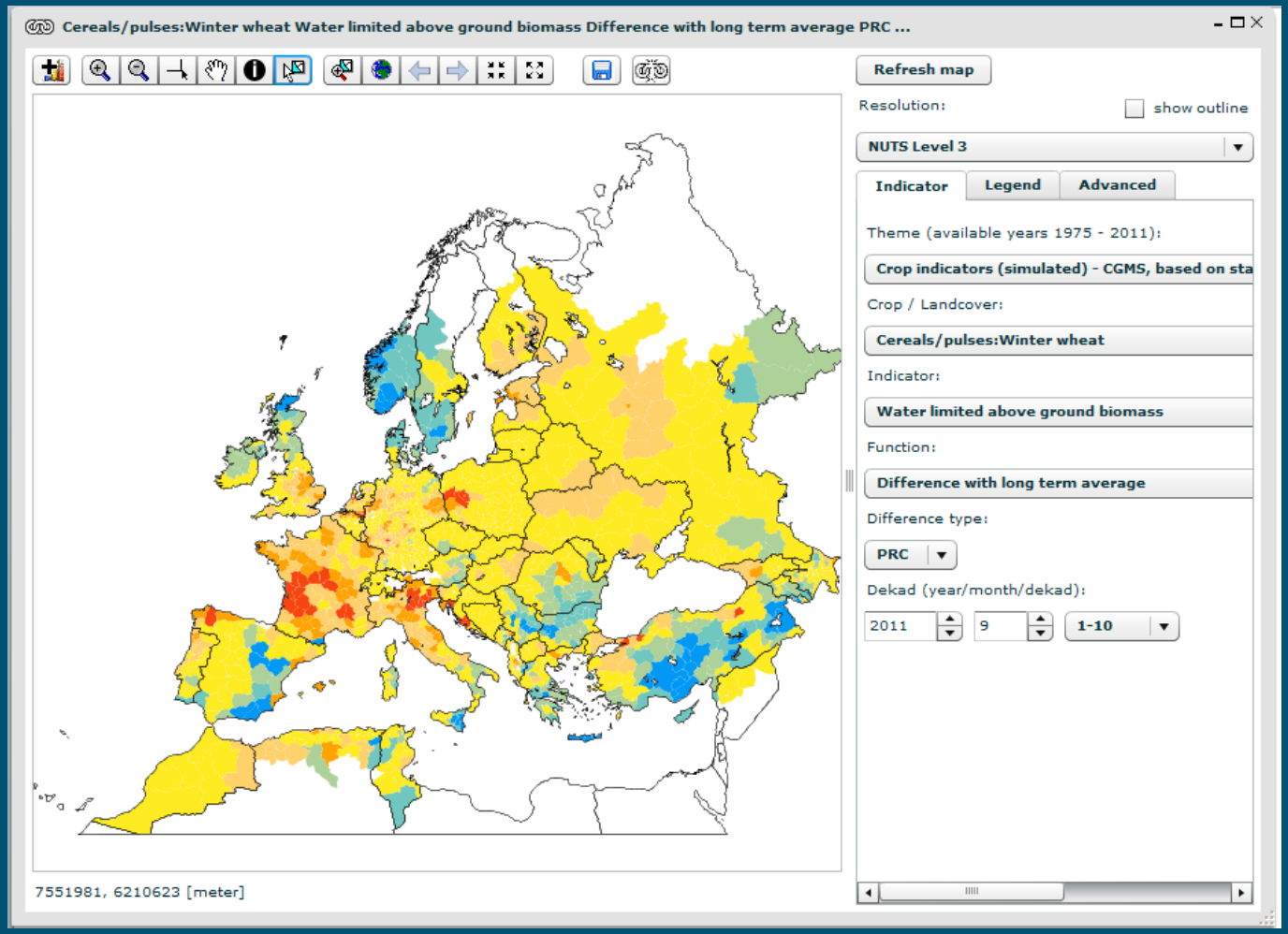
WOFOST crop model

- simulation of crop physiological processes (daily time steps):
  - phenology (sowing- flowering- maturity)
  - Photosynthesis
  - Respiration
  - Evapotranspiration
  - Soil water balance
  - soil fertility (seasonal nutrient supply)

Tools for visualizing results in MARSOP3

- Developed in Adobe Flex
- Rich Internet Application (RIA)
  - Rich set of user interface controls
  - Internet application with a desktop experience
- Runs within Flash player
- Webmapping
  - Open source (Geoserver)
  - Shape files
- Can run within a browser or ‘stand-alone’

Some examples: spatial analysis



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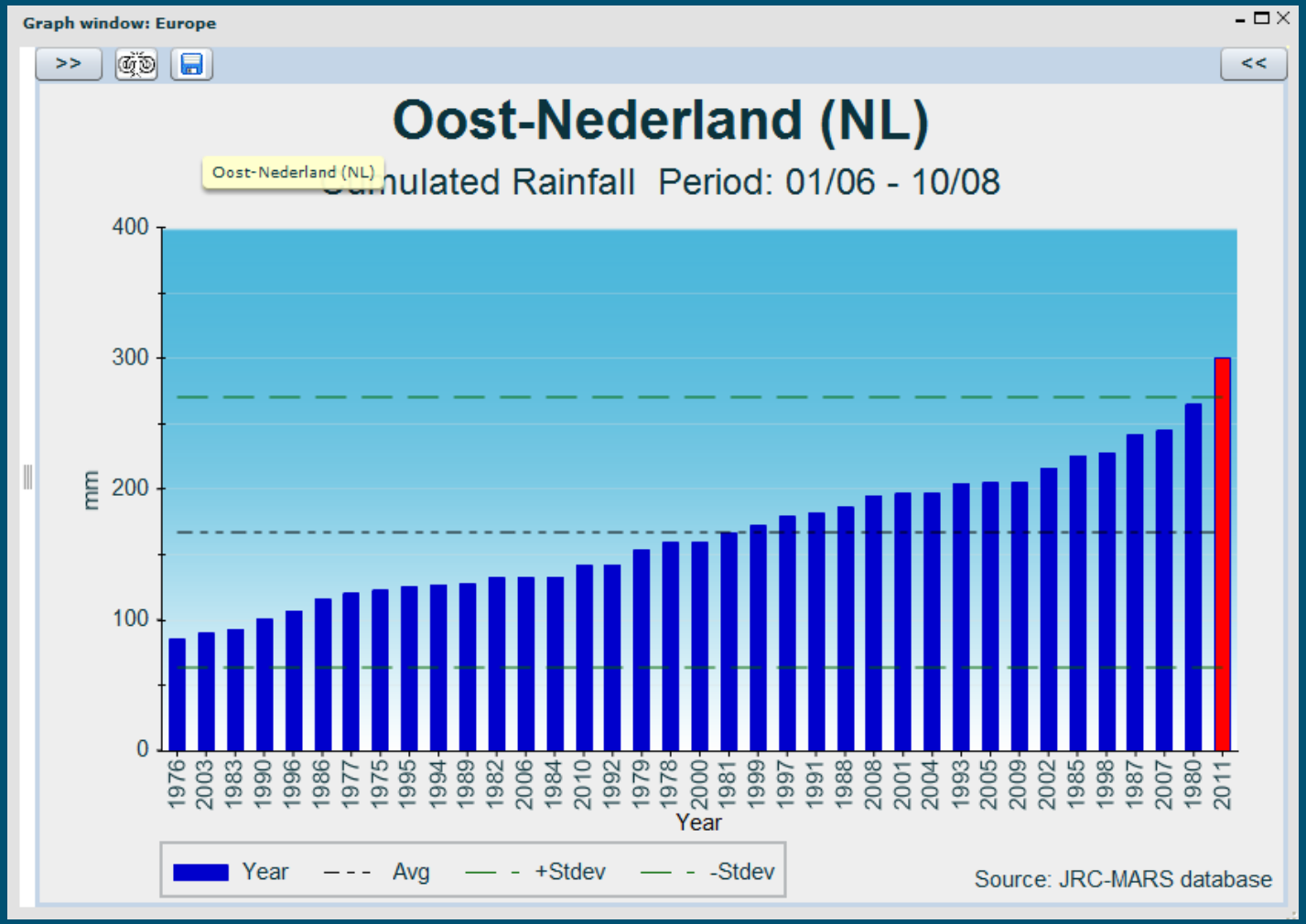
Temporal analysis: ranking of years



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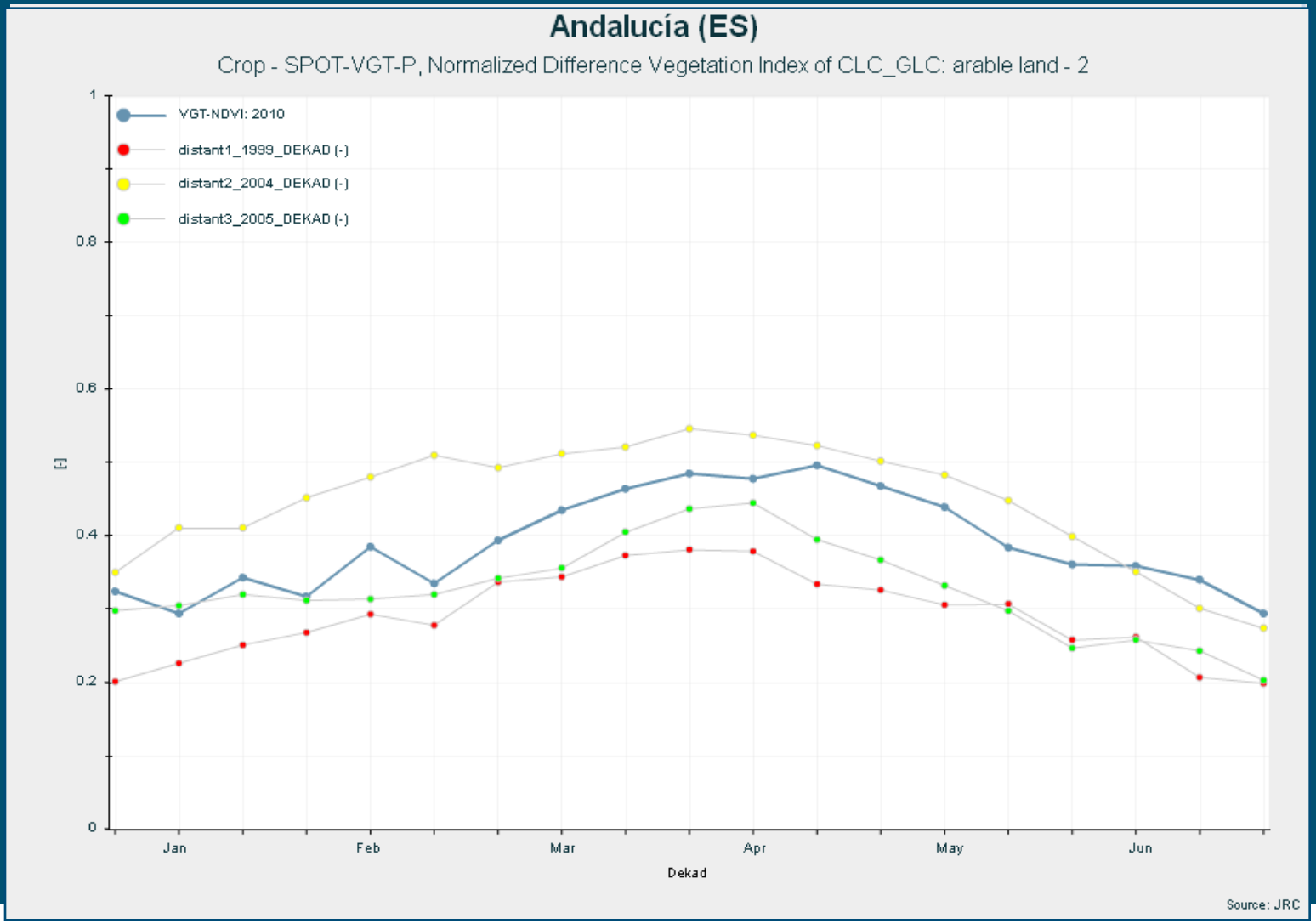
Similarity analysis



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Courtesy: JRC – Agri4Cast

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Conclusion

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