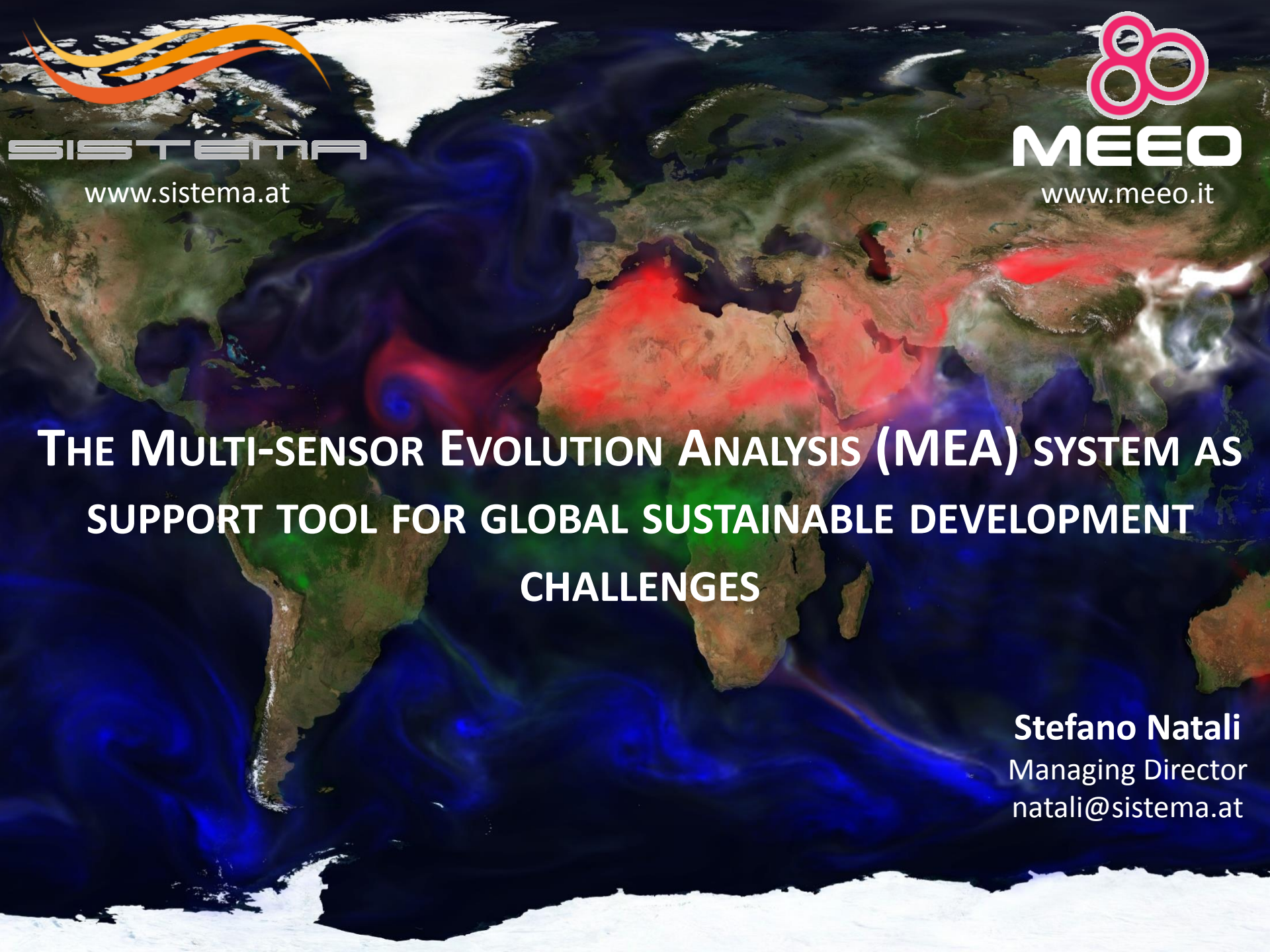

www.sistema.at

www.meeo.it

THE MULTI-SENSOR EVOLUTION ANALYSIS (MEA) SYSTEM AS SUPPORT TOOL FOR GLOBAL SUSTAINABLE DEVELOPMENT CHALLENGES

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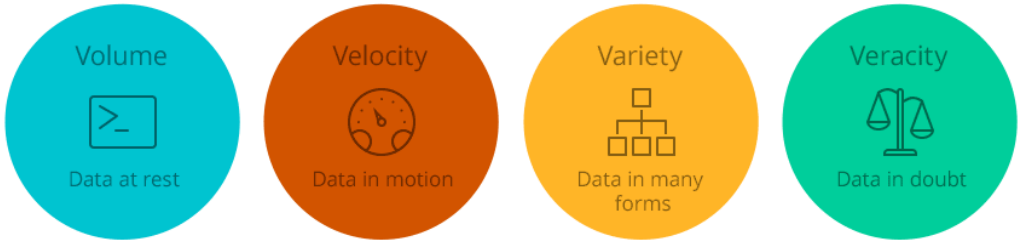
Summary

- **Earth Observation Climate data** as support tool for sustainable development policy makers
- MEA as **climate data management platform**
- **Success stories** and cooperation models 
- **Lesson learnt** and future perspectives

The Big Data era is running



Is the data exploitation (availability, collection and preparation) effective?

Each product has its own:

- data distribution format
- distribution platform (one producer per product)

Some of the users

- use only one dataset per time
- use multi-temporal datasets

Datasets to be managed are huge (GB→TB→PB→EB→ZB→YB)

Discovery, **data access** and **data access processing** services are crucial

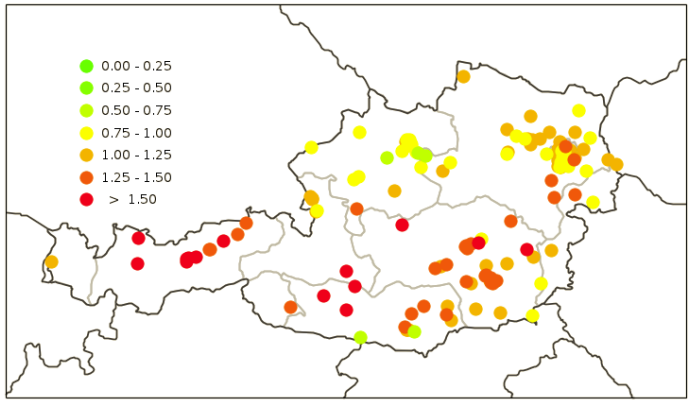
Which data are we talking about 1/2

→**Climate data**: temperature, humidity (soil, air), precipitation, vegetation status, ice / snow, solar irradiance, … (from local to global scale)

→Integration and **synergy between remotely** (e.g. satellite) **and locally** (e.g. stations) collected information

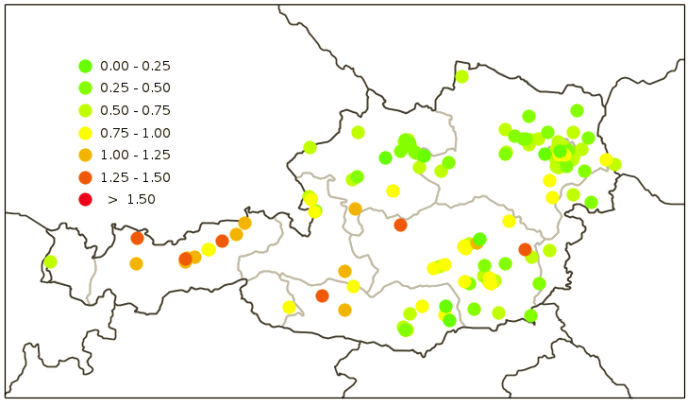
Only Model

Fractional BIAS: daily means and hourly values



Model + ground+ satellite

Fractional BIAS: daily means and hourly values



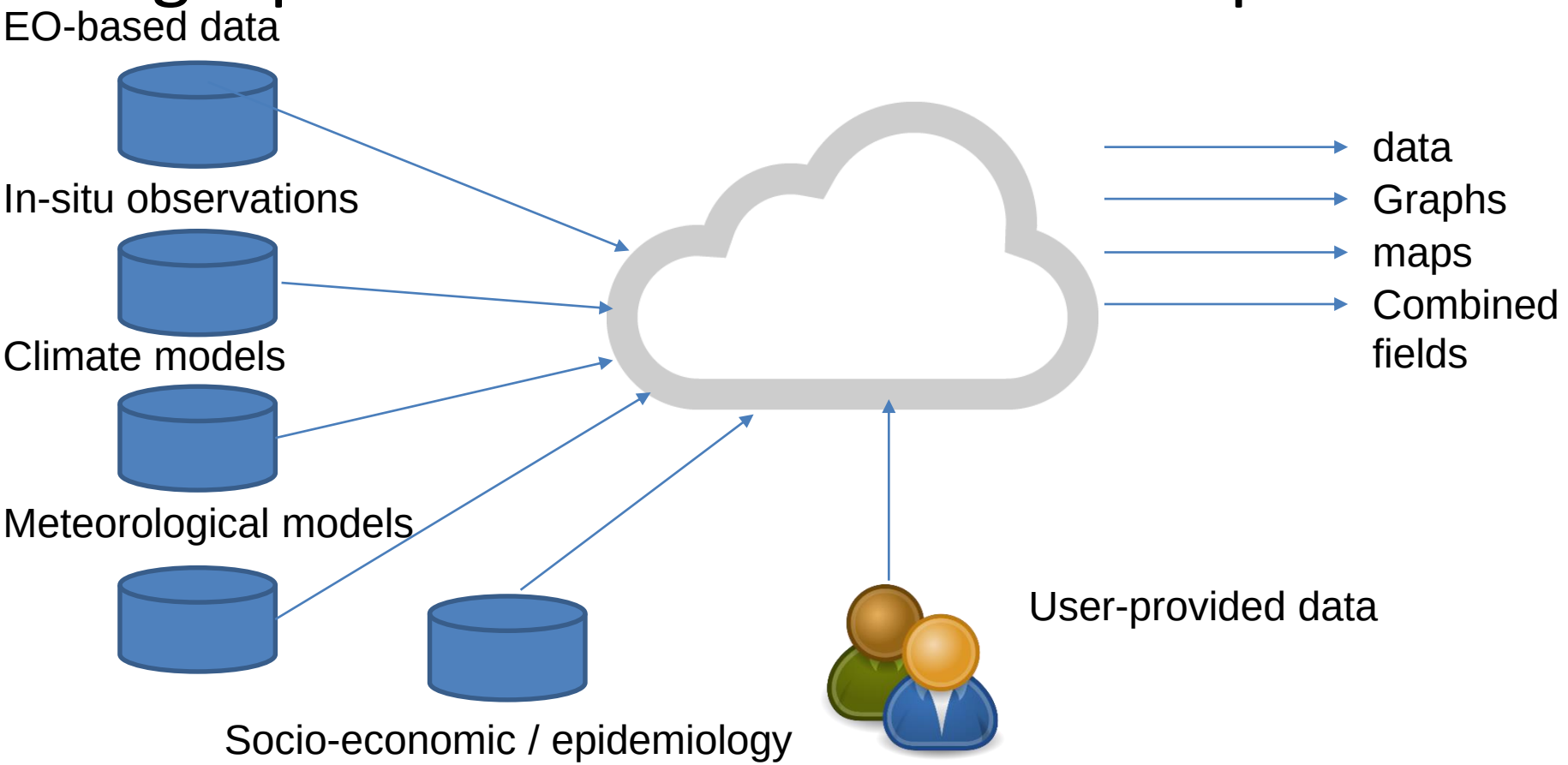
From Hirtl et al, EGU 2012, EGU 2013

Which data are we talking about 2/2

→Integration and synergy between climate data and other types of data **(socio-economic, epidemiology …)**

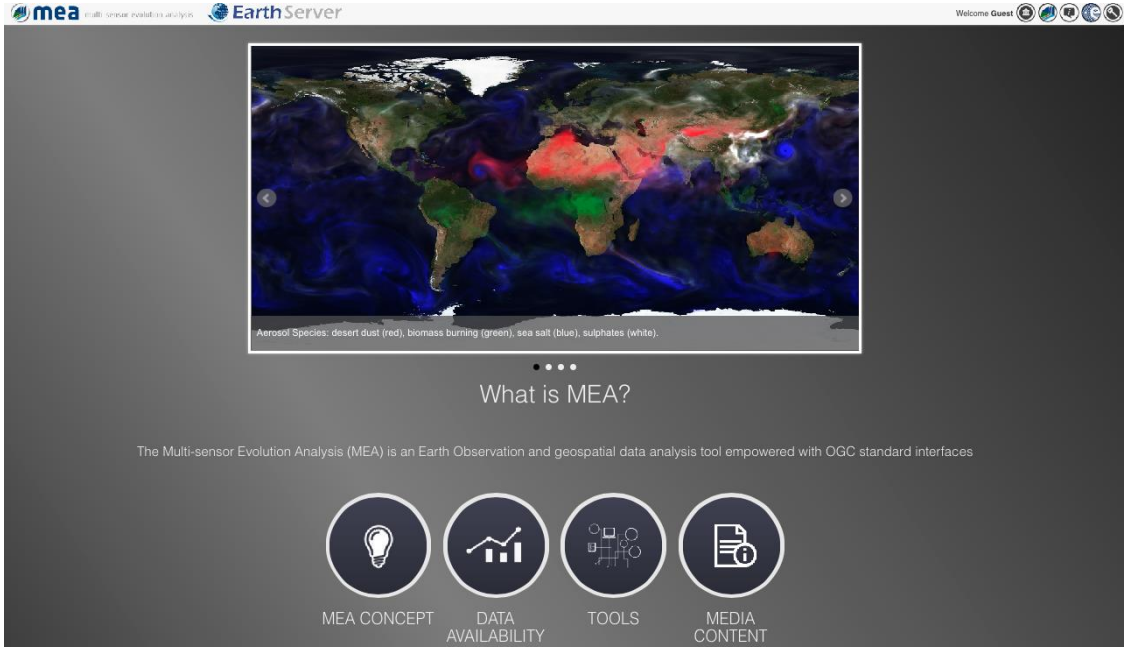
→**Climate model scenarios** to assess the impact of changes

Single point for data collection and provision



Only one requirement: each observation shall have collection position and time attached

Make users' life easier: the **web portal**



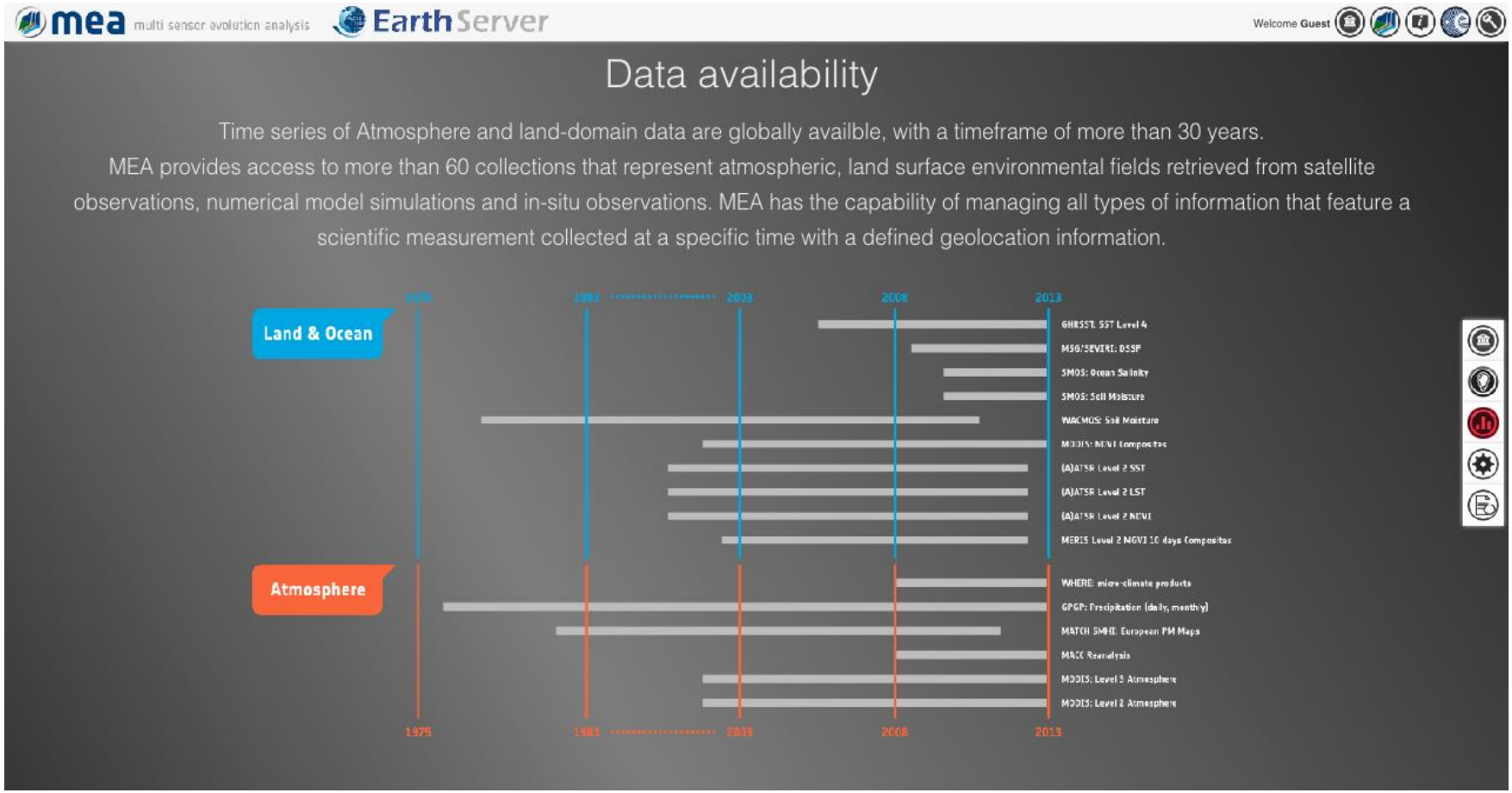
Make users confident: **on site installation**

Full **OGC compliance** (WxS interfaces)

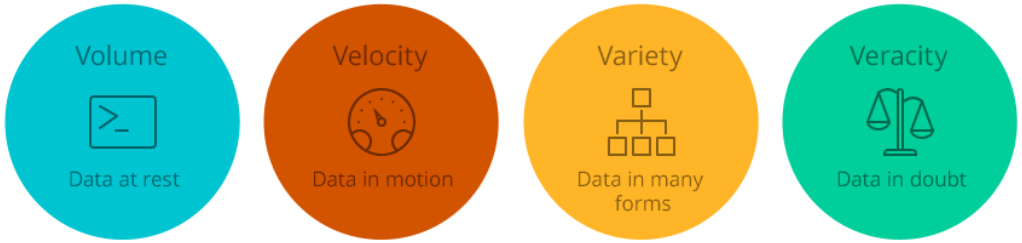
Make users' life easier: the **one-stop-shop**

- **Heterogeneous datasets**
  - EO products (from Level 1 to Level 4)
  - Forecast / re-analysis products (ECMWF, SHMI, ENEA, ZAMG, NMA, …)
  - Others (GPCP, CHIRPS, …)
- **Near Real Time services running to keep up-to-date the data availability**
- **> 100TB data distributed across several Data Storage servers in different infrastructures: ESA, MEEO, EODC, cloud environments**

Make users' life easier: the **one-stop-shop**



Make users' life easier: **customized services**



- Access processing
  - Download (full / subset)
  - Re-projection in the target / common grid
  - Format conversion
- On-the-fly Data Analytics
  - Real time data access and visualization
  - Heterogeneous data comparison
  - On-the-fly data analysis (e.g. extraction of statistical parameters)

Implemented Services

- MEA platform, EO products exploitation in Atmosphere/Land&Ocean domains
- Earth Observation Data Service, to support EO user communities with eff robust access processing services for Atmosphere, Land and Ocean applications
- InSAR Italy, open data portal to disseminate maps of the ground deformation
- EOCHA Data portal, to support Climate-Health experts in Africa
- Climate KIC projects
  - URBMOBI to support air quality monitoring over urban areas
  - WAT-ENER_CAST climate data platform, integration and visualization
- UNODC test installation made to support illicit crop detection
- Dep. of Epidemiology of Lazio region – Italy, to support Climate-Health experts

Earth Observation for Climate-related Health risk in Africa (EOCHA)

- **Scope**: to provide an effective web based platform to **collect meteorological and climate parameters** from heterogeneous data sources (satellite, in-situ, model) to support **geostatistical study of the relationship between climatic conditions and the diffusion of disease vectors** (e.g. Anophele mosquitoes)

Key factor: Users, scientists, and data experts together to build the tool

EOCHA Project

Area of interest:

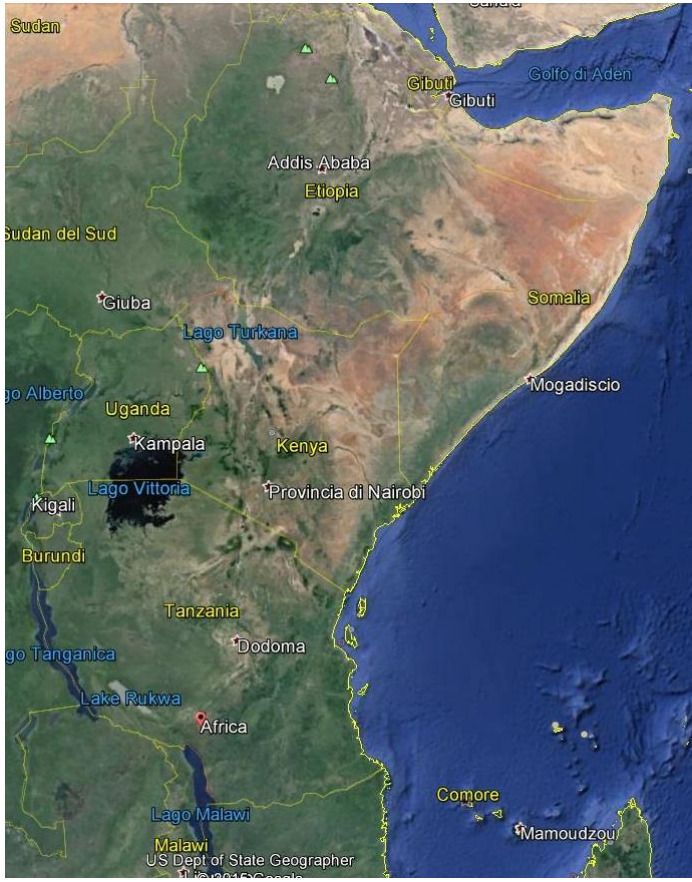
Eastern Sub-Saharan Africa (Kenia, Etiopia, Uganda, Tanzania, Somalia)

→**Restricted to Kenia, Tanzania, Somalia for higher data availability**

Diseases of interest:

Malaria, RFV, Chikungunya, Meningitis

→ **Restricted to malaria** for epidemiological data availability (Plasmodium falciparum – pf - parasite rate in population)



Climate indicators from Temperature

Product	Description	Type
Current temperature	Either individual stations and/or krigged interpolated surfaces	Map
Temperature anomalies	Departure from climatology for decadal and monthly time periods. Allowing a user to click a ROI and obtain a graph showing values would be very useful	Map & Graph
Optimal vector thresholds	Maps highlighting those areas where the temperature is between 22 and 30 °C for current and past decades/months	Map
Optimal malaria thresholds	Maps highlighting those areas where the temperature is between 27 and 30 °C for current and past decades/months	Map

- Different resolutions
- Avalaible from MEA data portal at given resolution or regionalized
- **Climate indicators computed** for all selected variables

EOCHA Project

- **Collected / used socio-economic datasets**

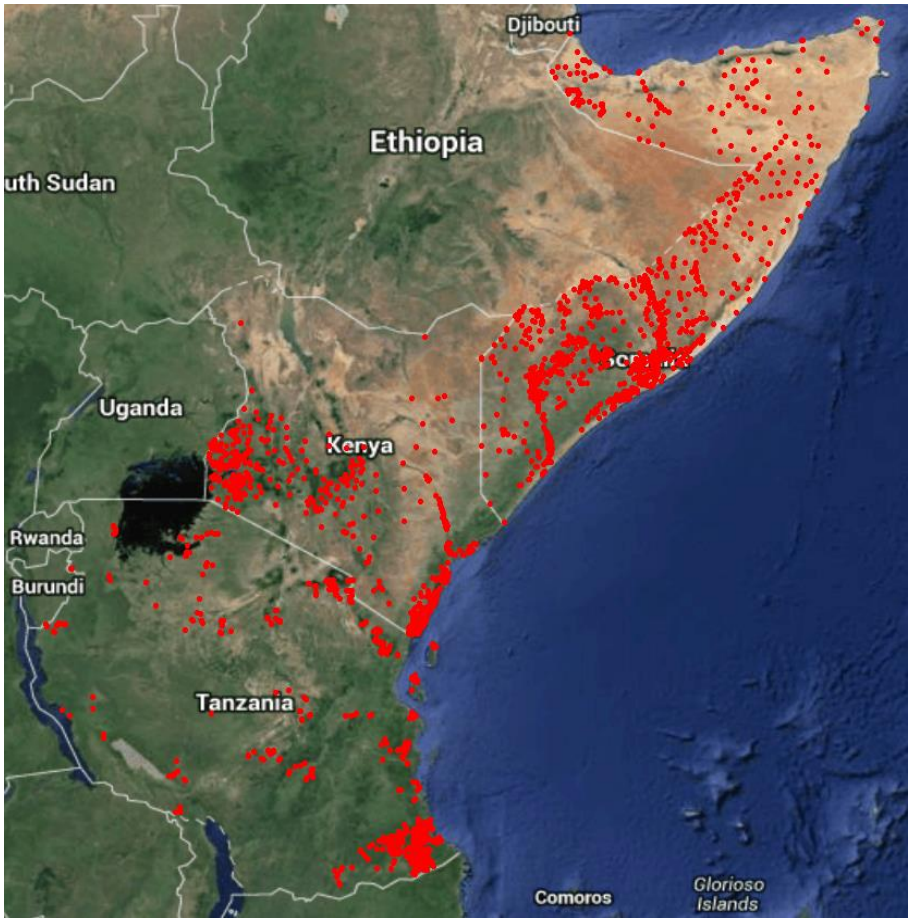
	Kenia	Tanzania	Somalia
Time period			
2000-2005	211	364	214
2006-2011	766	412	1275
Upper age sampled			
<=5	55	398	0
6-10	43	0	0
11-15	475	329	0
16-20	404	49	0
>20	0*	0~	1489§
Sample size			
20-50	232	437	843
51-100	275	164	516
101-500	464	169	122
>500	6	6	8
Total records	977	776	1489

* Max upper age for Kenia is 19

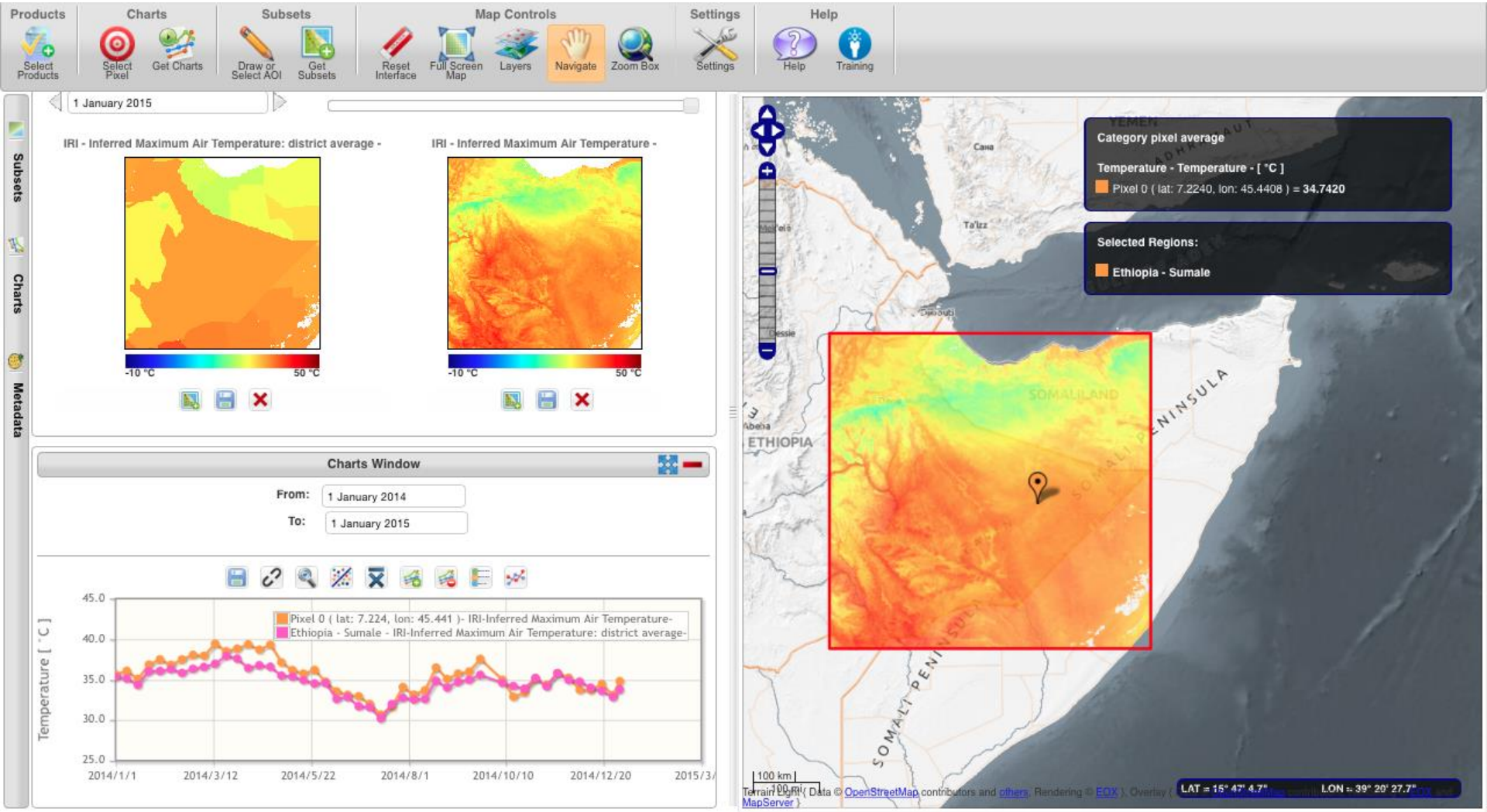
~ Max upper age for Tanzania is 19

§ Min upper age for Somalia is 30, max is 99, median=99, mean=88.91

Available locations under selection criteria

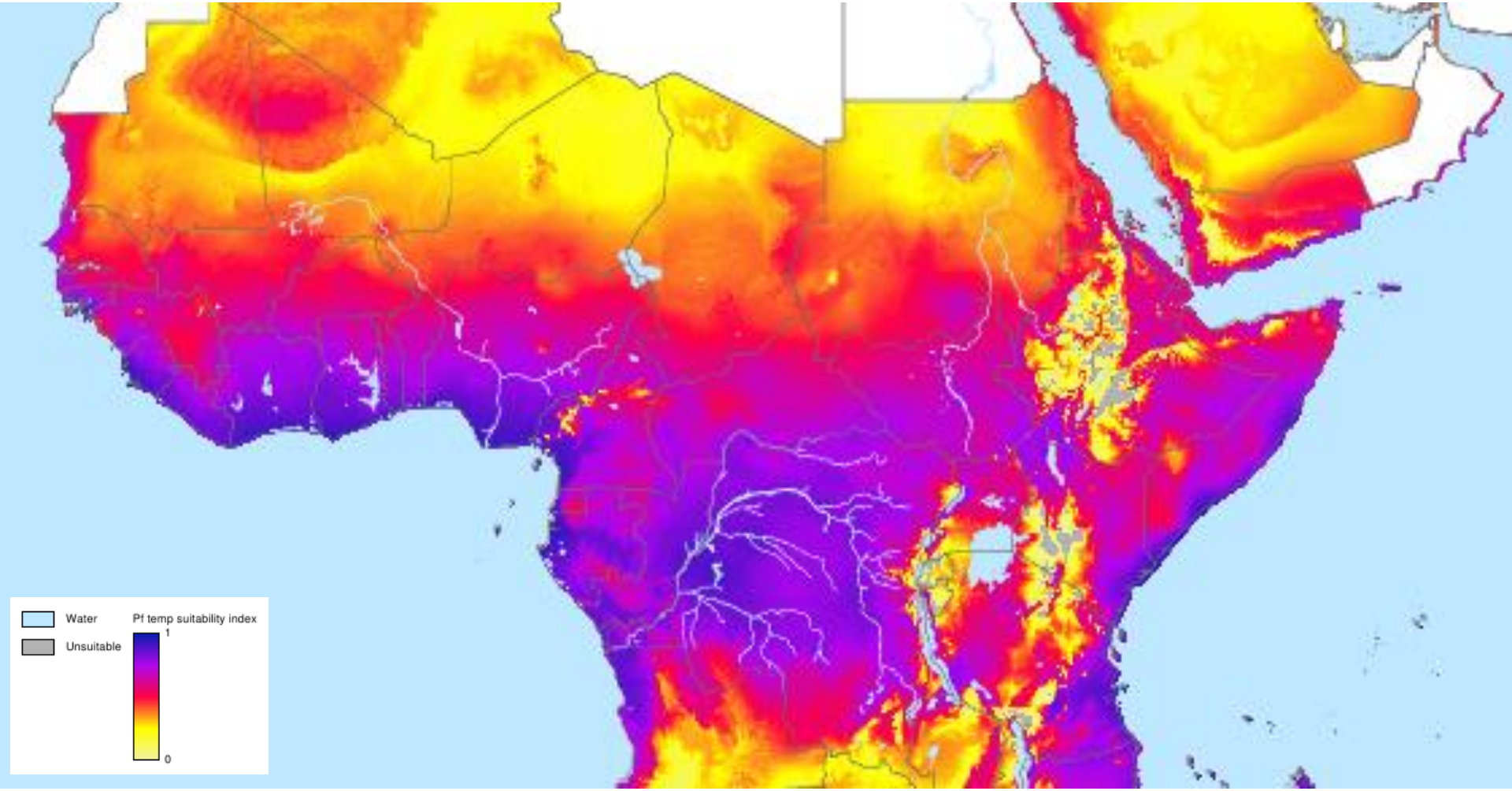


EOCHA Project



EOCHA Project

pf temperature sustainability index map

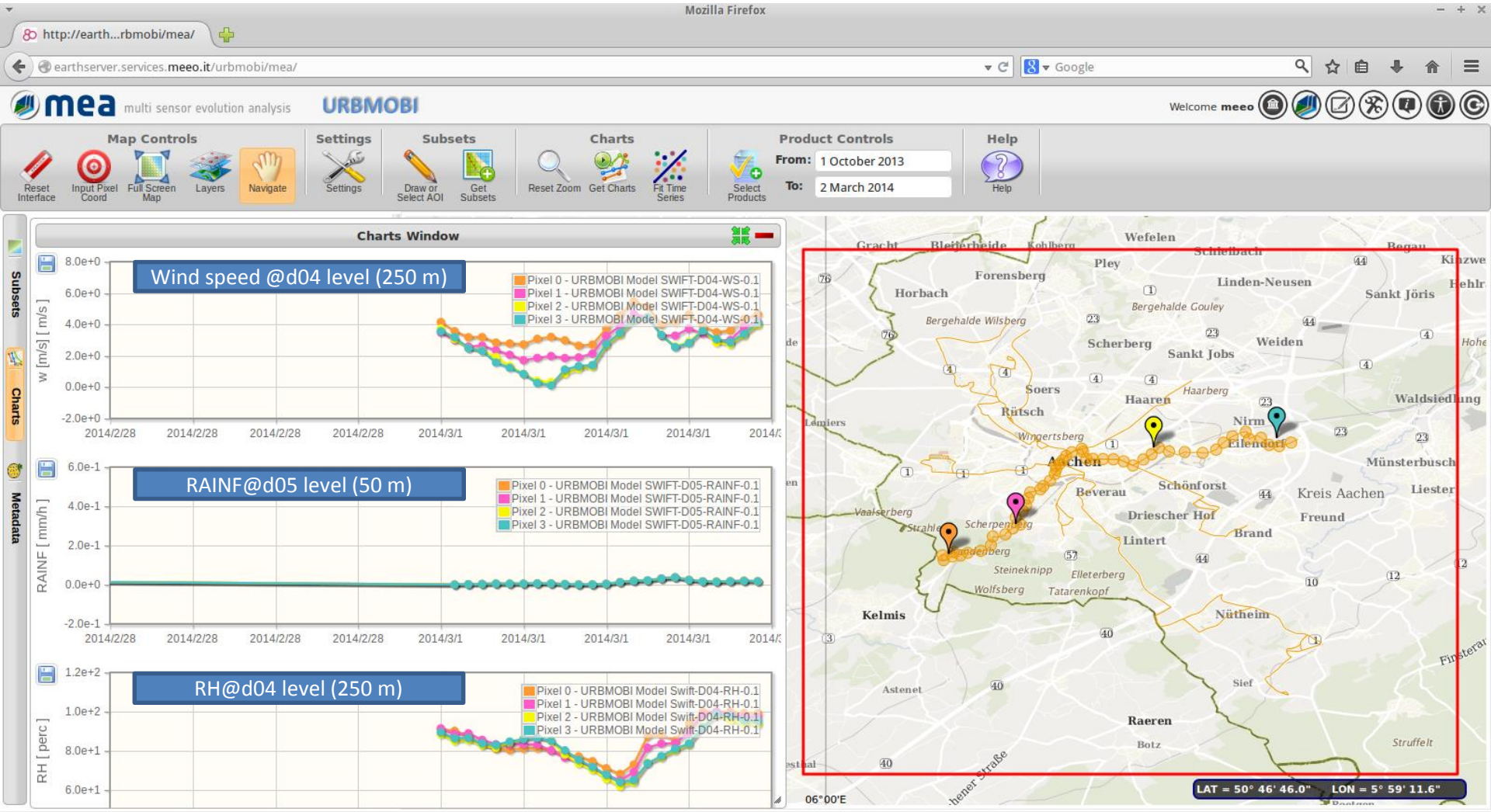


Urban Mobile Instruments for Environmental Monitoring

- **Scope**: to provide an effective web based platform put together environmental monitoring information coming from models and mobile sensors

Key factor: single platform to collect, process, correlate, intercalibrate environmental data

URBMOBI Project



Lessons learnt (1/2)

- Users' requirements are the lymph for the service(s) design

- Cross-disciplinary is the key point for a successful implementation of services and applications
  - Infrastructure / environment set-up
  - Implementation of robust performing tools
  - Service(s) deployment
  - Service(s) operation

Lessons learnt (2/2)

- The service becomes a success story when the users start promoting its usage within their communities.

- Have a look at the video “Climate-health experts at work” (~20’ long) to know more about the EOCHA Data Portal

"…so I totally endorse this system and I think that **once people** in the medical community those you do research as well in to the effect of the climate and climate change on disease **are aware of this system that it will become a one stop shop for those people who need that data for their existing models and to develop new models in the future**.”

Future Perspective

→To **distribute Level 1 satellite data**, offering advanced data combination and sub-setting services (e.g. time series of data over the same area from different satellites)

→Create **plug-ins for the most common GIS system** to provide MEA collections as remote drives to import only specific fields over specific areas within specific timeframes (to **reduce at the minimum the data transfer** needs)

Conclusions

- ***'Digital Earth'*** *as a multi-resolution,* ***three-dimensional representation of the planet that would make it possible to find, visualise and make sense of vast amounts of geo-referenced information on physical and social environments.*** *Such a system would allow users to navigate through space and time, accessing historical data as well as future predictions (based for example on environmental models), and would support its use by scientists, policy-makers and children alike (Gore 1999).* Gore, A., 1999. The Digital Earth: understanding our planet in the 21st century.

- "**the combinations of satellite EO data with other sources** of data improve the quality of the information provided to end users, including decision makers" (added value of EO for DRR)

- There is a need of **data access and SDI** (from the groups' discussions)

MEEO

Meteorological Environmental Earth Observation

SISTEMA

Environmental Information Mining

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Fax: +39 0532 1861637
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Fax: +43 (0)1 2533033 7427
info@sistema.at
http://www.sistema.at

MEA main platform: http://earthserver.services.meeo.it/mea
EOCHA platform: http://eocha.services.meeo.it/mea

mea multi sensor evolution analysis

APACHE

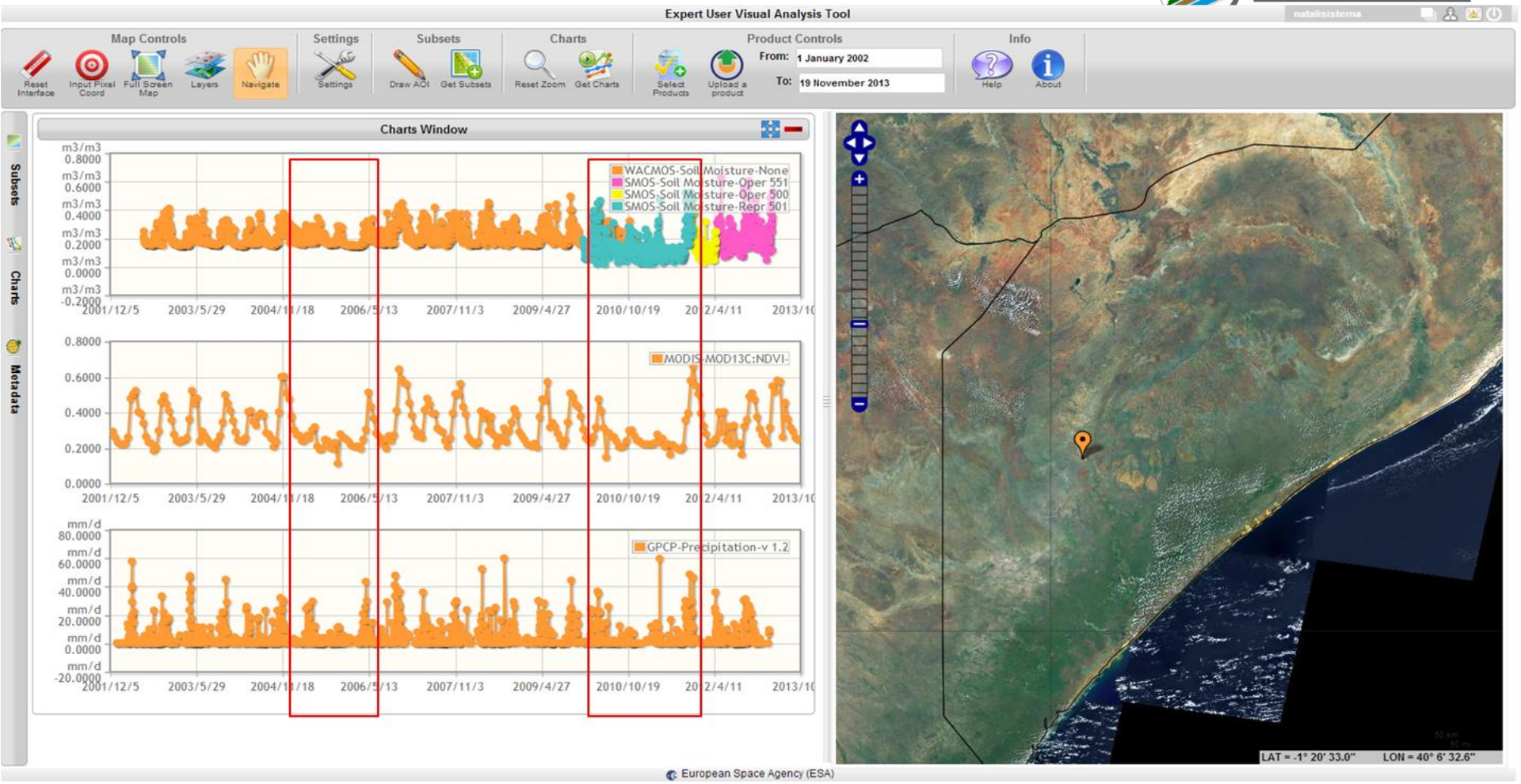
GDAL

PostgreSQL

rasdaman raster data management

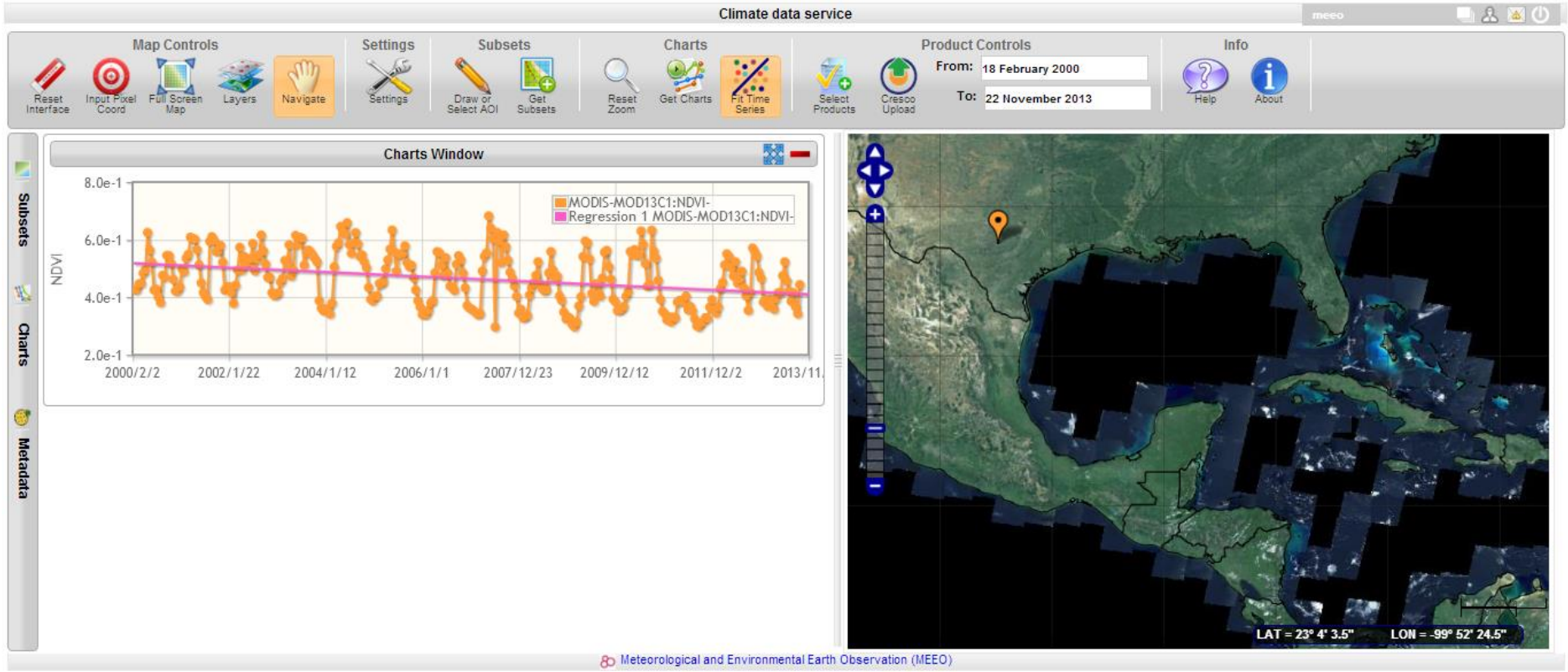
python™

Drought Application



Identification of **drought / famine events** in Eastern Africa (Somalia) and evolution trends using multi-temporal data analysis of **Soil Moisture** (top), **NDVI** (middle) and **precipitation** (bottom) time series

Drought trends

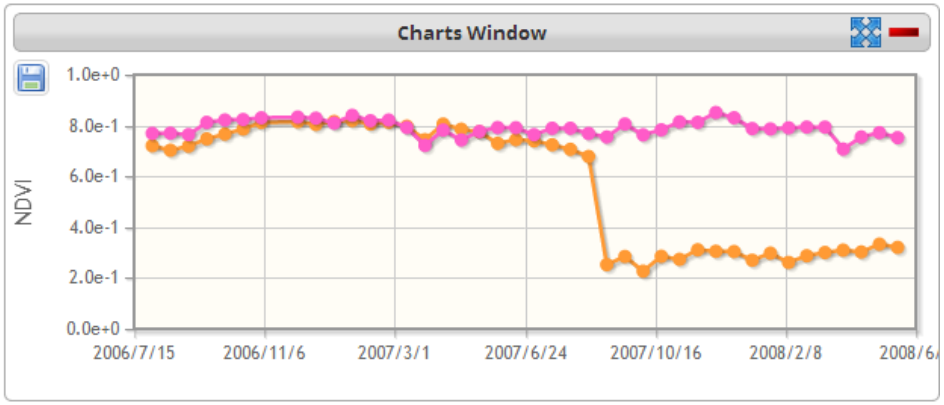


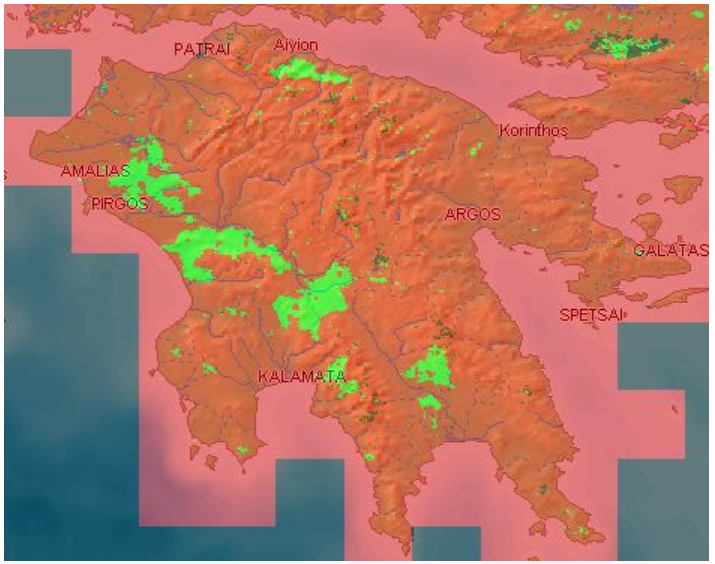
Identification of **slow but continuous decrease of vegetation index values** close to the US / Mexican border in Texas. Tendency line is also shown

Burned Areas Detection

MOD 13 Q NDVI 06/10/2007

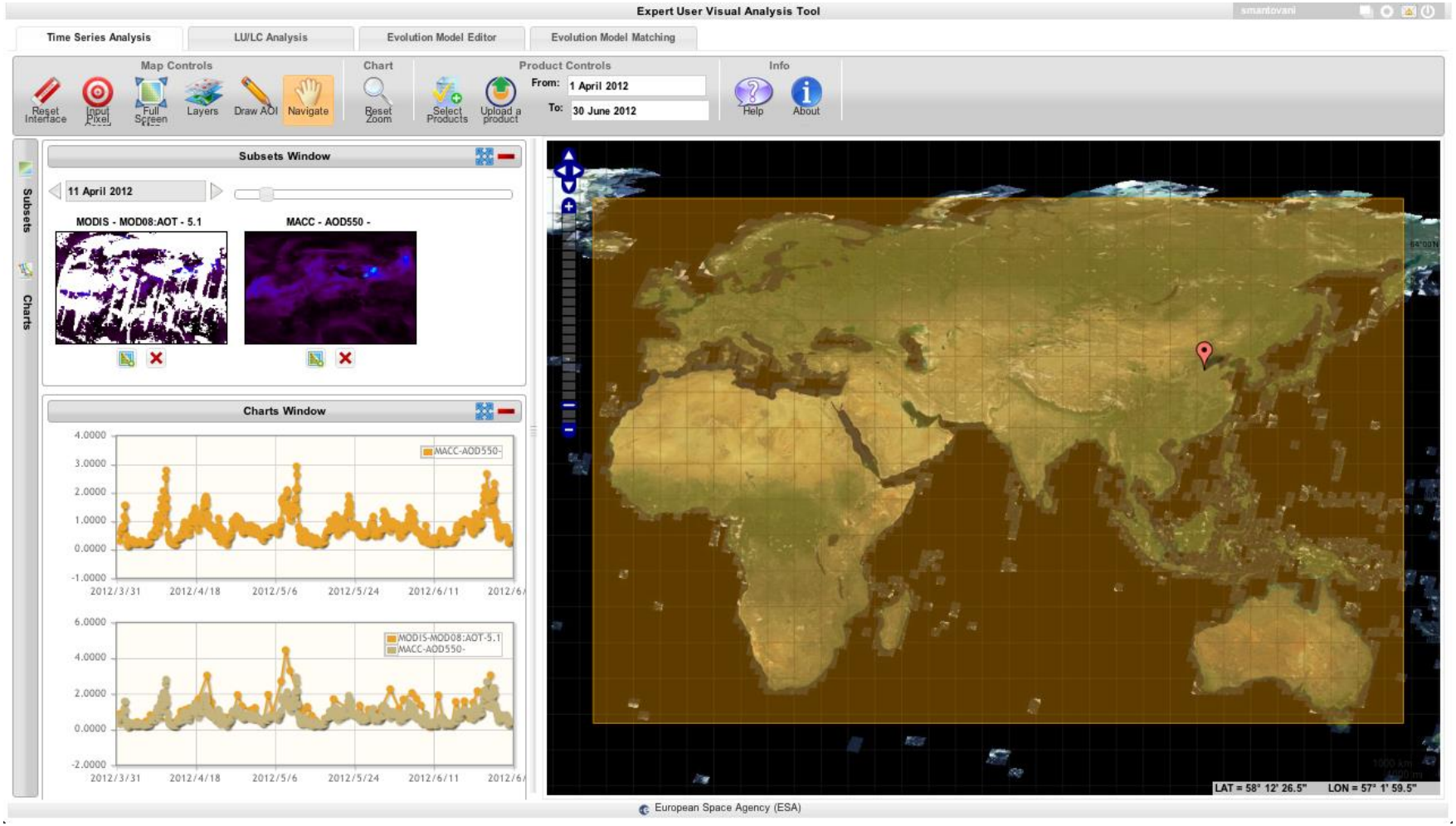
- Greece summer- fall 2007 – single point data analysis
- Anomalies model definition
- Model application



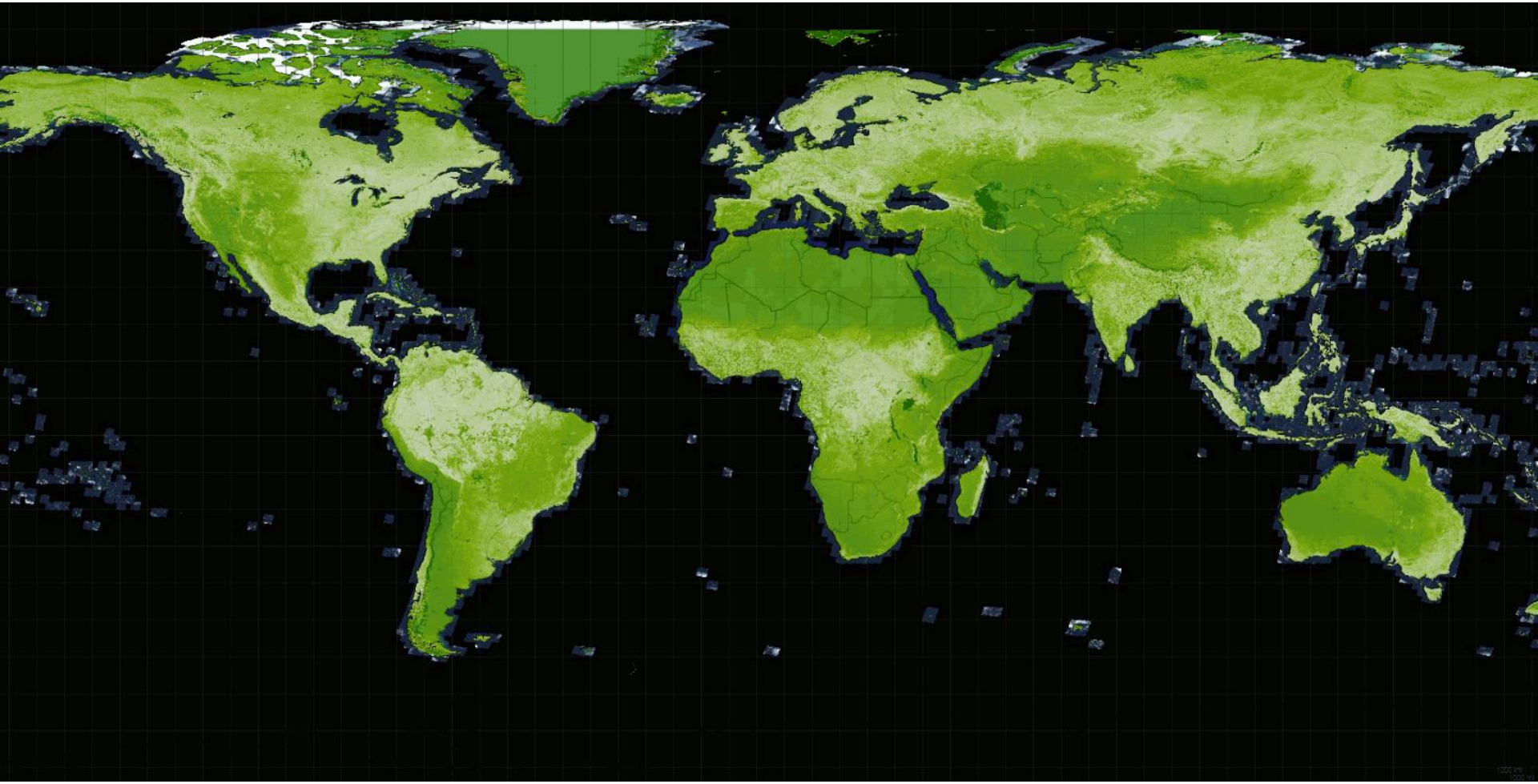


Green pixels: burned areas in the period Aug. – Oct. 2007

- **Global applications**



- **Global applications: MODIS NDVI, WACMOS and SMOS SoilMoisture**



- **Global applications: MODIS NDVI, WACMOS and SMOS SoilMoisture**