



Air Quality Services



KINGDOM of SAUDI-ARABIA
by
SGS-GAF-DLR-TPZ





Air Quality Monitoring and Forecasting – Overview

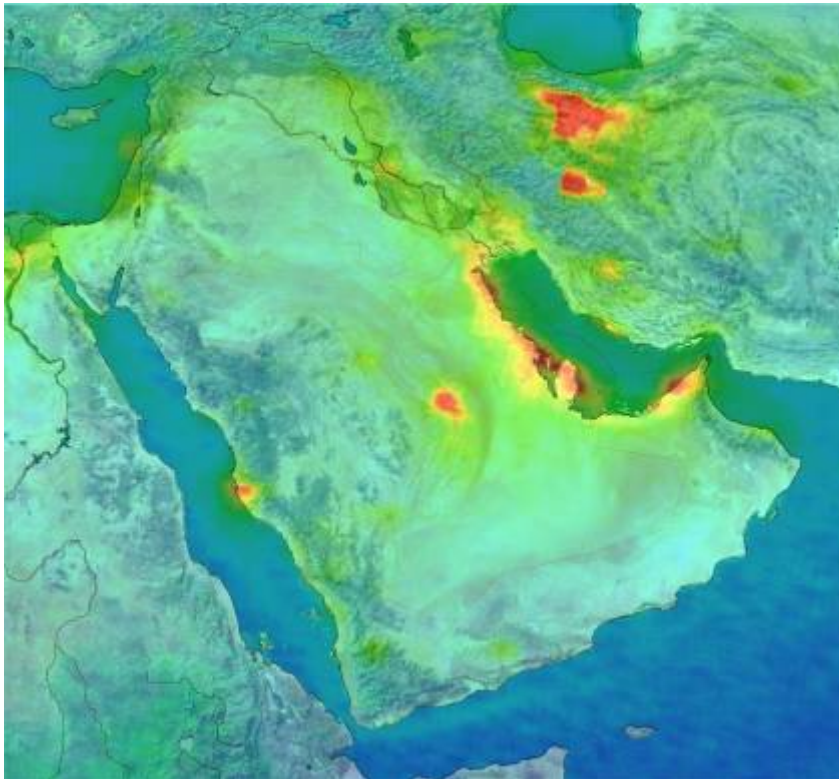
PME Air Quality Training

November 2009

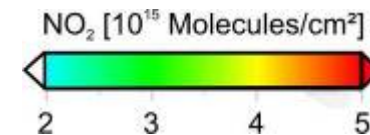


Objective

- Implementation of a remote sensing based Air Quality Monitoring and Forecasting Service for KSA



Tropospheric NO₂,
Dec 2008





Training schedule

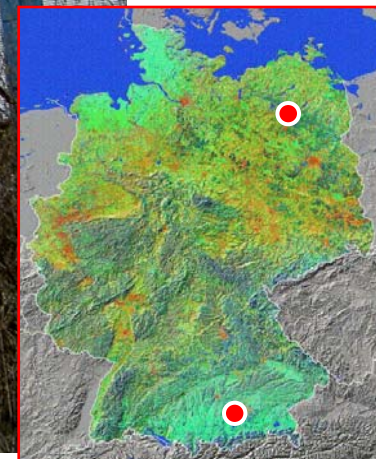
- Day 1: Introduction and overview
- Day 2: Satellite-based data
- Day 3: Modelling System
- Day 4: Training PME Use Cases





DLR - German Remote Sensing Data Center: www.dlr.de

- Founded in 1981
- 2 locations in Germany (Oberpfaffenhofen, Neustrelitz)
- 200 staff (2009)
- Complete earth observation chain
 - Data acquisition
 - Processing
 - Archiving
 - Distribution
 - Applications
- National Remote Sensing Data Library (NRSDL)
- Centre for Satellite Based Crisis Information (ZKI)
- World Data Center Atmosphere (WDC-RSAT)
- ESA Multi Mission Facility (ESA-MMF)





Expertise of DLR in air quality services

- World Data Center for Remote Sensing of the Atmosphere hosted and coordinated by DLR with mandate of
 - International Council for Science (ICSU)
 - World Meteorological Organisation (WMO)
- Responsible for retrieval and processing of trace gas data from
 - METOP/GOME2 on behalf of EUMETSAT (2007 to present)
 - ENVISAT on behalf of ESA (2002 to present)
 - ERS-2/GOME on behalf of ESA (1995 to present)





Expertise of DLR in air quality services

- DLR coordinates the ESA service element for AQ monitoring and forecasting for GMES
- Coordinates the EC FP7 project for future regional/local AQ services covering all major regions and cities in Europe (22 partners)
- Responsible for the implementation of the European AQ Platform for the European Environmental Agency (EEA) (consisting of 6 models)
- Coordinates for the EEA the service for European AQ Index from ground-based measurement network





Aims

- Qualitative analysis of air pollutants and their distribution
- Quantitative analysis/forecasting of air pollutant levels
- Allocation of air pollution sources
- Monitoring of cross-boundary transport of air pollution
- Contribution of information to detailed reports on air quality





Method

- Exploitation of all relevant data sources
- Usage of best available remote sensing data to quantify air pollutants from space and in-situ data
- Application of cutting edge algorithms and modules
- Synergistic combination of data with modelling and forecasting capabilities by data assimilation





Objective

- Implementation of an Air Quality Monitoring and Forecasting Service for KSA by combining the techniques of:
 - Satellite remote sensing
 - Ground-based air pollution monitoring
 - Emission inventories and modelling
 - Data assimilation
 - Modelling of transport
 - Modelling of chemical conversion
 - Geographic Information Systems





Benefits of service for PME

- Assures leading role in environmental technology and strengthens the Kingdom's international position in dealing with environmental issues
- Increases preparedness for short term actions
- Allows early warning and alerting of people at risk
- Supports health care community and hospitals
- Contributes to reporting on concentration levels
- Supports exceedance and compliance monitoring
- Contributes to implementation of AQ directives
- Builds prerequisite for modern environmental management of traffic, health etc.





Benefits for public use

- Improves quality of daily life
- Raises awareness of people on air pollution
- Allows early warning and alerting of people at risk
- Relief medication can be taken in advance
- Reduces number of hospital admissions
- Increases life expectancy





Air Pollutants

- NO₂ (Nitrogen Dioxide)
- O₃ (Ozone)
- SO₂ (Sulphur Dioxide)
- CO (Carbon Monoxide)
- Particulate Matter
- Air Quality Index following EPA definition and colors





Air Quality Services for PME

- Daily maps for AQ monitoring
- Daily maps for 72-hour AQ forecasting

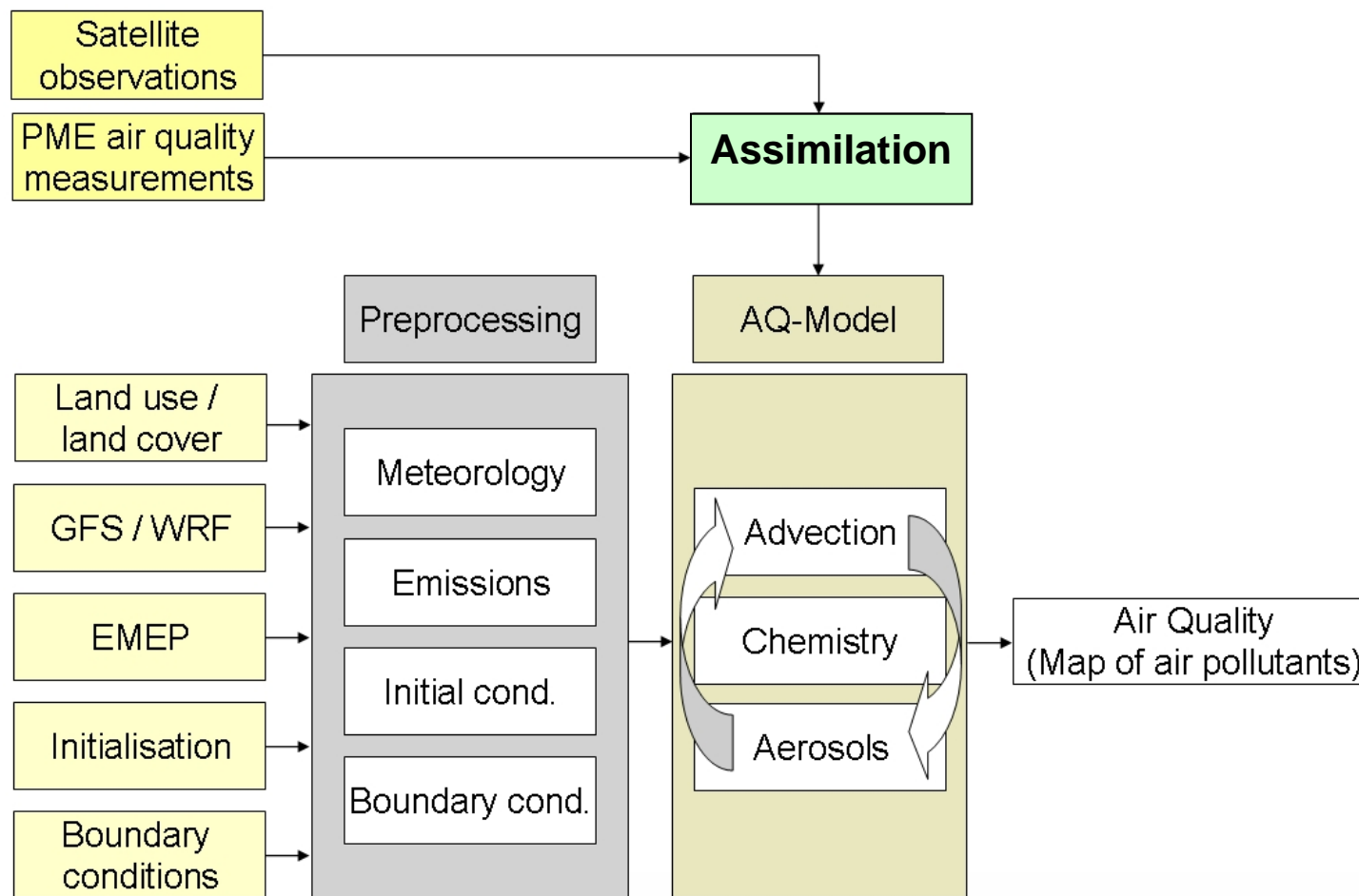
Comprising:

- Near-real time remote sensing data
(available 2 hours after overpass)
- Ground-level concentrations
- Daily maxima and means
- Coverage: KSA + Red Sea + Arabic Sea
- Spatial resolution: 25x25 km, 10x10km nests
- City level demonstrator for Jeddah (street-level resolution)





EIMS Air Quality Forecasting System - Overview

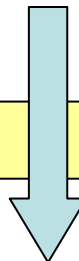




Steps and Current Status

1. Retrieve and process air pollutant data from satellites ✓
2. Implement emission inventories and modelling ✓
3. Interface to meteorological data ✓
4. Implement transport and chemical conversion modules ✓
5. Interface to ground-based data from PME
6. Assimilate all data into modelling system (✓)
7. Perform AQ analysis and forecasting ✓
8. Mapping of data ✓

Validate products



Deliver AQ information layers to PME geoportal ✓





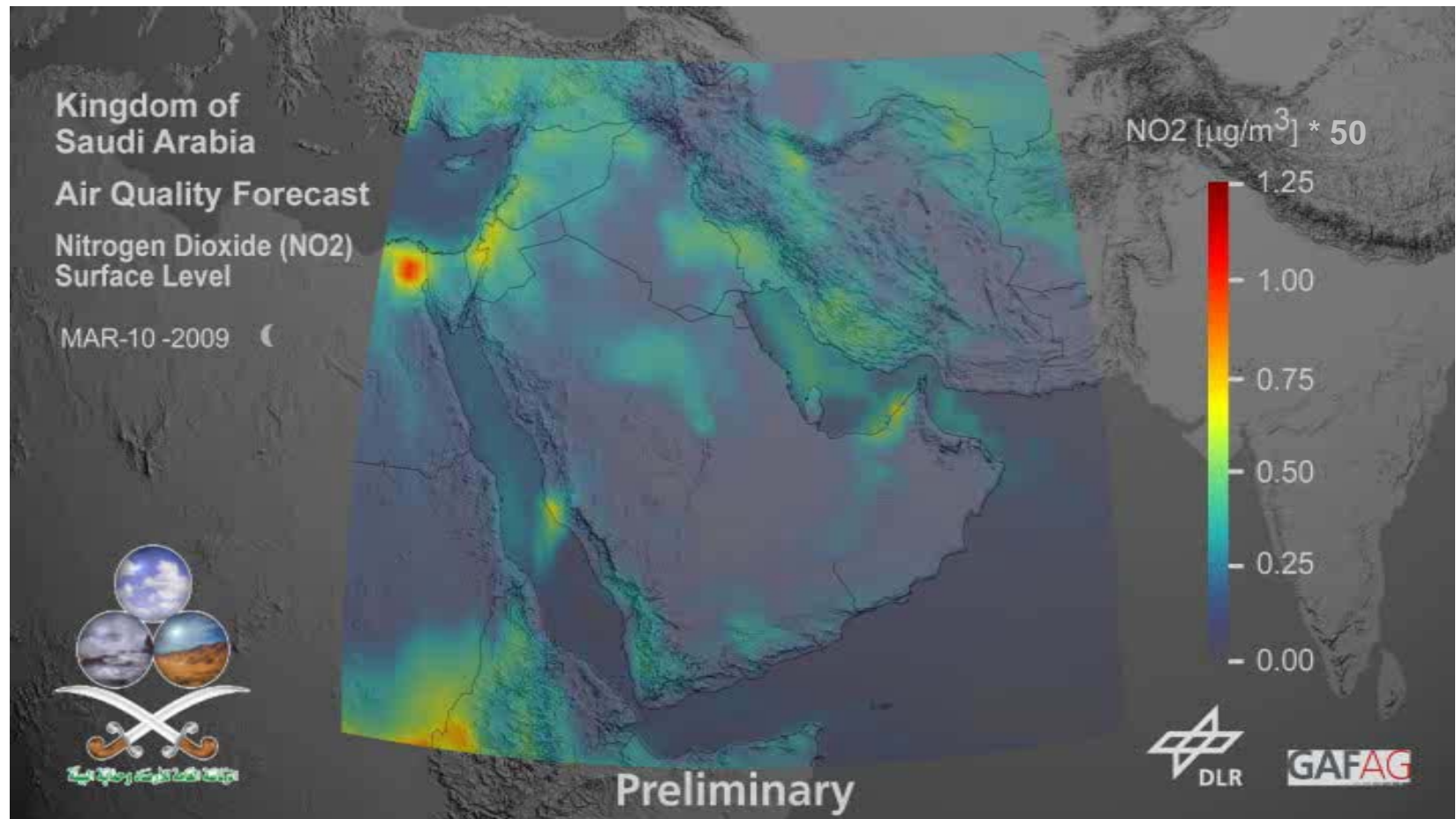
Status after 10 months

- Operational state-of-the-art system has been implemented
- Service up and running
- Daily forecasts and analyses of air pollutants for KSA available in PME Geoportal
- Service Design Document available
- 5 Use cases have been identified
- Demonstrator for Jeddah Street Level
- Additional monitoring of volcanic activity



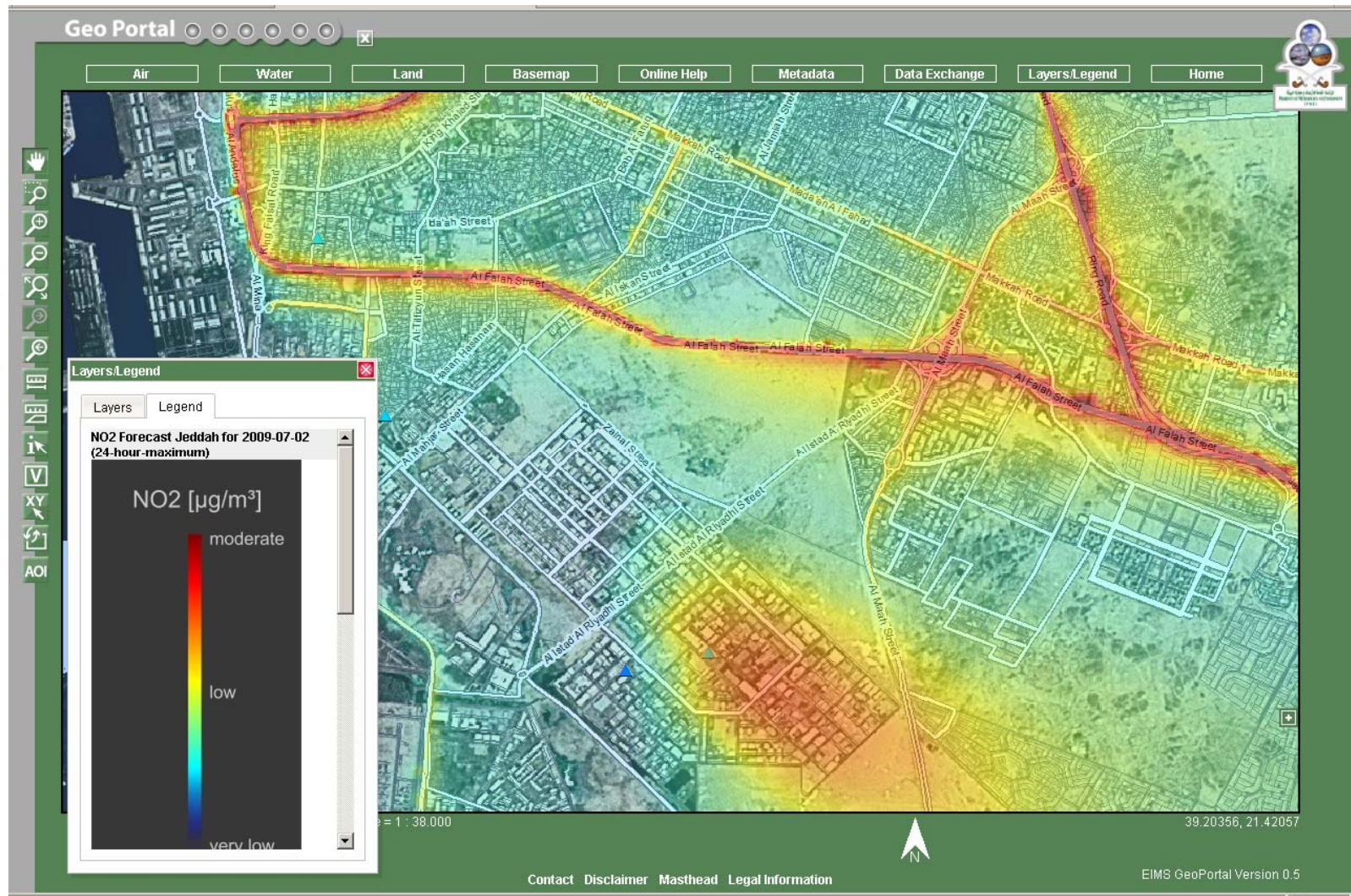


Air Quality Forecasting integrating observations



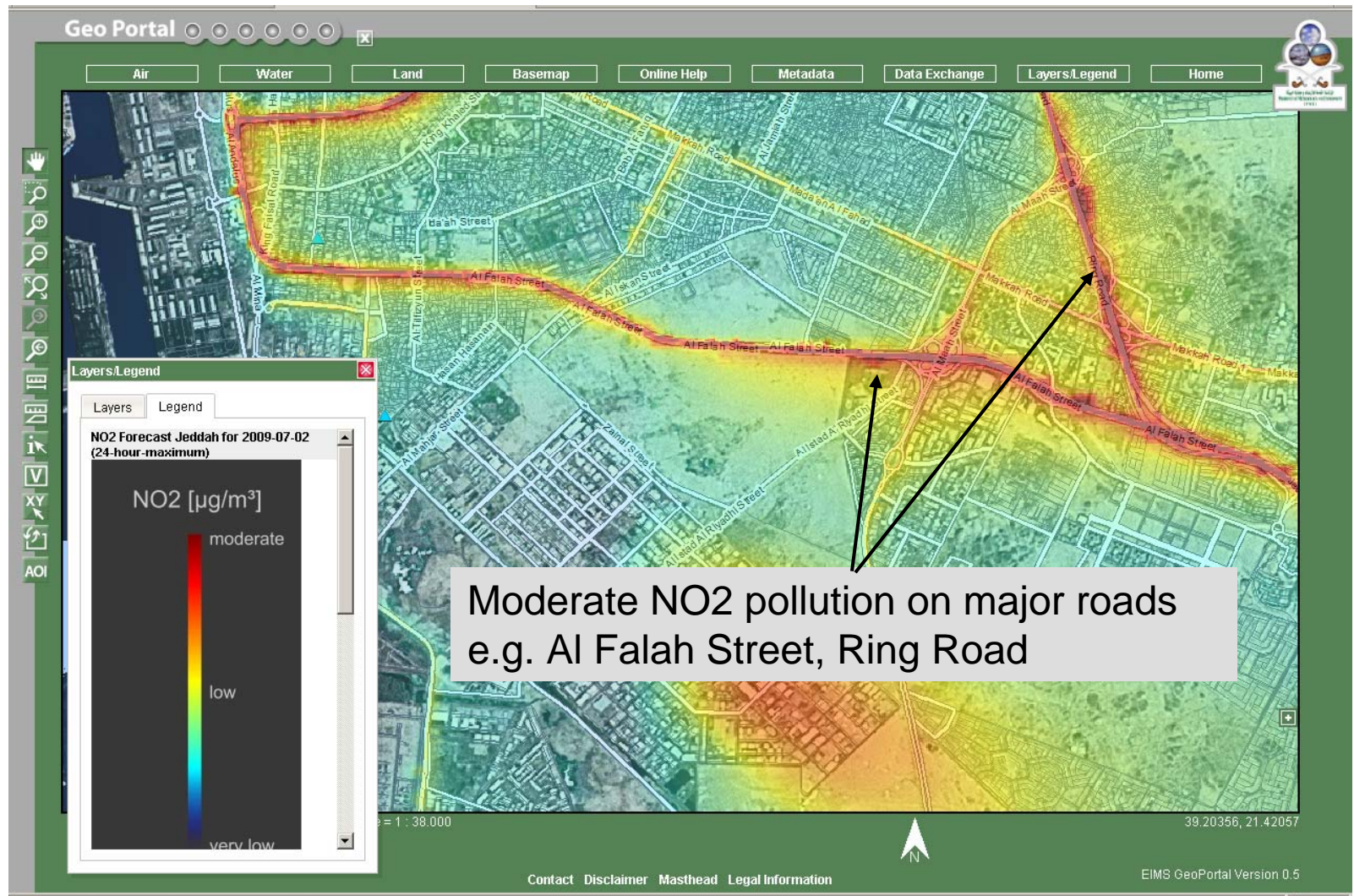


Street Level Demo: NO₂ forecast for 2009-07-02 (Fr)



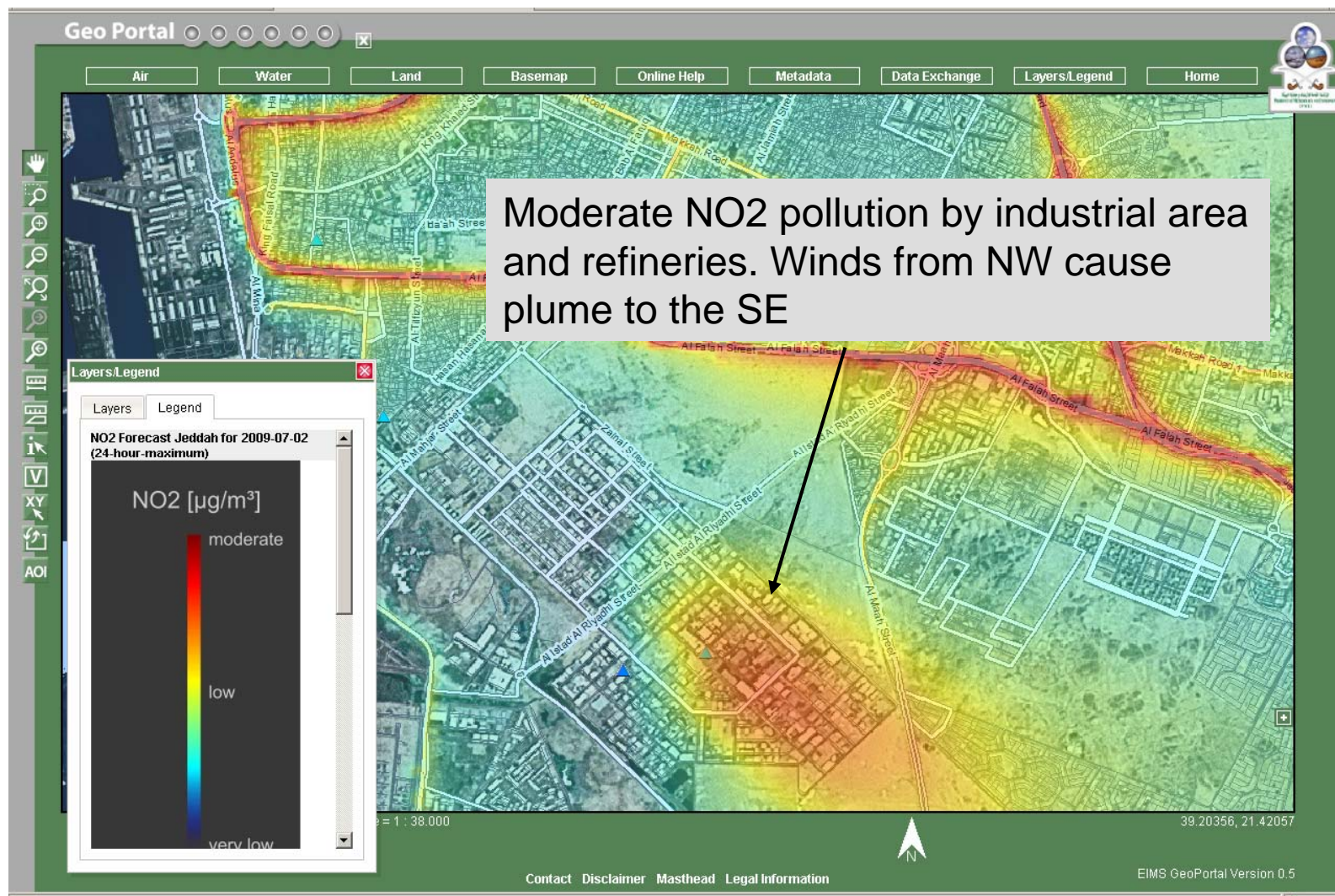


Street Level Demo: NO₂ forecast for 2009-07-02 (Fr)



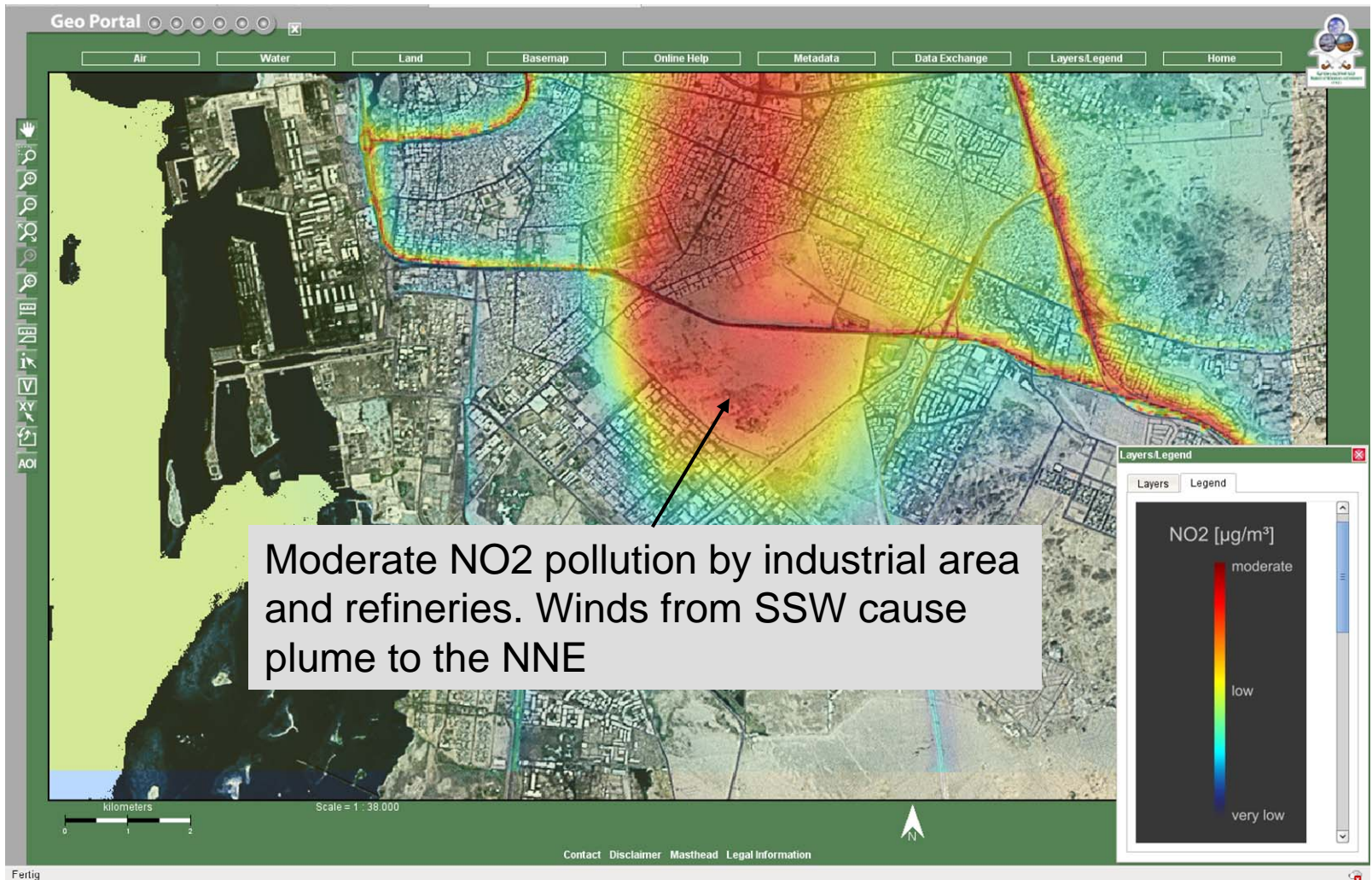


Street Level Demo: NO₂ forecast for 2009-07-02 (Fr)





Street Level Demo: NO₂ forecast for 2009-07-05 (Mo)





Volcanic Activity Monitoring

- An important indicator for volcanic and related seismic activity can be the emission of trace gases, such as sulfur dioxide (SO₂)
- Changes in SO₂ flux can be a precursor for the onset of volcanic activity.
- Then SO₂ is degassing from the magma chamber.





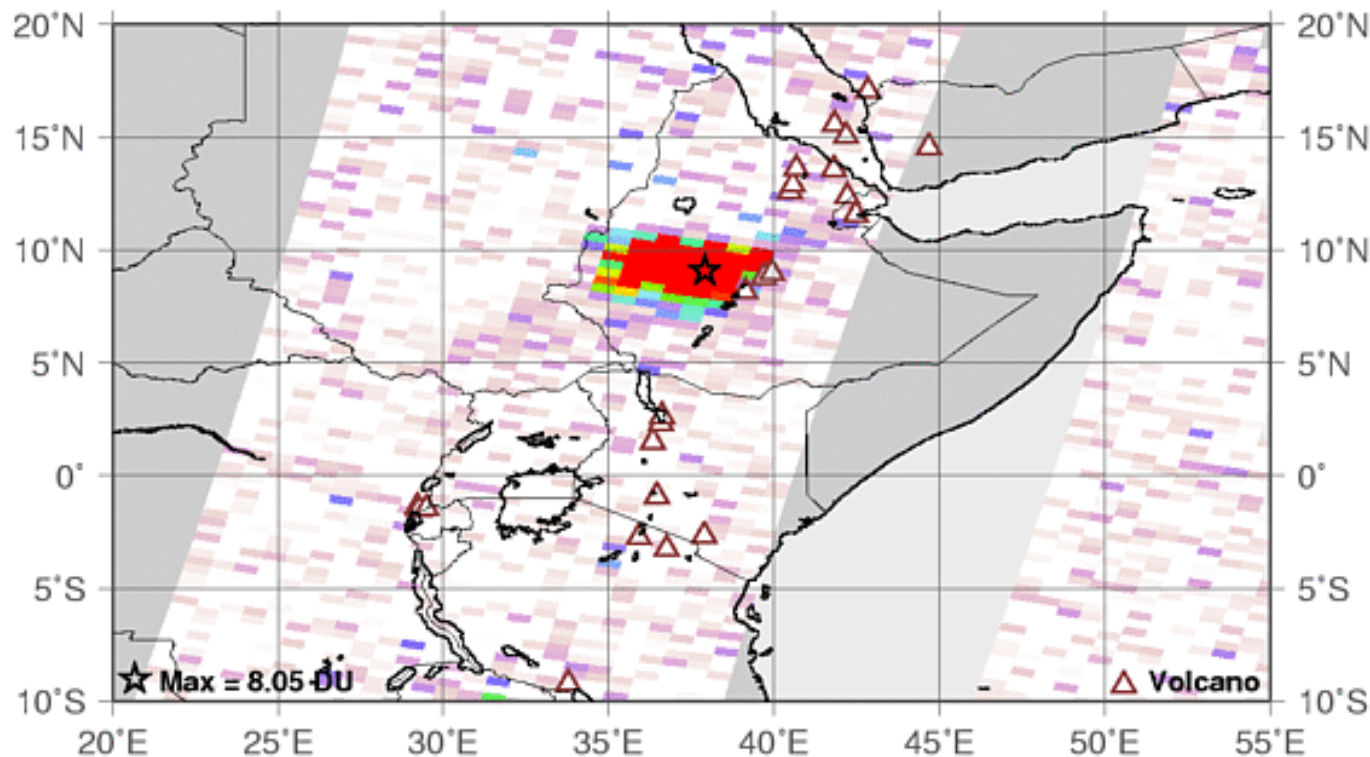
Volcanic Activity Monitoring

GOME-2 / MetOp

Jun 30, 2009

SO₂ Vertical Column Density

Ethiopia

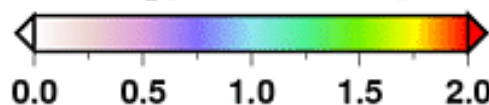


One-day Composite

Lv2 Version: GDP-4.3

<http://wdc.dlr.de>

SO₂ [Dobson Units]





Conclusion

- Service up and running
- Latest products available at PME Geoportal
- Everything delivered on schedule so far

