

GMES

Global Monitoring for Environment and Security

MONITORING THE AIR WE BREATHE FROM SPACE

On average, we breathe 20 times a minute. Clean air is essential to our health. However, it is estimated that in Europe particles in the air reduce average life expectancy by eight months and in some areas even by 36 months. Assessing and monitoring air quality are therefore fundamental to assuring better health. From their vantage in space, satellites provide global measurements of many pollutants, their transboundary movement and support ground-based air quality monitoring.

GMES contributes to air quality monitoring and forecasts over Europe in support of European policies aiming to protect human health.

- Satellites are capable of measuring the most important air pollutants, greenhouse gases and particles such as those from dust, smoke, and pollen. They provide timely, spatially explicit, large-scale information on distribution in a cost-effective manner. When these data are coupled with ground-based measurements from monitoring stations and atmospheric chemistry models, accurate information on air quality can be provided in near-real time to support European air quality policies, air pollution mitigation and public health protection. Regional and municipal governments are increasingly interested in providing services to monitor and forecast local- and city-level air quality using models based on satellite data. Citizens in some cities are already provided with detailed air pollution alerts via email, mobile phone text messages, or via websites.



A study for Brussels shows that a significant number of citizens are exposed to annual mean concentrations of nitrogen dioxide exceeding the European threshold of 40 $\mu\text{g}/\text{m}^3$ in 2007. Nitrogen dioxide is an atmospheric pollutant causing adverse health effects and its levels are regulated by the European Air Quality Directive. In order to capture the strong concentration gradients of nitrogen dioxide, high resolution modelling and satellite observations are needed to accurately estimate human exposure.

Source: VITO

COSTS OF POOR AIR QUALITY IN EUROPE

- 80-90% of urban populations are exposed to particulate matter levels exceeding air quality guidelines of the World Health Organisation (WHO).
- At current standards, healthcare costs associated with poor air quality are estimated to reach at least €189 billion/year by 2020.

BENEFITS OF EARTH OBSERVATION

Satellite-based air quality assessments support the EC's goal of improving reduced life expectancy due to airborne particulate matter (PM) by:

- Compliance monitoring support for environmental agencies.
- Early warning of pollution exceeding allowed levels.

The WHO estimates that by reducing illness caused by airborne PM the EU could save up to €29 billion/year.

SUPPORTED POLITICAL OBJECTIVES

- New Air Quality Directive including daughter directives
- Clean Air for Europe (CAFE)
- Convention on Long-range Transboundary Air Pollution (CLRTAP)



CURRENT ACTIVITIES

Three **GMES** projects address air quality and pollution by providing:

- monitoring and forecasting European air quality,
- support information and alerts on poor air quality to the health community,
- tailored regional and local air quality products for use in major events,
- tourism and traffic management, data records on global atmospheric composition.

The **European Environment Agency** provides access to data and information related to air pollution through its **interactive Air Pollution Data Centre**.

HOW ELSE CAN GMES CONTRIBUTE?

The **GMES Sentinel-5P mission** will provide information on atmospheric variables in support of European air quality policies by providing a **continuation of reliable, long-term space-based monitoring of atmospheric constituents**.

This will be followed by Sentinels-4 and -5, carried on meteorological satellite missions of EUMETSAT.

Future air quality services using data from the Sentinels as well as ground-based measurements will be part of the operational GMES Atmosphere Service.

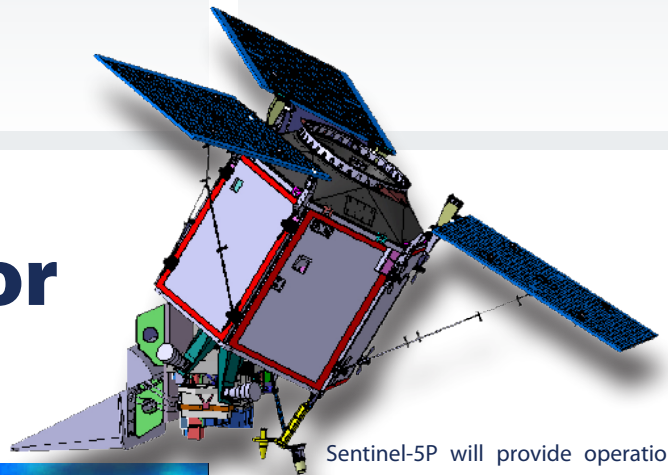
NEXT STEPS

The global nature of air pollution requires:

- continuous large-scale monitoring with advanced satellite-based systems,
- timely and reliable long-term information for assessment, monitoring and verification purposes, and
- satellite-based transboundary predictions of future conditions – in both the short- and long term.

Sentinel-5 precursor

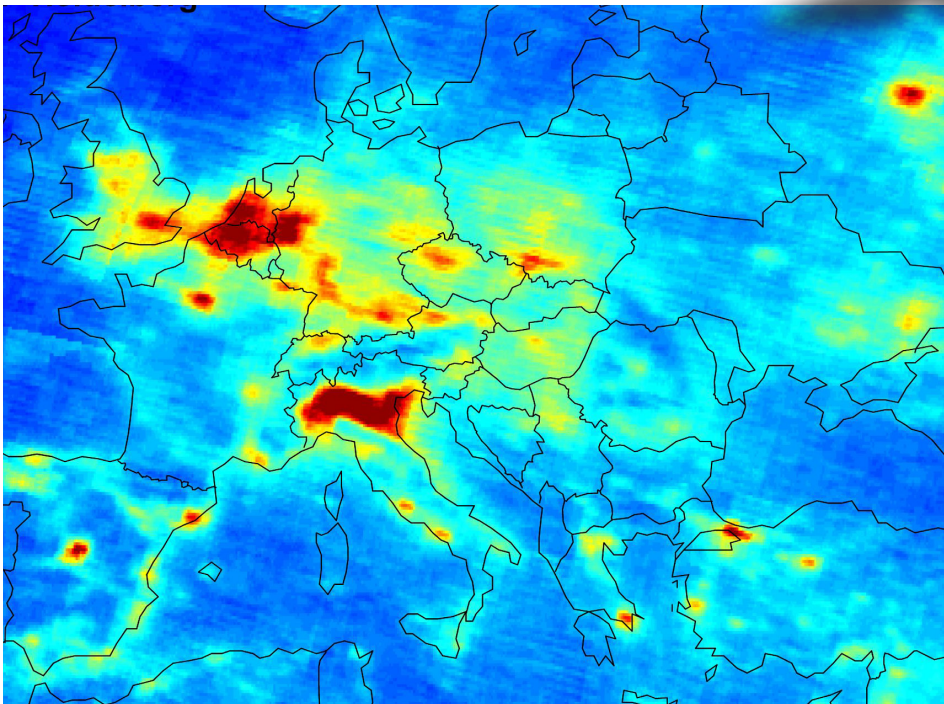
The GMES low Earth orbit atmosphere mission



Sentinel-5P will provide operational atmospheric chemistry observations necessary for air quality monitoring and forecasting. The observations of polluting chemicals in the atmosphere will be made at better temporal and spatial resolutions than currently available.

In particular, the mission is expected to provide detailed measurements of ozone, a major greenhouse gas contributing to global warming, nitrogen dioxide stemming mainly from vehicle exhausts and power plants, sulphur dioxide resulting from industrial processes and volcanoes, as well as other air pollutants.

Data from SCIAMACHY (shown in the image on the left) will no longer be available when the Envisat mission completes its life in orbit. Sentinel-5P will fill the gap between these measurements and the launch of the Sentinel-4 and -5 missions, envisaged for 2017 and 2020 respectively.



The image shows the mean density of nitrogen dioxide over Europe between January 2003 and June 2004, as measured by the SCIAMACHY instrument on ESA's Envisat satellite.

Source: ESA, University of Heidelberg