

Development of a Web GIS Data Visualization Viewer for remote sensing MODIS cloud and aerosol data using OGC standards and **Open Source Technologies**



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THE PROBLEM

Urban clusters have become a prominent political and economic topic all over the world, particularly in Europe and in China. Increased numbers of medium and small cities, increase of population, intensive urbanization and anthropogenic activities are the main features in these regions causing increasing pollutant emissions and serious air pollution. Further, anthropogenic aerosols may impact regional climate indirectly, through their effects on cloud formation and precipitation.

In that framework AeroVis Project focuses on a better understanding of the distribution of sources for major air pollutants, particularly aerosols, in the selected region, and their impact on climate.

AIM OF THE PROJECT

THE AEROVIS WEB APPLICATION

- The **AeroVis web application** utilises state-of-the-art technologies and open source projects, including:
- Server based GIS Data Services (PostGIS and GeoServer),
- Use of the **Geoserver Image Mosaic Plugin** for serving temporal raster datasets
- Open source web client (GET SDI Portal) and
- Standard OGC technology (WMS, WCS, kml) including the new EO option for WMS, for the handling and visualisation of large datasets.

The current implementation of the software analyses a total of **30 satellite parameters**, including global level 3 monthly cloud and aerosols datasets from MODIS Terra and Aqua satellite sensors for over 10 years period, high resolution satellite datasets for Greece and China and Ground-based measurements for key compound pollutants.

The AeroVis web application incorporates a number of tools and functionalities for the management and visualization of satellite data, like: i) Add raster

The main aims of **AeroVis project** are the **development** and **implementation** of a generic satellite data **visualization software** for visualization of air pollution and climatic data and the study of air pollution and climate over China using long time series of satellite observations. In order to realize AeroVis, the project focuses on the following, strongly interrelated, objectives:

- To **empower** the participating enterprises from Greece and P.R. China with the technological and operational framework for full exploitation of satellite technologies and related visualisation technologies in the field of air pollution and climate studies.
- To study air pollution over China and its effects on weather through the modification of cloud cover, with emphasis on the main urban clusters in China and their effects on regional air quality and climate and case study of the Beijing-Tianjin-Hebei Region as a quickly developing urban cluster.

The research part of the Project combines:

- Ground-based measurements of key compound species at and near Beijing region and several cities in China for satellite validation
- Satellite retrieved column abundances of aerosols, NO2 and SO2 (from MODIS Terra and Aqua, GOME-2 and SCIAMACHY (ii) satellite sensors) in order to gain insight in anthropogenic and natural emissions of air pollutants over China and
- Total cloud cover, cloud droplet effective radius, cloud top-level pressure satellite data combined with data from (ii) above to study the effects of air pollution on climate.

THE CONSORTIUM

The AeroVis Project Consortium consists of innovative companies and leading institutions from Greece and China, all experts in their field. In particular:

- From Greece
 - 1. DRAXIS Environmental S.A.
 - 2. Laboratory of Atmospheric Pollution, Democritus University of Thrace
- From China
 - 1. Institute of Atmospheric Physics, Chinese Academy of Sciences, China
 - 2. Anhui Institute of Optics and Fine Mechanics
 - 3. Fudan University, China

layers using WMS services (supports also WFS, CSW, WMTS, WMC, KML, ATOM, GeoRSS), ii) Time enabled raster layers, iii) Display of layers metadata, iv) Export of raster layers (tiff, geotiff, kml), Selection of styles using predefined SLDs, v) Time animation of raster layers, vi) Google Earth integration (3D) view), vii) Point information, including time series, viii)Dual map interface – map comparison



PLATFORM ARCHITECTURE

- 4. Beijing Huirenhui Scientific-Technical Company (HUSTEC) Ltd,

AEROVIS PROJECT PRELIMINARY RESULTS

A part of the satellite parameters included in the project (Aerozols Optical Depth, Angstrom Exponent and Cloud **Fraction**) has been processed, producing a number of reports presenting **time series** and **maps** of:

- Seasonal Statistics and Variation
- Monthly statistics (Average Maximum Minimum) and Anomalies
- Maximum Minimum Occurrence





TERRA Aerozol Optical Depth Land And Ocean Mean

Period: 1/3/2000 - 1/3/2013

Monthly Anomalies for MAY



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ADDITIONAL INFORMATION

ACKNOWLEDGEMENT

AeroVis Web Application: http://www.draxisgis.com/aerovis_v03/

AeroVis Project website: http://www.aerovis.gr The Project has been financed by EPAN II and PEP under the national action "Bilateral, multilateral and regional R&T cooperations" - Greece - China Bilateral R&TD Cooperation 2012-2014.

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