

MAPPING REAL-TIME AIRBORNE PARTICLE POLLUTION

Satellite observations and in-situ particulate matter (PM) measurements are used to create maps and improve real time monitoring, modelling and forecasting performance.

The challenge

Airborne particles constitute a major atmospheric pollutant for local and regional air quality. The management of air pollution is still challenging in Greece and Patras in particular, due to lack of monitoring tools and complexity of sources (natural and anthropogenic) as well as topography. The adverse effects of aerosols on both climate and human health are of great importance to atmospheric science studies. Satellite data combined with in-situ real time aerosol concentration measurements are employed to produce a high spatio-temporal analysis of particulate matter (PM) concentrations.

The space based solution

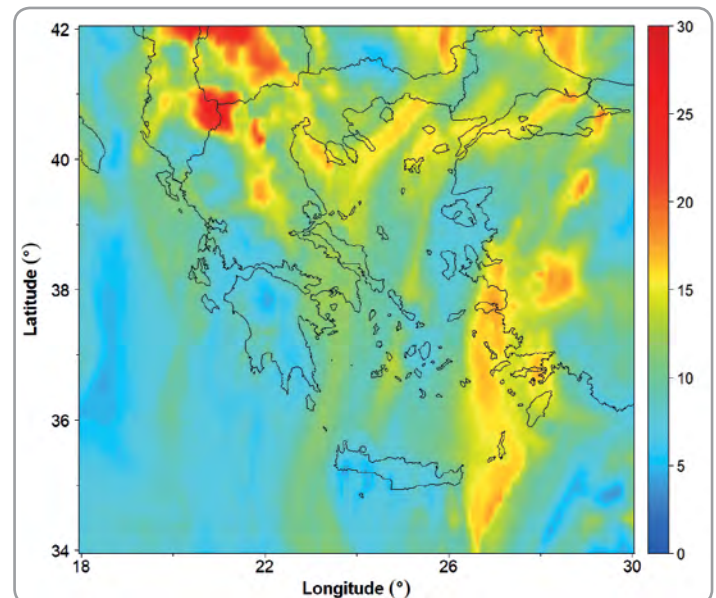
Patrasair.gr is a real time PM concentration monitoring network of certified and regularly calibrated sensors, implemented across the city of Patras. Copernicus Atmosphere Monitoring Service (CAMS) products require certified accuracy. Quality assured in-situ measurements can be used as a basis for the evaluation of CAMS products. Analysis, modelling and forecast capabilities could eventually be improved. The greater region of Western Greece lacks high density PM monitoring stations. Verified satellite-based observations can overcome this problem providing estimations of airborne particle concentrations across areas with limited measurement availability.

Moreover, the patrasair.gr network uses results from the CAMS European air quality forecast service over four days in order to provide forecasts across the city of Patras. In many cases, CAMS products are instrumental in showing if the measured air pollution by particles is caused by local or regional sources.

Finally, PM values are reported in near-real time, as an operational service to the citizens and stakeholders. In compliance with European Directives and the recommendations of the World Health Organisation, the air quality index values are disseminated directly to the public.

Benefits to Citizens

Patras regularly suffers from poor air quality conditions due to emissions from traffic, agricultural products/biomass burning. Air pollution is associated with adverse effects on human health. Inhaled airborne particles can provoke respiratory diseases, heart attacks and premature death. Although there is not a threshold below which no adverse health impacts are observed, there are guidelines aimed at reducing the reduction of PM concentrations. Studies show that the proposed limits are exceeded both in urban and rural areas. Mapping real time PM concentrations can be used



Daily mean prediction of airborne particles ($\mu\text{g}/\text{m}^3$) issued from CAMS with 0.1 degree resolution over the greater area of Greece.

Thematic Area



PUBLIC HEALTH

Region of Application



WESTERN GREECE - ACHAEA

Sentinel mission used



S5P

Copernicus Service used



CAMS

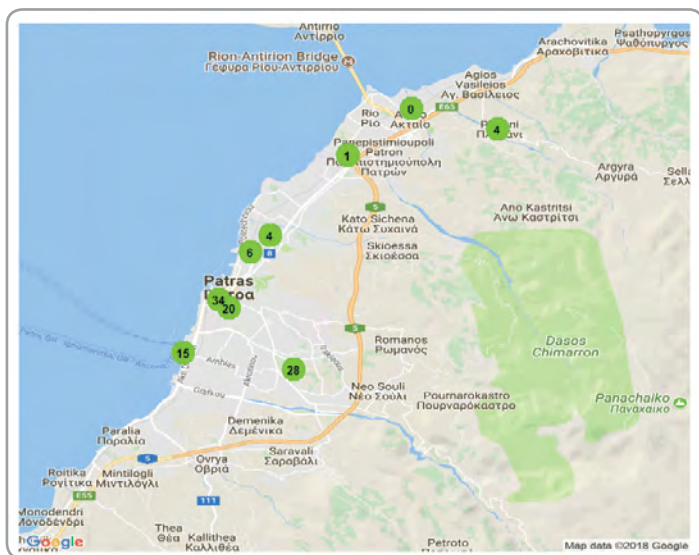
Usage Maturity Level



2

for the promotion of environmental education and awareness of the citizens. Improvement of air quality modelling and forecasting capabilities is possible through the collaboration of CAMS forecasts and in-situ data. Authorities are also expected to be involved more actively in monitoring and air pollution management. The aforementioned tools are freely provided to policymakers to set up alerts and notifications and to take precautions to protect citizens' exposure when high PM concentrations are predicted.

Patrasair.gr is a crowd-funded project. Since its pilot operation, it has received significant attention from citizens and has been invited to many social events concerning environmental education, air quality information campaigns/programmes and the impact on the health of sensitive groups like children and the elderly.



Example map of air quality index at the ground-based stations of PM across the city of Patras.

“The synergy of satellite-based data from Sentinels, forecasts from CAMS and in-situ measurements of airborne particulate matter make us confident we can provide air quality products at neighbourhood scale.”

Andreas Kazantzidis, University of Patras

Outlook to the future

Sentinel-5P and Sentinel-4 will provide key information for the improvement, as well as for the sustainability of this application.

In this context, operational satellite-based PM measurements with high spatial and temporal analysis will be used in synergy with CAMS forecasts and in-situ instrumentation to face future air quality challenges.

Acknowledgements

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ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication “**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**”, 2018, Edited by NEREUS, the European Space Agency and the European Commission.

The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains. The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.

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