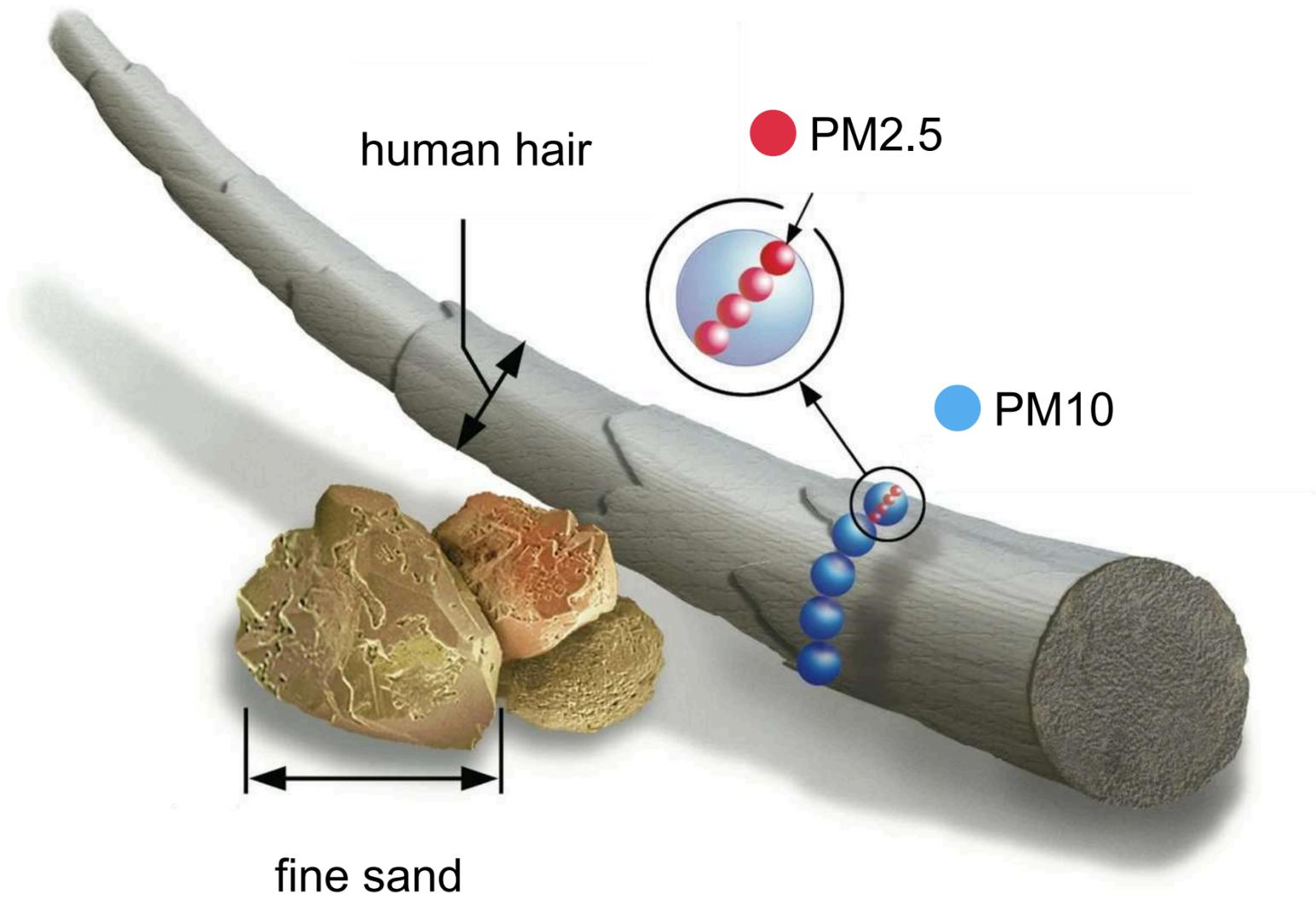


SMART^{AQ}

SATELLITE MONITORING OF AEROSOLS
FOR RELIABLE TRACKING OF AIR QUALITY

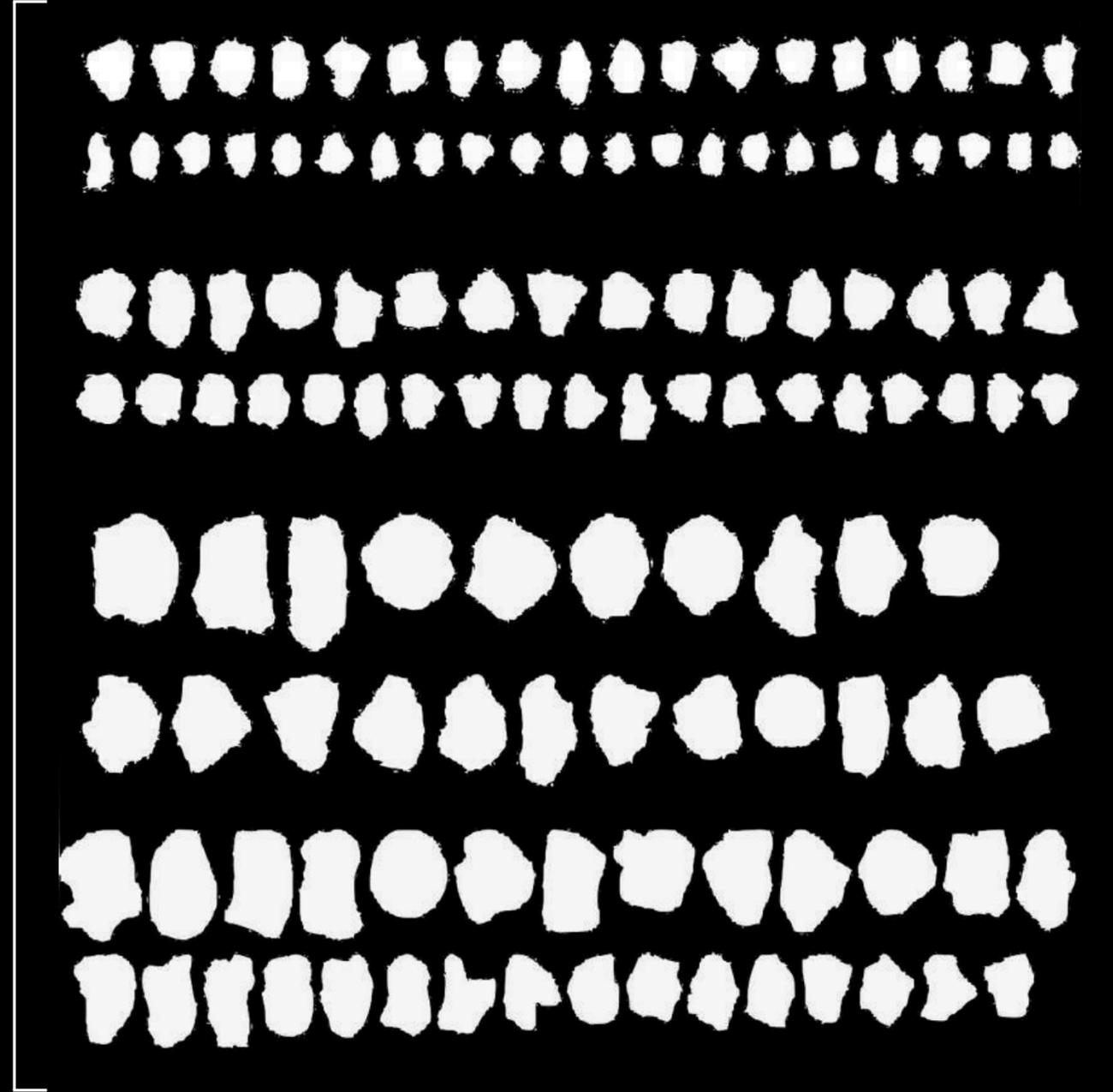


ESA ARTES4.0 BASS program for downstream applications



PM2.5

PM10



Addressing particulate pollution requires urgent global action

Particulate pollution is a major global health crisis, responsible for an estimated 60% of 7 million premature deaths each year. Despite efforts to improve particulate pollution policies, only 1% of the global population lives in areas where air quality meets the World Health Organization's (WHO) guidelines (WHO guidelines, 2022). Among common pollutants, fine particulate matter (PM_{2.5}) poses the greatest threat to human health due to its ability to penetrate deep into the lungs and bloodstream. Beyond health impacts, air pollution also carries significant economic costs—an increase of just 1 mg/m³ in PM_{2.5} concentration is estimated to reduce real GDP by 0.8% annually, underscoring its far-reaching effects on both human well-being and economic productivity. Addressing air pollution requires urgent global action to meet stricter standards and reduce harmful emissions.

7M

IS THE NUMBER OF ESTIMATED PREMATURE DEATHS EVERY YEAR DUE TO AIR POLLUTION

1%

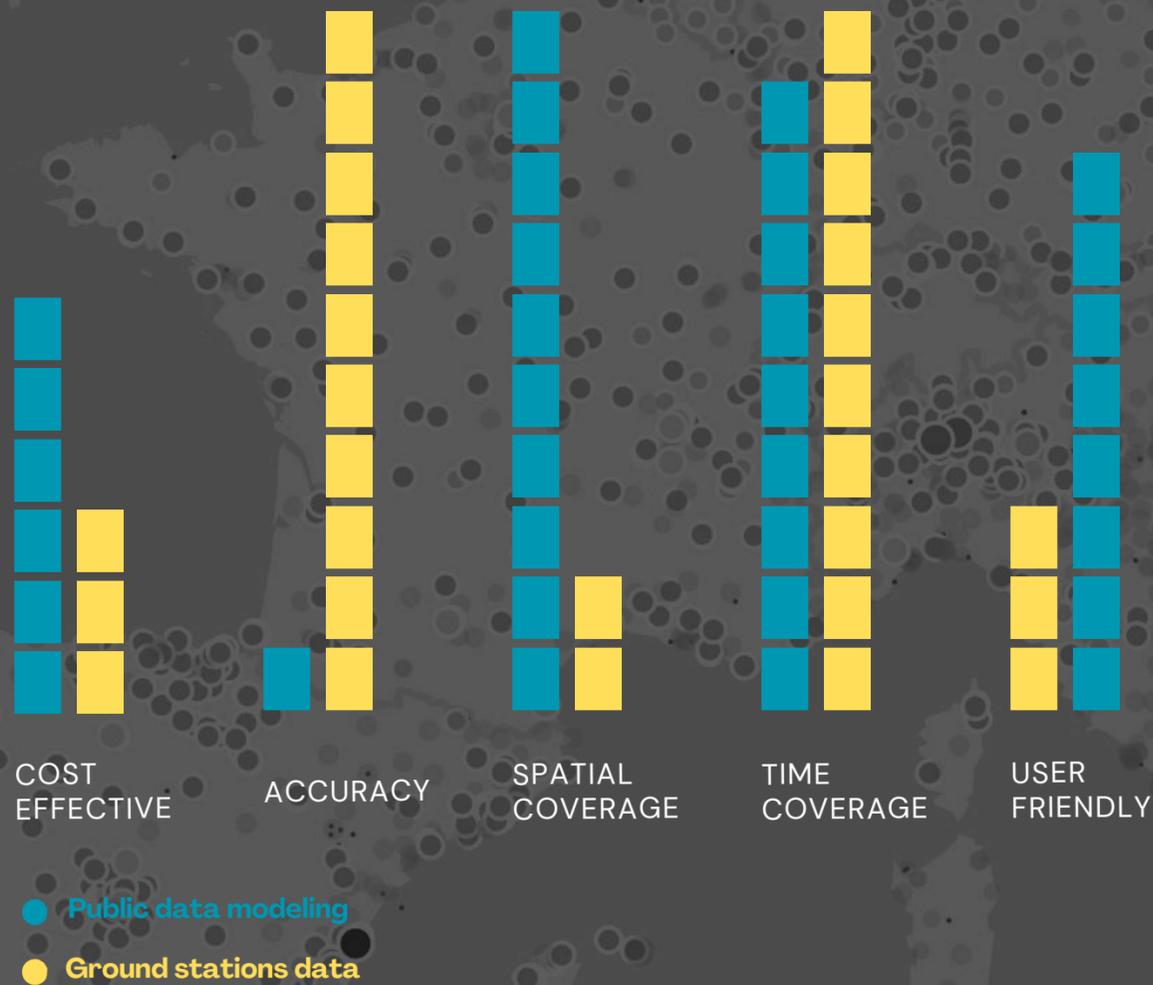
IS THE KNOWN PERCENTAGE OF THE GLOBAL POPULATION LIVING IN PLACES WHERE WHO GLOBAL GUIDELINES ARE MET

PM^{2.5}

IS CONSIDERED AS THE MOST HARMFUL TO HUMAN HEALTH, OUT OF THE SIX COMMON AIR POLLUTANTS

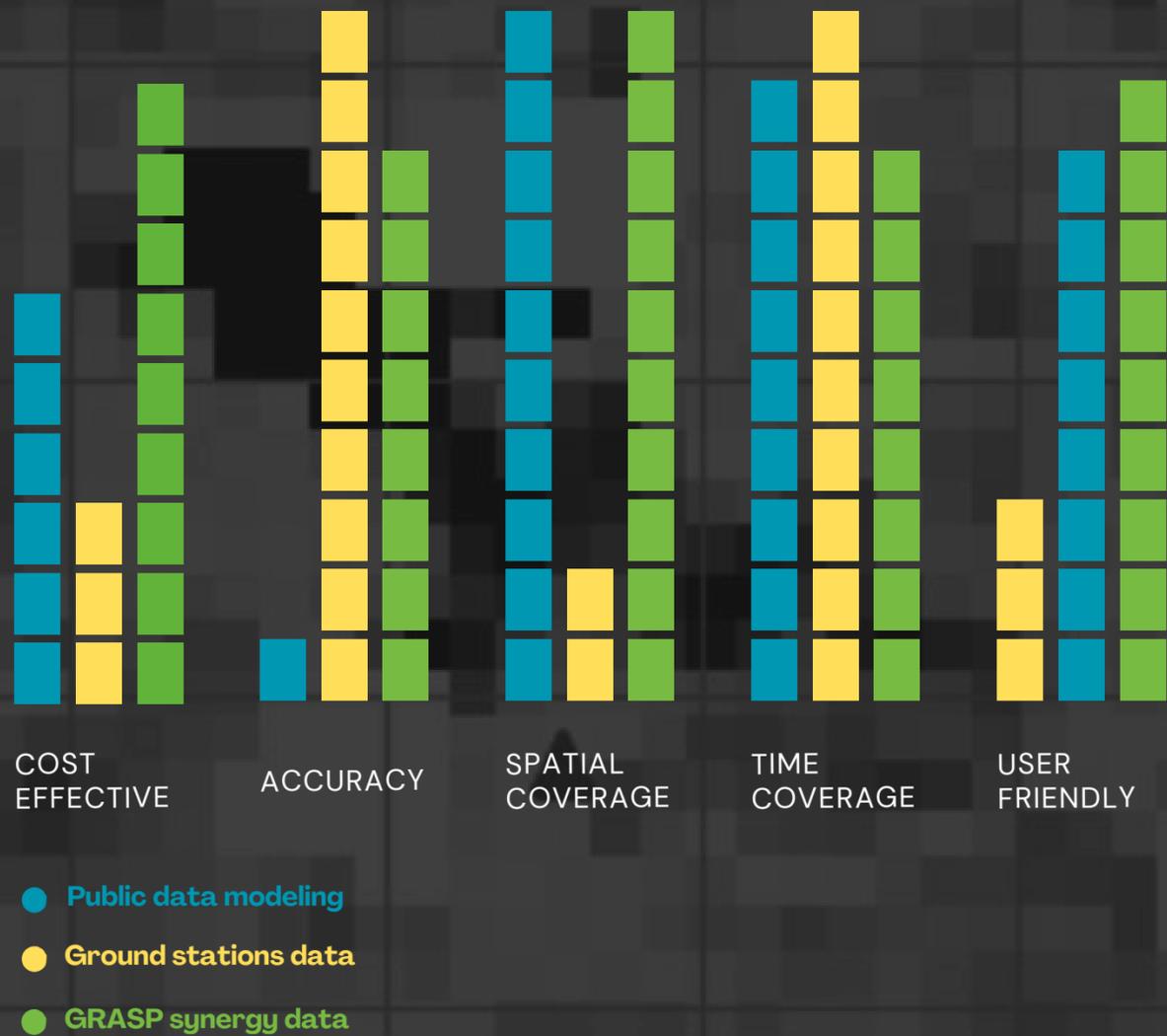
0.8%

IS THE ESTIMATE REDUCTION THAT A 1MG/M³ INCREASE IN PM_{2.5} CONCENTRATION CAUSES IN REAL GDP IN A YEAR



Limitations of current ambient particulate monitoring

To address this issue, there are currently 2 methods used to monitor particulate monitoring; although they are considered as valid use, they also have some limitations. On one hand, solutions are based on assumptions: they often use generalized environmental models that may not accurately capture local air quality variations, leading to gaps in precision and localized relevance. For instance, these models could inaccurately estimate pollution levels by up to 30-50%, failing to detect small-scale yet significant emission sources. On the other hand, ground-based data are very precise for delimited areas; yet their scalability is constrained. Stations are costly and complex to deploy and maintain, leading to cover less than 5% of a city's total area, hence to significant blind spots. For instance, in a city covering 25 km², a ground-based system might only monitor effectively in areas totaling 1,25 km², largely ignoring up to 95% of residential areas.



Combining solutions in order to overcome limitations

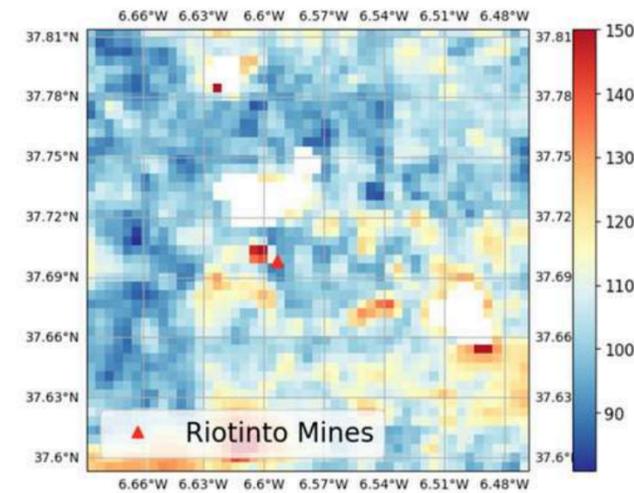
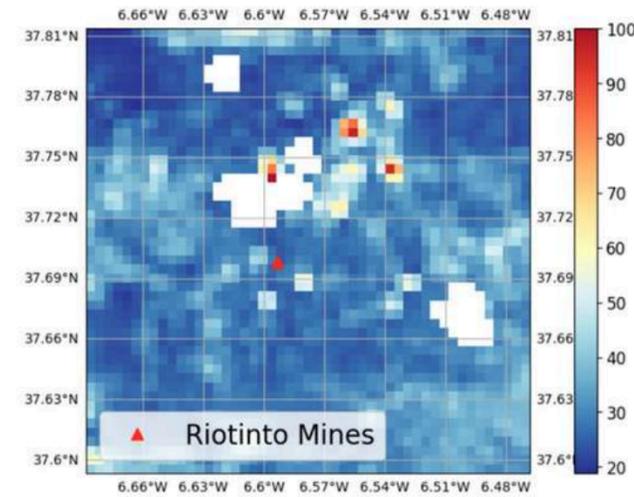
Our approach leverages over 30 years of aerosol research to create a comprehensive ambient particulate monitoring solution. By combining satellite data from public as well our own GAPMAP constellation, ground-based instruments and models using the GRASP algorithm, we provide highly accurate, real-time data on PM2.5 and PM10 pollution. This integrated system addresses the limitations of traditional methods, offering broader coverage and more precise insights at lower costs. It empowers better decision-making in pollution management, helping to improve public health, reduce environmental impact, and foster economic growth through more effective air quality interventions



RIOTINTO, SPAIN

Mining PM emission control from Space

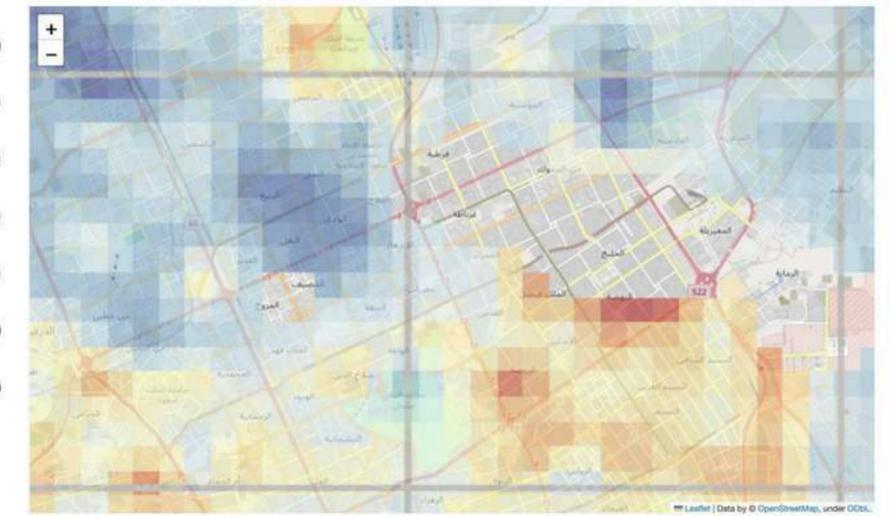
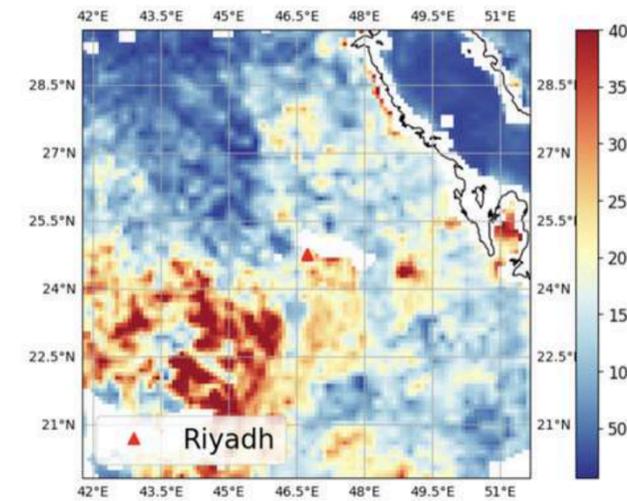
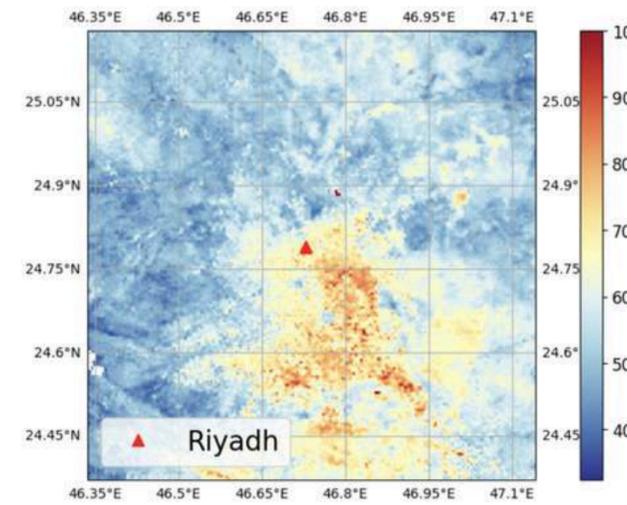
Total monitored area: 628 km²
POLDER (6km), TROPOMI (1km), OLCI (300m)



RIYADH, KINGDOM OF SAUDI ARABIA

Municipalities PM emission control from Space

Total monitored area: 1,973 km²
POLDER (6km), TROPOMI (1km), OLCI (300m)



GRASP algorithm for atmosphere & surface retrieval

The GRASP algorithm (Generalized Retrieval of Atmosphere and Surface Properties) is an advanced retrieval algorithm designed to extract detailed information about atmospheric aerosols and surface reflectance from a variety of remote sensing data. It was originally based on the aerosol characterization algorithms used in NASA's AERONET network and has been expanded to be applicable to satellite data, ground-based observations, and other remote sensing measurements. GRASP plays a critical role in Earth observation by offering precise aerosol property retrievals, such as particle size and composition, which are typically not available from conventional satellite observations.

cnrs **NASA** **JAXA**

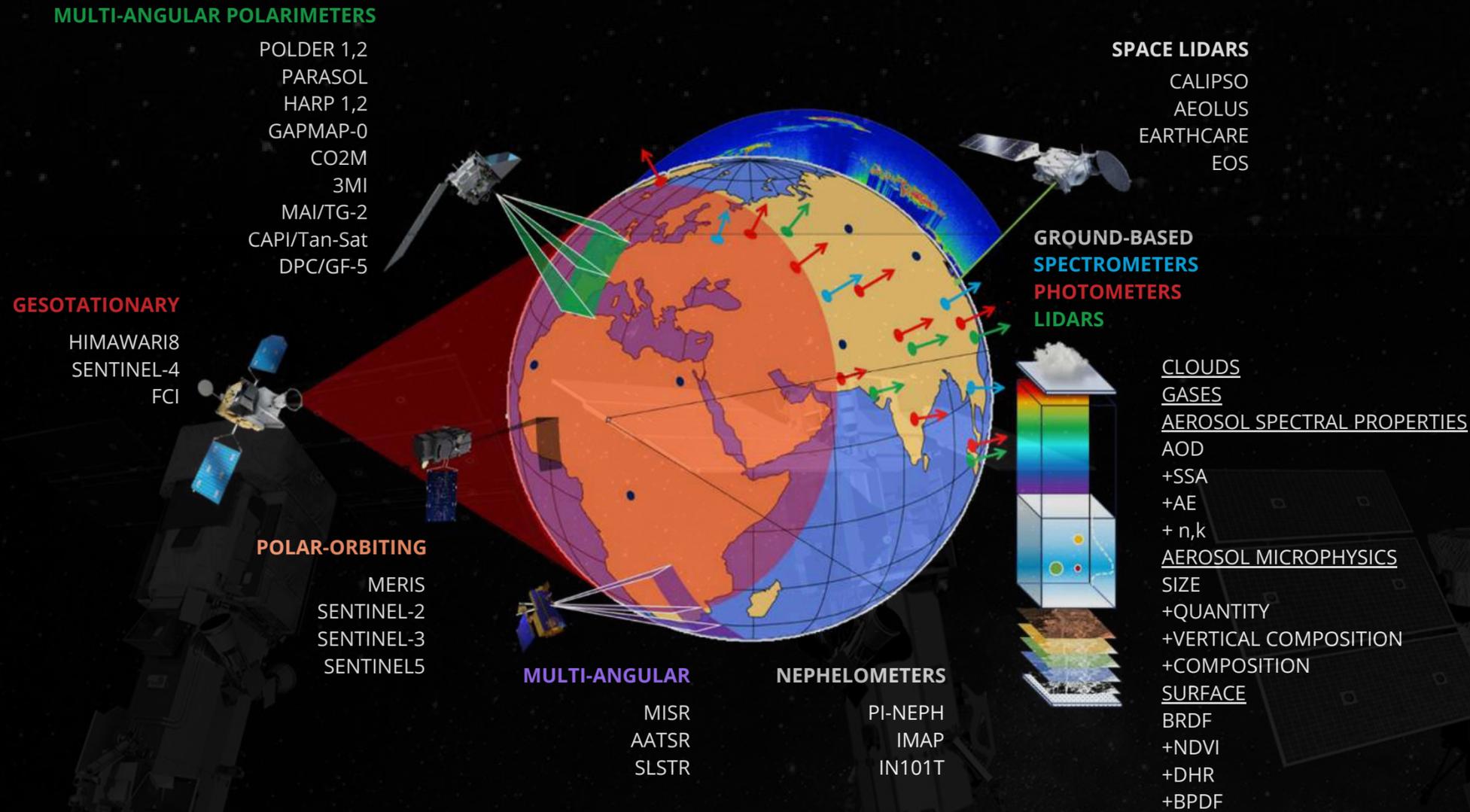
cnes **EU | ESA | EUMETSAT** **sentinel-4** **COPERNICUS**

+80k
CITATIONS

RESEARCH **SCIENCE** **ENGINEERING**

metop-sg **esa** **EU | ESA** **cozm** **COPERNICUS**

Université de Lille **EUMETSAT**



Applications and synergies established

The GRASP algorithm integrates data from in-situ, ground-based, airborne, and satellite platforms, enhancing aerosol and surface property retrievals across various contexts. It is versatile, applied in instruments like sun-photometers and lidar on the ground, and used in airborne and satellite remote sensing. Notably, GRASP serves as the operational algorithm for key public missions such as Sentinel-4, CO2M, and 3MI, enabling advanced aerosol monitoring crucial for air quality and climate studies.



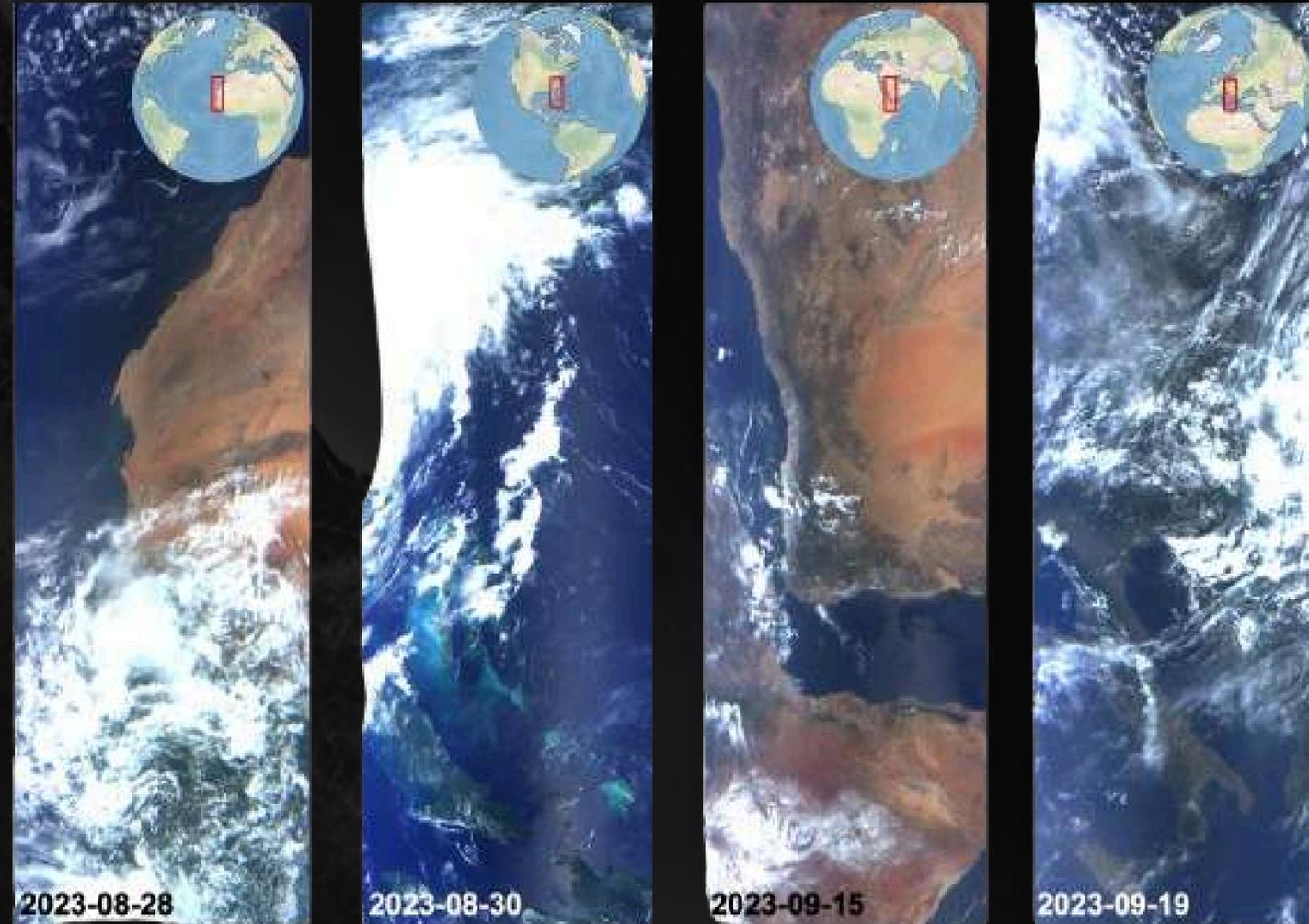


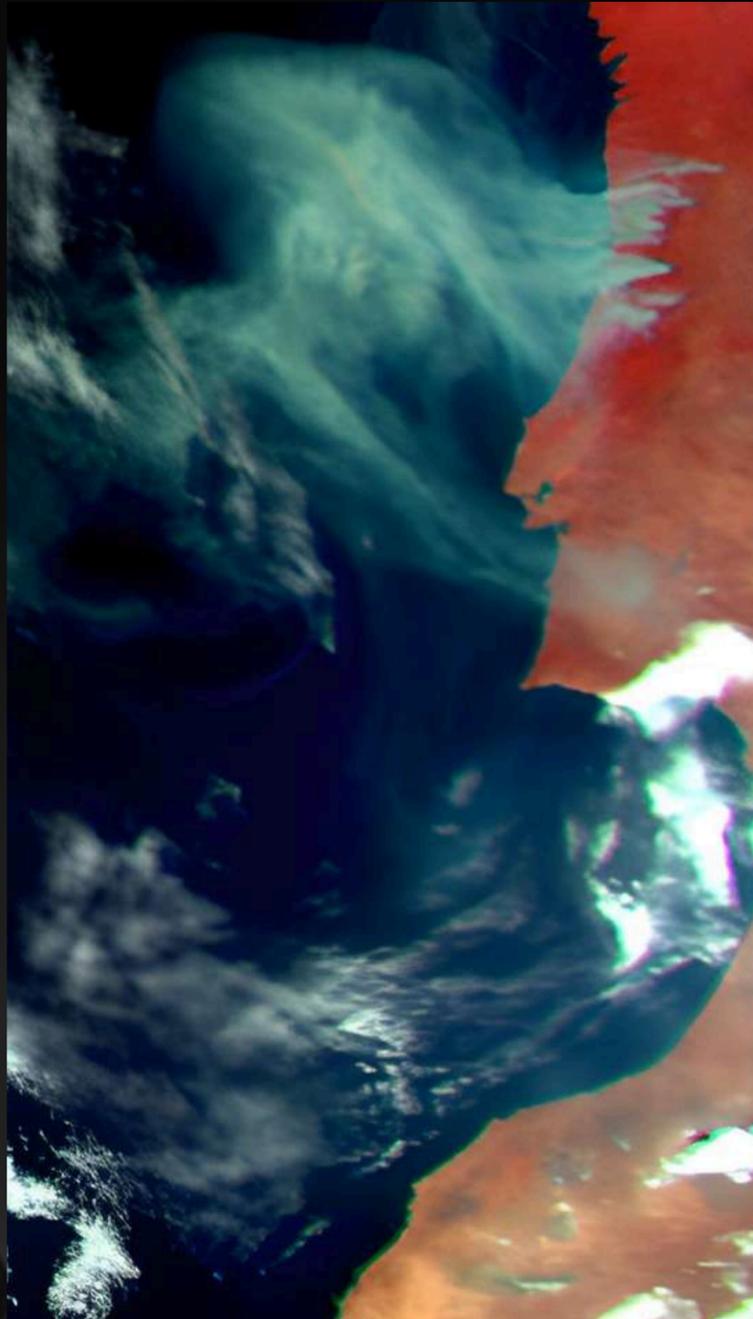
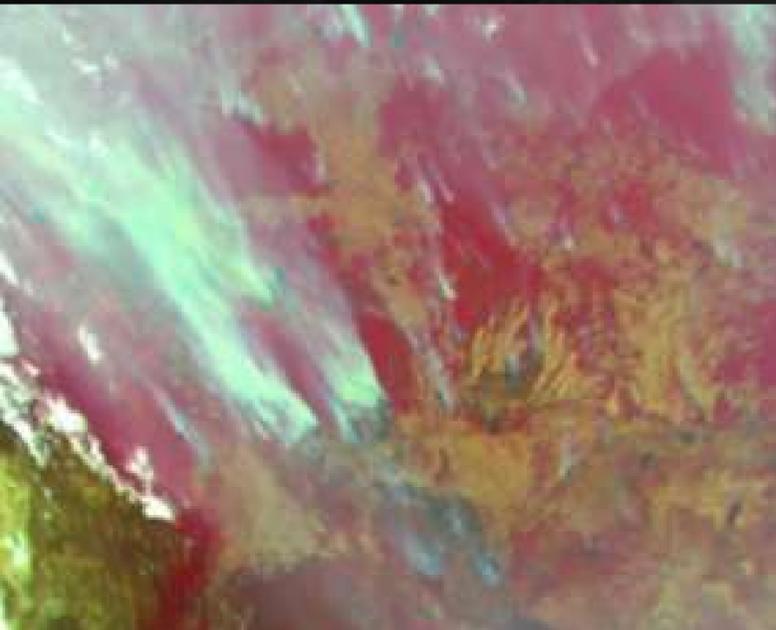
Image:GAPMAP-0's data scenes across 4 different regions of the globe. Each scene is identified with the specific region on a map and the corresponding capture time. Source: GRASP

Multi-Angular polarimetry: aerosols near-real time global coverage

The GAPMAP constellation is designed to provide high-resolution, multi-angle polarimetric observations of the Earth's atmosphere, specifically focusing on aerosols. The purpose of launching the GAPMAP constellation is to merge its data with existing space-based and ground-based measurements, enhancing the quality of aerosol retrievals by leveraging a combination of diverse data sources. GAPMAP's unique multi-angle observations allow for improved characterization of particle properties like size and composition. Additionally, it aims to deliver near-real-time, global coverage, significantly increasing the temporal resolution of aerosol monitoring, with up to five observations per day over each location.



HUMAN EYE



 GRASP TECHNOLOGY



Our Space capabilities adapted to monitoring needs

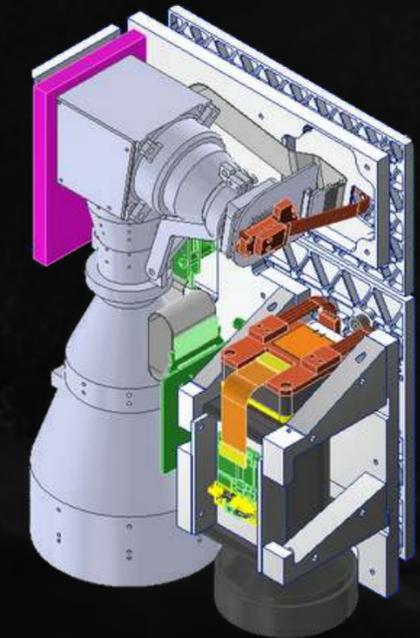
With *GAPMAP* IoD mission success validating our space capabilities, we are now positioned to expand beyond aerosol monitoring to address additional urgent needs, such as monitoring gas emissions, including CO₂ and methane. This led us to complete the *G3* prototype in early 2024, a spectrometer that can provide high-resolution, real-time data for effective gas emissions tracking. Yet, going even further, we recently developed the *CLIMATE* prototype, a multi-instrument payload that allows for scalable, multi-angular observations of both aerosols and gases.



GAPMAP
status: testing completed
value: aerosol measurements



G3
status: prototype completed
value: gas measurements



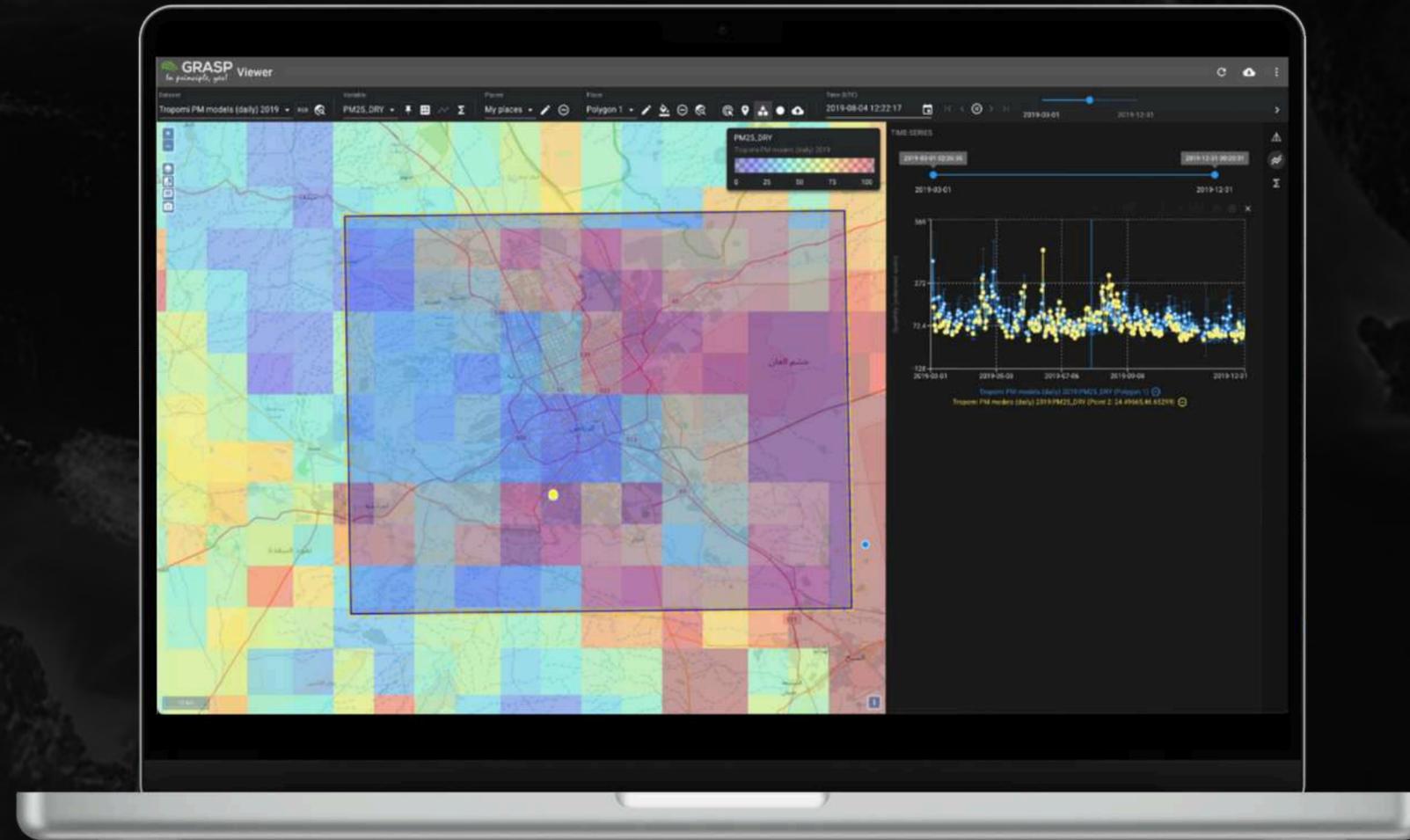
CLIMATE
status: prototype completed
value: aerosol&gas measurements

- 1996 ● POLDER-1, mission ADEOS-1
- 2000 ● NASA/AERONET inversion code established
- 2002 ● POLDER-2, mission ADEOS-2
- 2004 ● POLDER-3, mission PARASOL
- 2006 ● Extension of AERONET inversion for POLDER
- 2012 ● AirPhoton company birth (Baltimore, US)
- 2015 ● GRASP company birth (Lille, France)
- 2022 ● GRASP-AirPhoton merge
GRASP raises 2M round
- 2023 ● GAPMAP-0 launch, mission ADLER-2
GAPMAP-0 first captures (Lille, France)
- 2024 ● SMART AQ ESA-BASS project KO
- 2026 ● GAPMAP-1 launch
- 2027-28 ● GAPMAP-N constellation deployment
- 2028-30 ● Full Operational Service

From POLDER to GAPMAP, the Roadmap of a Climate ambition

With the first images captured at the beginning of 2024 marking the success of our Space capabilities as well as the kick-off of our first downstream application project with ESA recently, GRASP's roadmap outlines significant developments ahead. The next steps include the launch of GAPMAP-1 in late 2026, followed by the full deployment of the GAPMAP-N constellation between 2027 and 2030, providing global coverage with five daily revisits. By 2030, the constellation is expected to be fully operational. In parallel, GRASP continues to enhance its Earth observation algorithms and services, integrating public satellite data with its own proprietary constellation.

FIND OUT TODAY BETA Test now available



eliot.llopis@grasp-earth.com





GRASP SAS, 7, Bd. Louis XIV 59000 Lille, France
+33 320 436 610 | office@grasp-earth.com
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