

HAPSVIEW USE CASES

The Regional Authority of the Great Rotterdam region (Rijnmond area) and Rotterdam's City Council have noted emission monitoring needs for this densely populated region in the Netherlands, related to harbour activities like petrochemical industry, energy production and intensive agricultural production under greenhouses.

The Regional Government of Andalusia and Seville's City Council have recalled air quality data needs to implement health and environmental regulations. Summer ozone and NO₂ episodes can be acute on public health while black carbon PM from agricultural waste burning is a year-round problem, out-lawed during the summer season.

For both end users the study primarily strives:

- To monitor CO₂ emissions on the city scale at sub-kilometre resolution for verifying the measures implemented to meet the Paris agreement.
- To monitor the anthropogenic emissions of NO₂, attribute the sources of Particular Matter (e.g: black carbon from biomass burning) and better understand how to mitigate tropospheric ozone exceedances.



Identification of High Altitude Pseudo Satellites (HAPS) in Support of Satellite Air Quality Activities

CONTACT INFORMATION:

- ESA Technical Officer
Thorsten Fehr thorsten.fehr@esa.int
- Project Manager
María Julia Yagüe mjyague@gmv.com
GMV
Isaac Newton 11 P.T.M. Tres Cantos - 28760 Madrid

www.hapsview.eu

PARTNERS



www.gmv.com



Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

www.knmi.nl



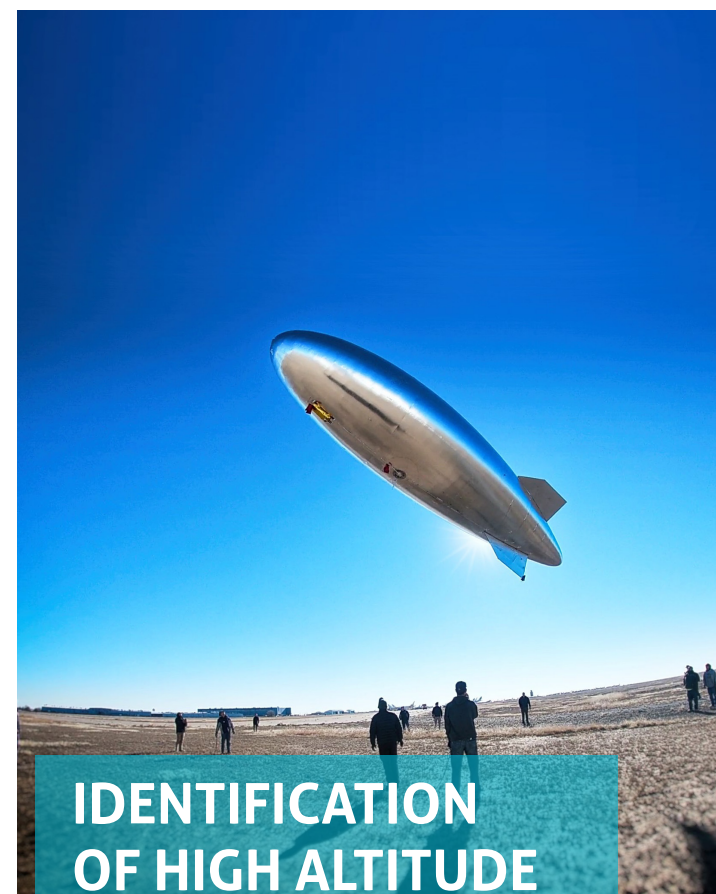
www.sceye.com



www.abb.com/spacedefense



ESA Contract No. 4000126407/19/NL/FF/gp
25/01/2019 to 24/01/2020



**IDENTIFICATION
OF HIGH ALTITUDE
PSEUDO SATELLITES
(HAPS)
IN SUPPORT
OF SATELLITE
AIR QUALITY
ACTIVITIES**

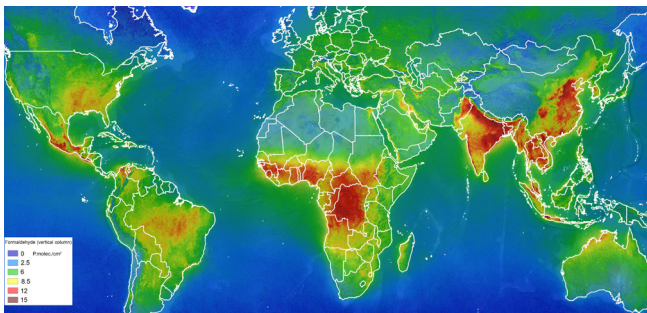
BACKGROUND

Poor air quality is a health issue in the EU, particularly in urban areas. Cities currently encompass most of the population in Europe and are foci of air pollution from industries, household heating/cooling, and traffic. Exposure to noxious gases or small particles is statistically and medically proven to cause lung diseases and premature deaths. The 2015 Air Quality Report by the European Environmental Agency attributes 403 000 premature deaths to exposure to fine particulate matter (PM_{2.5}), 16 000 due to ozone (O₃) and 72 000 due to nitrogen dioxide (NO₂) in 2012.

Cities account for more than 70% of the anthropogenic CO₂ emissions. The Intergovernmental Panel on Climate Change concluded that human-produced greenhouse gases such as carbon dioxide, methane and nitrous oxide are driving the observed increase in Earth's temperatures observed over the past 50 years. The Paris climate agreement has made the verification and improvement of local GHG emission inventories imperative.

Monitoring emissions and air pollution concentrations over urban areas requires data granularity at the local level, better than that provided by current and planned satellite missions and ground networks: horizontal and vertical resolutions do not always fit the observational requirements to be used in combination with urban and local air quality models. Urban air quality stations have a sparse coverage and local observations suffer from a limited representativeness. Moreover, the stations network density decreases towards suburbs and adjacent rural sites, hampering a citywide instantaneous view of air quality and the attribution of the pollution to its sources.

HAPS will enhance the provision of information on Air Quality and Greenhouse Gas emissions to decision makers and general public.



Global Formaldehyde measured by Sentinel-5P © ESA, processed by BIRA-IASB/DLR

HAPS



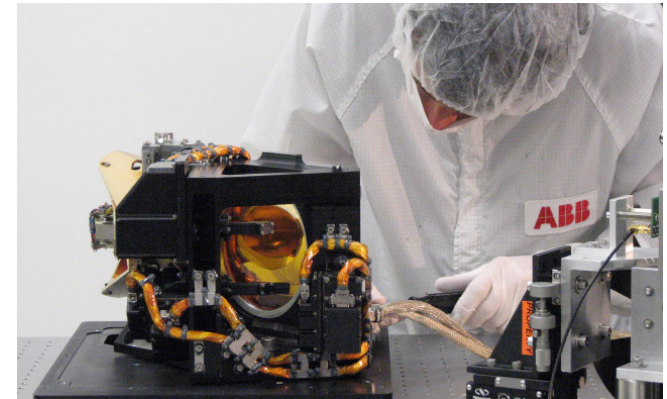
Sceye SSV (Sub-Scale Vehicle) ©SCEYE

High-Altitude Pseudo Satellites (HAPS) are air platforms in the shape of airships, balloons or gliders, circling over regions for extended time periods in the stratosphere, at ~20 km average height, above commercial airlines, jet streams and moisture.

HAPS notably complement ground-based and satellite observations, which is an asset for air quality and GHG applications at local level:

- Advantages in relation to ground networks include that HAPS provide spatially-resolved observations in contrast to local time records; HAPS measurements are less influenced by urban design elements compared to in-situ observations in e.g. street canyons.
- HAPS remain over an area for longer periods of time compared to low-orbit satellites, providing a better monitoring of the meteorological variability; HAPS also provide better resolution imagery compared to geostationary platforms, offering lower data latency and the possibility of return to the base for maintenance or payload reconfiguration as required by users.

OBJECTIVES

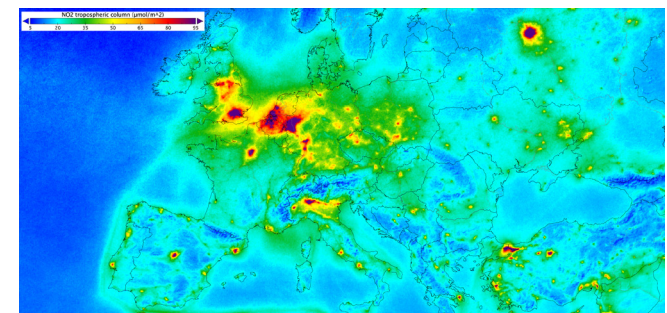


Interferometer developed by ABB for GOSAT-2 © ABB

The HAPSVIEW study seeks to identify how HAPS can provide data to operational air quality or GHG services, such as air quality modelling or greenhouse gas emission inventories.

Study objectives include:

- Identification of user requirements, capable to be provided by HAPS, focusing on high-resolution time-resolved emissions and atmospheric composition data, primarily NO₂, O₃, CO₂ and particulate matter.
- Definition of two HAPS use cases for the Great Rotterdam region and Seville metropolitan area, respectively
- Definition of the mission requirements for the use cases, including technical platform and instrument requirements, preliminary system concepts, air space regulations, geophysical data products and synergies with existing and planned satellite missions.



Nitrogen Dioxide over Europe measured by Sentinel-5p. © ESA, processed by KNMI