



Vision

Supporting Earth's
Sustainability from Outer
Space



Mission

Through International
collaboration, leverage space-
based technologies funding
and research to monitor,
manage and enhance the
sustainability of Earth's
ecosystems, ensuring a
balanced coexistence between
humanity and the natural
environment.



Goal

Safeguard Earth's future by
harnessing the vantage point
of space to drive informed
decision-making, proactive
environmental management,
and sustainable development,
ensuring a thriving planet for
generations to come.

The MEASMA Observatory Program

“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

برنامج راصد المياسما

“المرصد الفضائية لمراقبة التلوث الجوي فوق الشرق الاوسط وافريقيا”

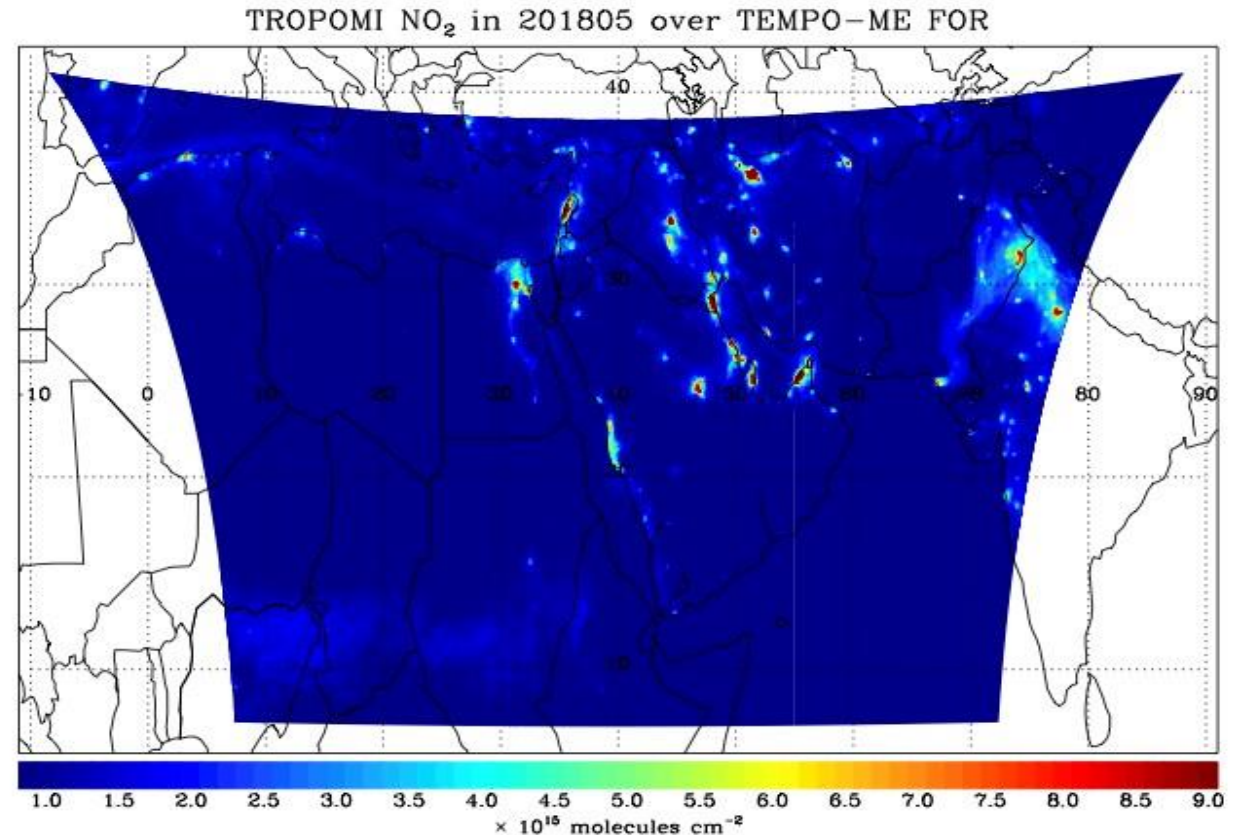
- ❑ **MEASMA-LEO Constellation:** Based on the MISO/CubeMAP/Solstice remote sensing payload, an RAL-Space unique and innovative remote sensing suite instruments for measuring and monitoring constituents of atmospheric layers from 6km up to 80km in Altitude, with vertical spatial resolution <3km. INTOSPASS to provide support by identifying partners that can provide CubeSAT platform(s) and support mission(s) through bilateral agreements.
- ❑ **MEASMA-GEO (GEO Platform Hosted Instrument):** Is an INTOSPASS initiative that aims to deploy a UV/VIS hyperspectral monitoring instruments based on those developed by BAE Systems such as NASA’s TEMPO and KARI/NIER’s GEMS. It will measure the principal elements of tropospheric air pollution over the Middle East and Africa. Two GEO satellites may be required to cover the whole field of regards: MEASMA-GEON and MEASMA-GEOS.

MEASMA-GEO Observatory Project 1 of 10

“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

❑ MEASMA-GEON Observatory Instrument:

Is an INTOSPASS initiative, inspired and based on a scientific paper by Dr. Raid Suleiman, Atomic and Molecular Physics Division - Center for Astrophysics at Harvard & Smithsonian, that was published by ArSCO, in their Arabian Journal of Scientific Research - Volume 2021, Issue 2 in October 2021. It is a geostationary orbit (GEO-belt) hosted instrument is based on GEMS and TEMPO developed by Ball Aerospace.



<https://iopscience.iop.org/article/10.1088/1742-6596/869/1/012085>

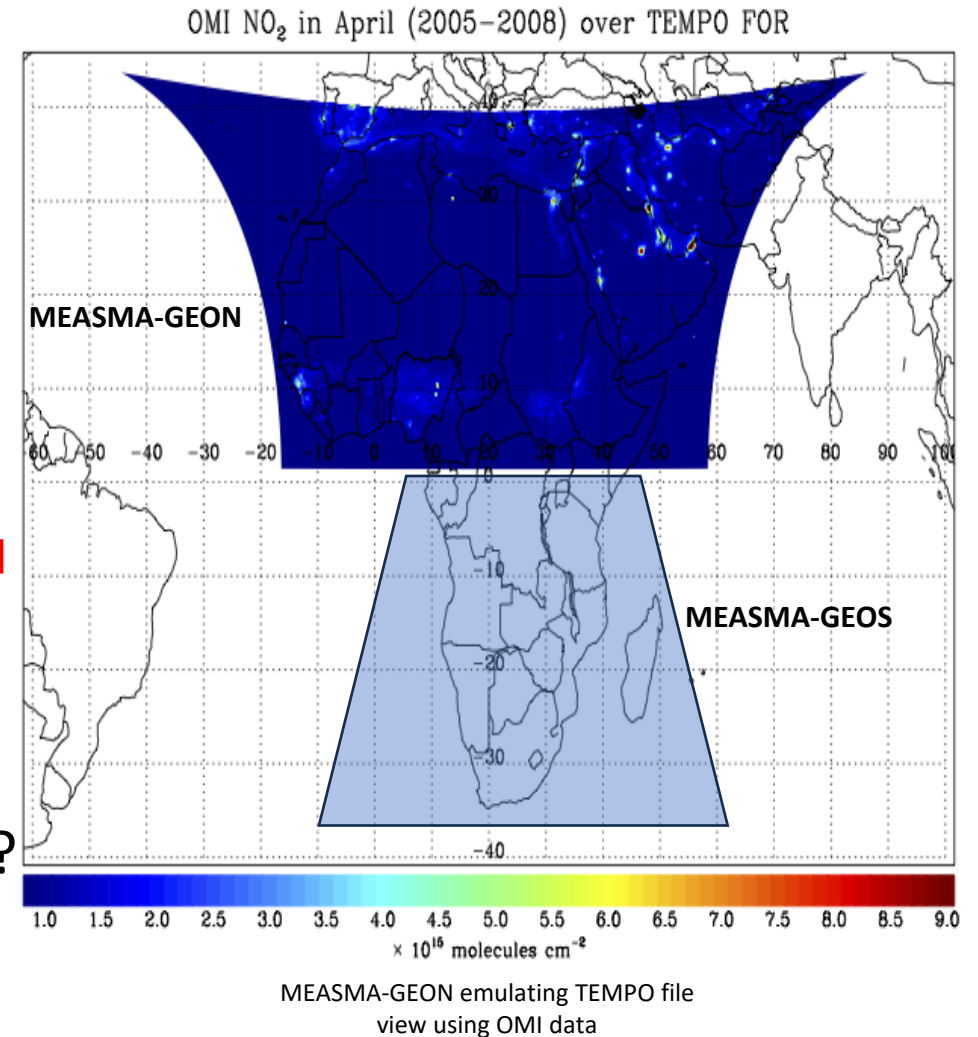
- ❑ Its aim is to deploy a UV/VIS hyperspectral monitoring instruments based on those developed by BAE Systems such as NASA’s TEMPO and KARI/NIER’s GEMS. It will measure the principal elements of tropospheric air pollution over the Middle East and Africa.

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“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

Observatory Instrument Science Overview:

- ❑ What are the temporal and spatial variations of **emissions** of gases and aerosols important for air quality and climate?
- ❑ How do physical, chemical, and dynamical **processes** determine tropospheric composition and air quality over scales ranging from urban to continental, diurnally to seasonally?
- ❑ How does air pollution drive **climate** forcing and how does climate change affect air quality on a continental scale?
- ❑ How can observations from space improve **air quality forecasts and assessments** for societal benefit?
- ❑ How does intercontinental transport affect air quality?
- ❑ How do **episodic events**, such as wild fires, dust outbreaks, and volcanic eruptions, affect atmospheric composition and air quality?



Examples of Atmospheric Aerosole Monitoring Applications:

- Socio-economic studies and National pollution inventories
- Monitor short lived Dust storms, that can last less than one day.
- Enables identify dust sources and tracking a dust plume backwards to the place where it first appears, i.e., the source area.
- Provide continuous measurements of aerosols/dust and water vapor that will enhance understanding of the microphysical processes governing storm formation/suppression.
- Enable the characterization air quality degradation due to the dispersion of dust over large areas, including for example the uptake of tropospheric O₃ by dust particles.

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“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

MEASMA-GEO high UV spectral and good spatial resolution – suited to Dust monitoring

MEASMA-GEO will produce Level 2 data products similar to those produced from:

GEMS (300-500nm) and TEMPO (290-490nm),

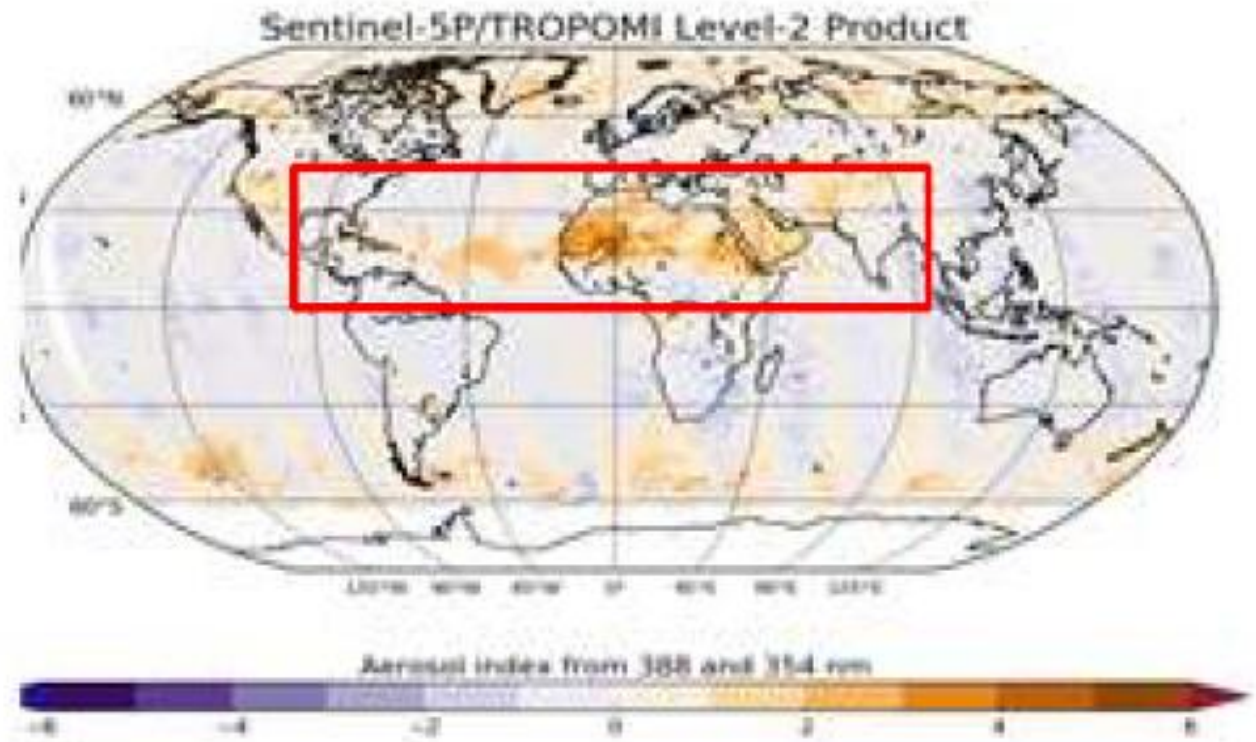
as well as the

Sentinel-5P - TROPOMI (AI:340/380nm) and

Aura - OMI (AI:354/388nm)

instrument’s UV Aerosol data products, that can be used for Dust monitoring, such as:

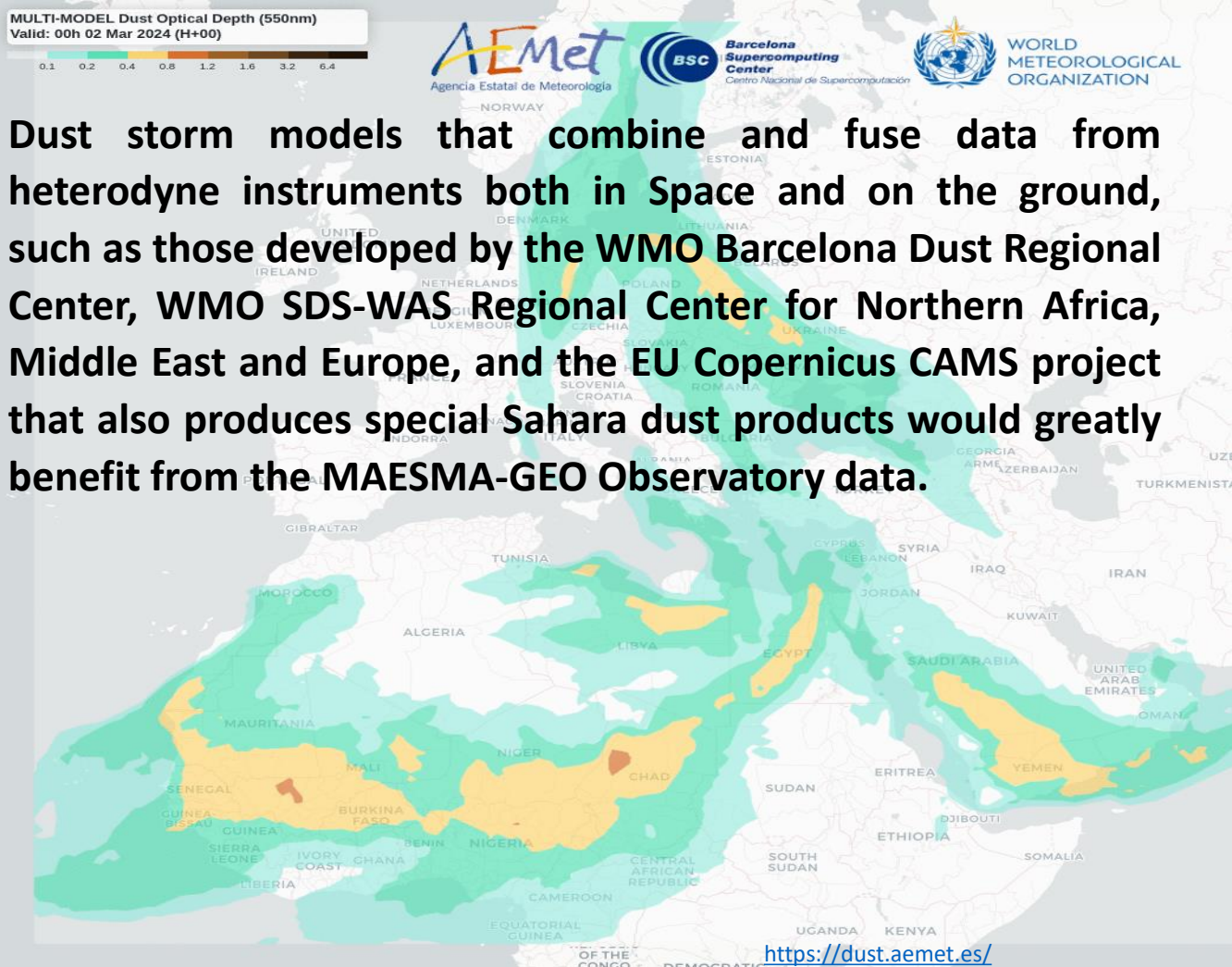
- Absorbing Aerosol Index
- UV & Visible Aerosol Optical Depth
- UV Single Scattering Albedo, Aerosol



Sentinel-5P TROPOMI Level 2 product can detect and characterize the Dust over the MENA and Saharan Africa – Daily revisit see orange area across the

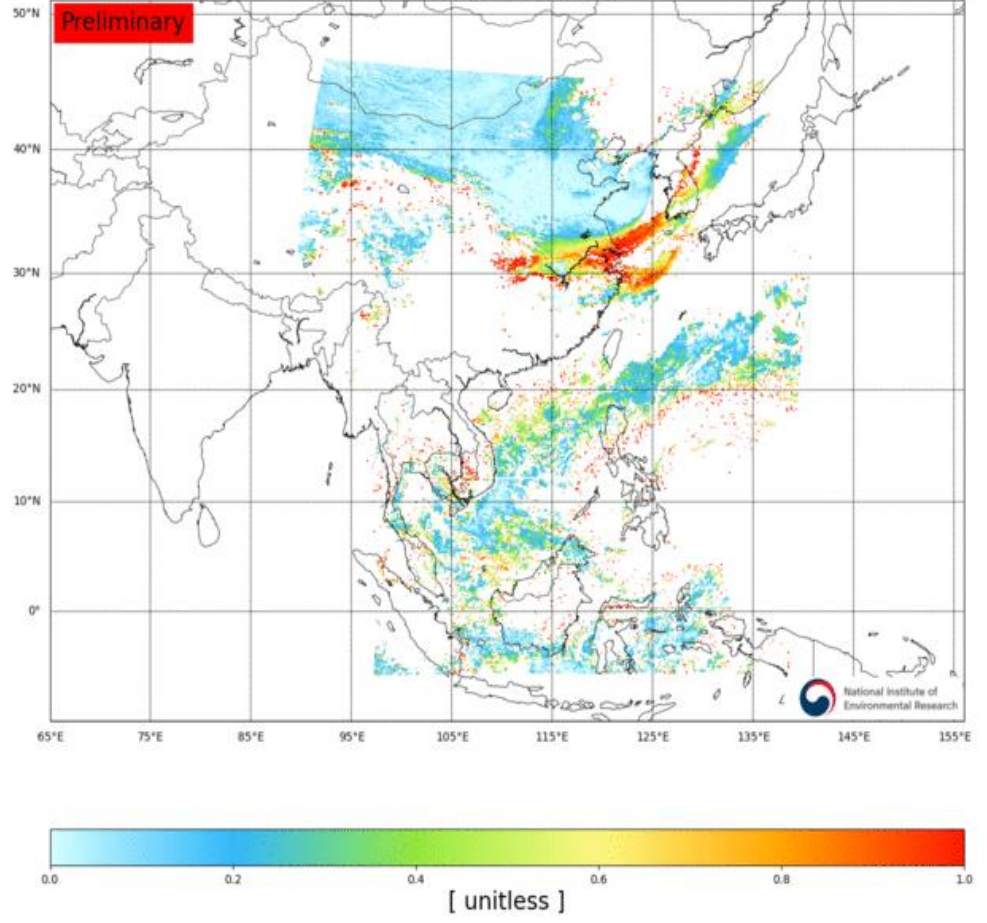
MEASMA-GEO Observatory Project 5 of 12

MEASMA-GEO with its hourly coverage will provide near real time monitoring of Dust storms, evolution, mobility and transport.



Dust storm models that combine and fuse data from heterodyne instruments both in Space and on the ground, such as those developed by the WMO Barcelona Dust Regional Center, WMO SDS-WAS Regional Center for Northern Africa, Middle East and Europe, and the EU Copernicus CAMS project that also produces special Sahara dust products would greatly benefit from the MAESMA-GEO Observatory data.

GEMS - April 17, 2021 Mongolian dust event (AOD 443nm)
GEMS L2_AERAOD 2021-04-17-00:45 UTC (2021-04-17-09:45 KST) FC-ETC_DPRO ESC
Aerosol Optical Depth at 443nm



MEASMA-GEO Observatory Project 6 of 12

“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

Ground Based Atmospheric Monitoring

- ❑ Essential for Validation and Verification of Satellite Data
- ❑ Important to be part of international network for global atmospheric monitoring
- ❑ Critical to the successful fusion of heterogeneous data from different type of sensors is:
 - Standardisation of data formats for the various data products
 - Regular maintenance and calibration of data to an agreed standard – against standardised benchmark instruments.

3 Development of remote observation equipment

Localization of Pandora H/W, S/W (2020~2024)

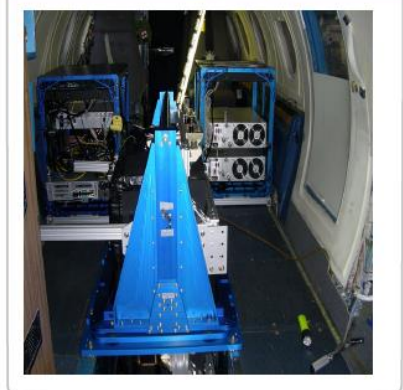
Expanding Pandora Asia Network



• Pandora
National Institute of Environmental Research

Development of aircraft onboard GEMS (2020~2022)

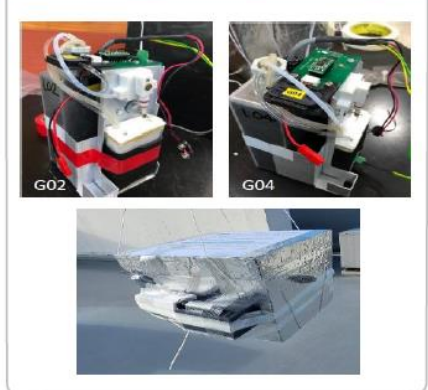
Observing hot spot



• example : GeoTASO

Low-price Sonde (O₃ + NO₂) (2021~2025)

Producing & Testing Sonde(NO₂)



Ministry of Environment

https://www.unescap.org/sites/default/d8files/event-documents/Session%201_Introduction%20to%20the%20GEMS%20project_by%20Mr.%20Dongwon%20LEE.pdf

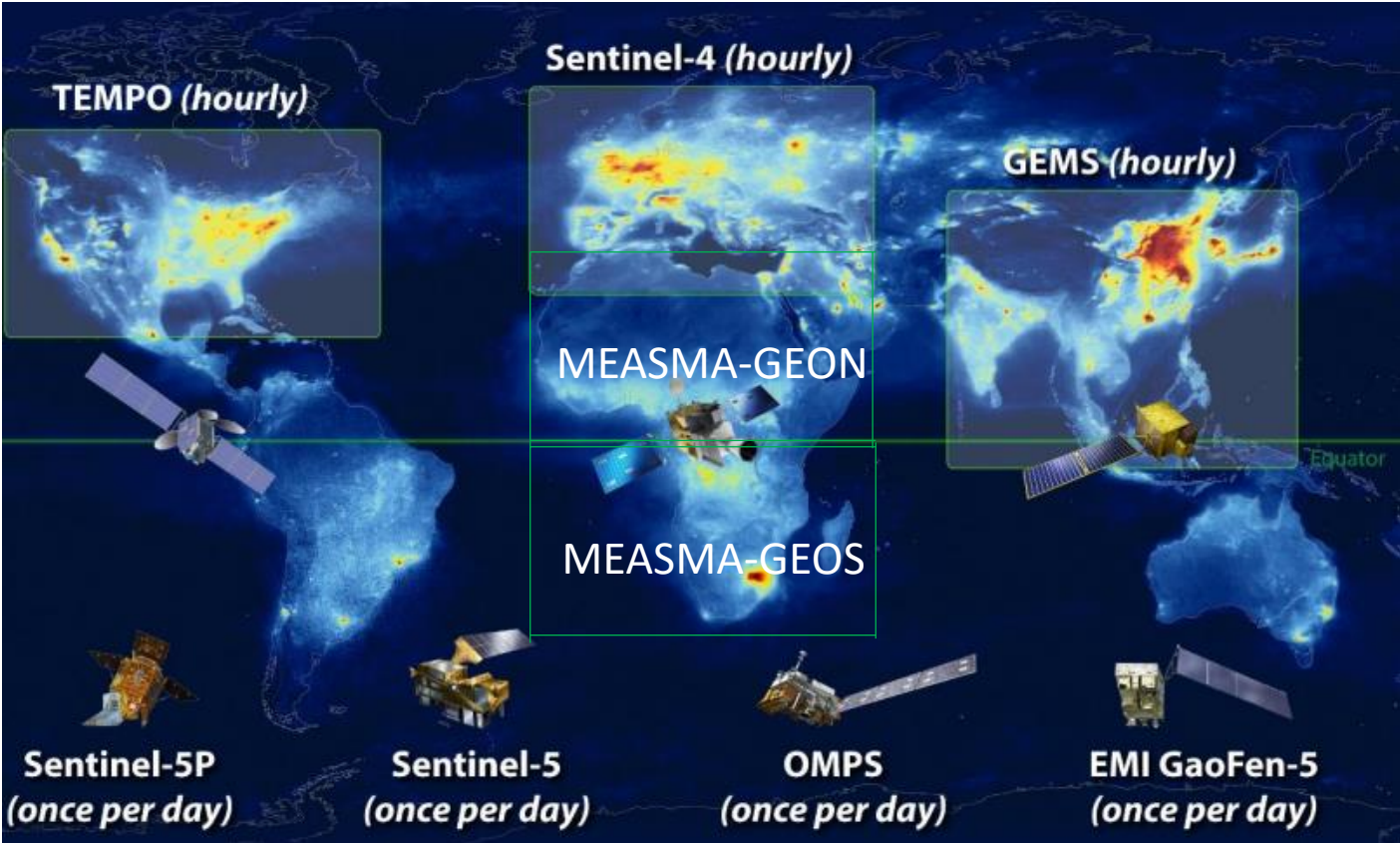
Slide Cursey of by Mr. Dongwon LEE.
Director of Environmental Satellite Center (ESC)
National Institute of Environmental Research (NIER)

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“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

MEASMA-GEO Observatory Instrument Filling the Gap in Global Atmospheric Prolusion Monitoring

The MEASMA-GEO Observatory will compliment NASA’s TEMPO that covers North America, and KARI/NIER’s GEMS that covers the Far-East, and ESA’s Sentinel-4. The aim is to be part of a global virtual network that will provide



atmospheric pollution data across the globe that can be shared freely for the benefit of all mankind as outlined by the whitepaper published by CEOS.

This project and the data it will generate will be of great value to support the efforts of the United Nation/UNOOSA, CEOS, GEO and Eye on earth, as well as all environmental and meteorological agencies/orgainsations including academic and research organizations across the globe.

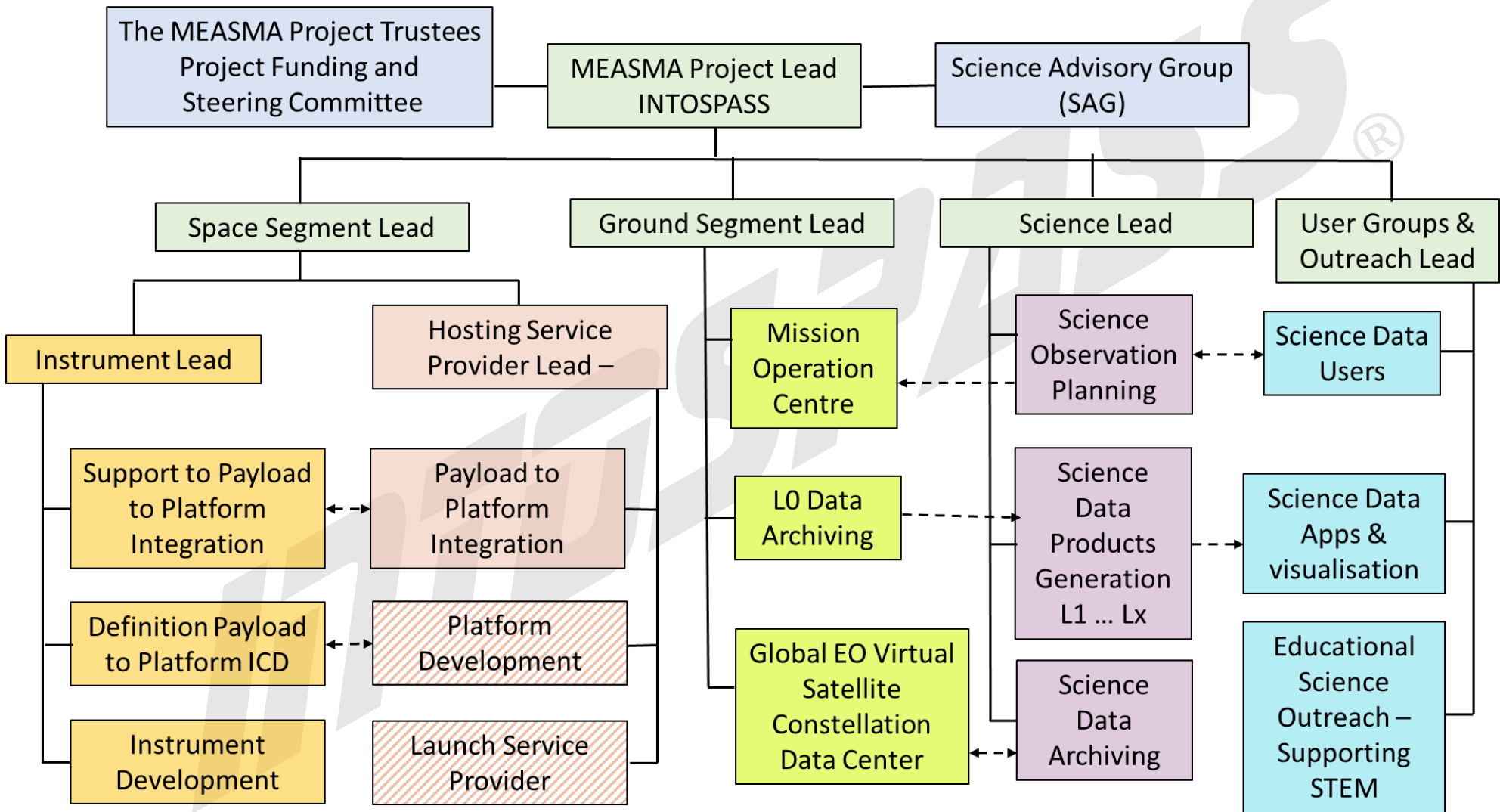
SERCO has been identified as one of the potential partners to support the implementation of the data center that would host the virtual constellation.

https://ceos.org/document_management/Virtual_Constellations/ACC/Documents/GEO%20AQ%20Constellation%20Geophysical%20Validation%20Needs%201.1%2020Oct2019.pdf

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“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

MEASMA-GEO Observatory Project Organisation Chart



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“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

MEASMA Saudi CoP



A proposal to Setup the MEASMA Aerosols & Air-Quality Saudi CoP

Proposed by

Saudi Space Agency – SSA

and

Saudi National Center for Meteorology – NCM

in partnership with

INTOSPASS -

International Outer Space Association

May 2024

MEAMA-Saudi CoP Objectives:

The primary objectives of the CoP are as follows:

1. Foster local, regional and global collaboration and networking among researchers, scientists, practitioners, and policymakers interested in space-based monitoring of aerosols and air quality in Saudi Arabia.
2. Share knowledge, expertise, and best practices in the acquisition, processing, and interpretation of satellite data for aerosol and air quality analysis.
3. Define the needs and science objectives for space based remote sensing system, that may lead to the definition of space mission objectives, requirements and concept for a spaceborne remote sensing instrument(s) and related satellite architecture.
4. Identify and address key challenges and gaps in aerosol and air quality monitoring, modelling, and impact assessment through collaborative research and innovation.
5. Support capacity building initiatives and skill development in space-based aerosol and air quality monitoring among CoP members and stakeholders.
6. Contribute to evidence-based decision-making and policy development for mitigating the environmental and health impacts of aerosols and air pollution in Saudi Arabia.
7. Encourage and grow a vibrant community in the domain of aerosols and air quality remote sensing, including participation and hosting of working groups, technical meetings and conferences.

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“Middle East & Africa Space-based Monitoring of Atmospheric-pollution”

MEASMA Working Group Workshop at UNCCD CoP16 - Green Zone

Science Pavilion – Riyadh 7th of December 2024



المركز الإقليمي للتحذير من العواصف الغبارية والرملية
Sand and Dust Storm Warning Regional Center



المركز الوطني للأرصاد
National Center for Meteorology

Side Conference Hall A

Day 6 Saturday 7th of December 2024 UNCCD - Workshop - Peoples' Day "How to Differentiate Climate-Induced versus Human-Caused Land Degradation"		
Time	Speaker	Title
Workshop 09:00 - 17:00		Present scientific approaches and tools for assessing the causes of land degradation. Discuss case studies highlighting the differentiation between climate-induced and human-caused degradation. Explore policy implications and strategies for addressing each type of degradation effectively.
9:00 - 9:20	GEO and GEO-LDN	Agenda and objectives of the working group meeting
09:20 - 12:30		Working Group discussion Refreshments and snacks will be available throughout
12:30 - 13:30	Contributors (TBD)	Lunch
13:30 - 16:45		Working Group discussion Refreshments and snacks will be available throughout
16:45 - 17:00	GEO and GEO-LDN	Summary of outcomes and recommendations to COP16 delegates

Side Conference Hall B

Day 6 Saturday 7th of December 2024 MEASMA - Working Group Meeting and Workshop "Middle East & Africa Space-based Monitoring of Atmospheric-pollution"		
Time	Speaker	Title
Workshop 09:00 - 17:00		The "Air" Remote Sensing Workshop: (MEASMA Program and update from CEOS AC-AV Meeting Outcome) Moderator: Dr Omar Emam - INTOSPASS Monitoring of atmospheric constituents and assessing air quality over the Middle East and Africa. Realising a virtual GEO remote sensing satellite constellation as proposed by CEOS AC-AV white paper. Working towards monitoring Dust and Sand Storms, smoke generated by mass burning of vegetation, Monitoring stratospheric Ozone, etc
9:00 - 9:20	Dr. Omar Emam (INTOSPASS)	Agenda and objectives of the working group meeting
09:20 - 12:30	Dr. Sheldon Drobot (BAE Systems US) Dr. Ben Veihelmann (ESA) Dr. Raid Suleiman (Harvard) Dr. Barry Lefer (NASA)	Working Group discussion Refreshments and snacks will be available throughout
12:30 - 13:30	Dr. Ali Omar (NASA) Dr. Pietermel Levetk (UCAR) Dr. Damien Widmann	Lunch
13:30 - 16:45		Working Group discussion Refreshments and snacks will be available throughout
16:45 - 17:00	Dr. Omar Emam (INTOSPASS)	Summary of outcomes and recommendations to COP16 delegates

THANK YOU FOR YOUR PARTICIPATION

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