

Atmospheric Composition Constellation (ACC)

Workshop on Air Quality

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US NAS Decadal Survey

- *Anthropogenic and natural processes are modifying the composition, chemistry, and dynamics of the global atmosphere. There is an urgent need to observe, model and forecast the consequence of these changes to be able to determine the best course of action to mitigate their impact*
- *High resolution global measurements and modeling of chemistry and dynamics across the lower atmosphere enable chemical weather air quality and surface UV radiation forecasts as well as providing global trends important to all segments of society.*
- *Benefits include greater protection of public health and help create appropriate avoidance and mitigation strategies and by enabling the development of better public policy to avoid or reverse adverse atmospheric changes And avert significant ecological damage.*
- **Recommends: GEO stationary (GEO-CAPE) and LEO (GACM) missions**

Global Monitoring for the Environment and Security (GMES)

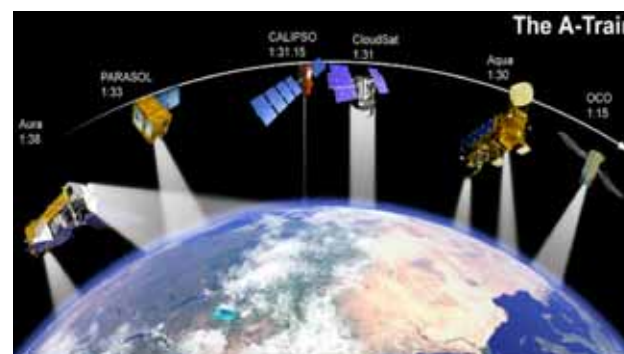
- *GMES is the European programme for the implementation of Earth Observation and contribution to GEOSS. GMES will provide decision-makers who rely on strategic information on environmental and security issues with an independent and permanent access to reliable data. Air Quality Monitoring is one important theme. Keeping air quality records, monitoring pollen concentrations, developing regional and local air quality forecasts, as well as urban and regional quality assessments will contribute to an improved quality.*
- *GMES is user driven as they are actively involved in projects via formal Service Level Agreements. The Services are being evaluated by the end-users and evolve based on this direct feedback. For Air Quality services key users are national environmental protection Agencies and EEA.*
- **Air Quality missions: Pre-cursor mission (LEO), Sentinel-4 (GEO) and Sentinel-5 (LEO)**

ACC Objectives

- Establish a framework for long term coordination among the CEOS agencies where the “Constellation” will identify specific opportunities for meeting science and application requirements
- Collect and deliver data to improve predictive capabilities for coupled changes in the *Ozone Layer, Air Quality, and Climate Forcing* associated with changes in the environment.
- Objectives meet participating Agency priorities and are aligned to the GEO SBA’s (Health, Climate, Energy, Ecosystems, Hazards))
- Objectives will be achieved through the following steps:
 - Develop a Requirements and Gap Analysis based on in-orbit and upcoming missions collecting AC data
 - Demonstrate how Constellation data can add value to data products serving the GEO SBA’s through Projects
 - Develop rationale, strategy, and standards for collaboration to meet requirements not being met and remain open for possible new requirements. Collaborate on future missions

Opportunity for conducting AC science and providing Societal Benefits using multiple instruments across international platforms

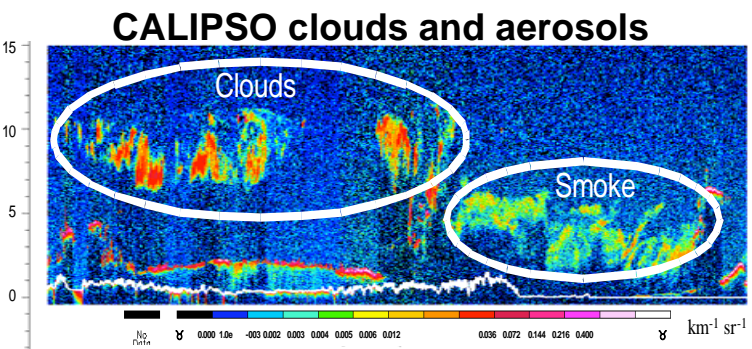
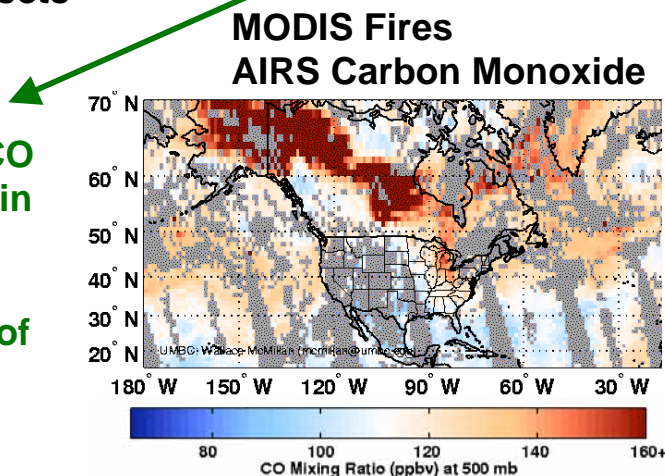
- Collaboration efficiency: take advantage of each instrument's unique capability
- Cross instrument validation
- Improved spatial and temporal coverage: e.g. different equator crossing times
- Enhanced data products: e.g. aerosol and cloud characteristics, pollution and its transport for assessments and forecasting
- *More accurate trends by comparing and combining data sets*



A-train is a good example of Constellation Science

CEOS provides opportunities for international collaboration

Example:
Geographic extent of CO from biomass burning in combined with vertical distribution of smoke improves assessment of total emissions and downstream impacts

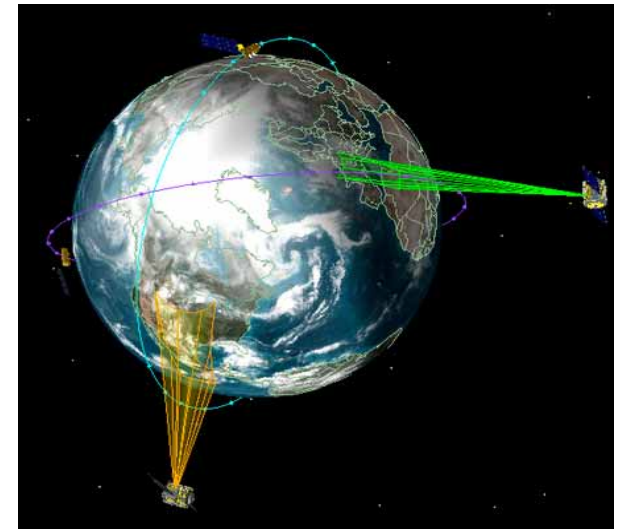


- ACC initiated several projects to demonstrate the Constellation concept. Projects involve its international partners using multiple missions. Initial Projects were selected for near term results and aligned with the GEO SBAs
- Projects are showing added value using constellation data over data used separately. Now in their implementation phases
 - *Pollution forecasts using Metop and Aura: Health/Air Quality (NOAA lead) (HE-09-03a_3)*
 - *Aircraft volcanic ash warning using Envisat, Metop and Aura: Hazards (ESA lead) (DI-09-02a_2)*
 - *Smoke prediction from biomass burning using Aura, Aqua, CALIPSO: Hazard and Health (NASA lead) (DI-09-02a_2)*
 - *Algorithm and cal/val collaboration between GoSAT (JAXA) and OCO (NASA): Also establish an international working group on GHG observations from space Climate (JAXA lead).*
- NO₂ Intercomparison campaign – Netherlands Jun 2009 (SIT-22-5 Action)
 - <http://www.knmi.nl/samenw/ceosgeomon/>
 - Working with WGCV/ACSG, Envisat, Metop, Aura
 - Establish accuracy of ground measurements
- Completed *Requirements and Gap Analysis* for existing and upcoming missions: Cross-cutting (AR-09-02a_14)

- **Workshop on the impacts of data gaps on climate modeling held at GISS, NYC, USA (CL-09-02a_13)**
 - Discussion of measurement requirements and gaps
 - Discussion of the status and requirements for chemistry/climate models
 - Panel discussion
 - Mission recommendations and priorities based on data gaps
 - Publish Workshop Report
- **Development of an AC Portal (AR-09-02b_2)**
 - NASA-DLR collaboration to establish an AC Data Portal coordinated within GEO
 - Data access and tools for value added AC products with GEO interoperability
 - Implemented through CEOS/WGISS and collaborate with the WMO
 - Requirements, specifications, and preliminary architecture underway
 - WDC-RSAT (hosted at DLR) is baseline



- The US and Europe have major Earth Science mission plans
 - US Decadal Survey
 - ESA Earth Explorers
 - GMES Sentinels
- AC Opportunities:
 - NASA: GEO-CAPE (2018) and GACM (2025)
 - Europe: Precursor (2015), Sentinels 4 (2018) and 5 (2020)
 - Operational systems: NPOESS (2014), Metop (2008)
- Areas of Collaboration
 - Algorithms, Cal/Val, Instrument/platform, Launch, Data sharing
- NASA, JAXA and ESA for CO₂ observations – International group being formed



LEO and GEO AC missions are highly Complimentary

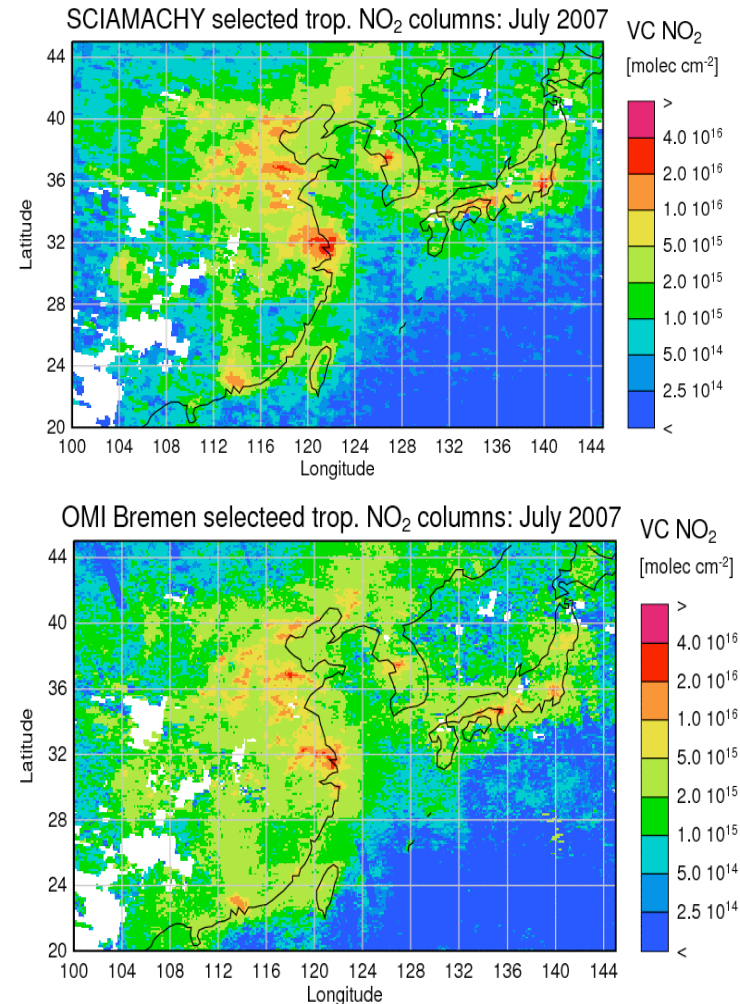
Back Up

Workshop Objectives

- **Identify data**
- **Establish priorities**

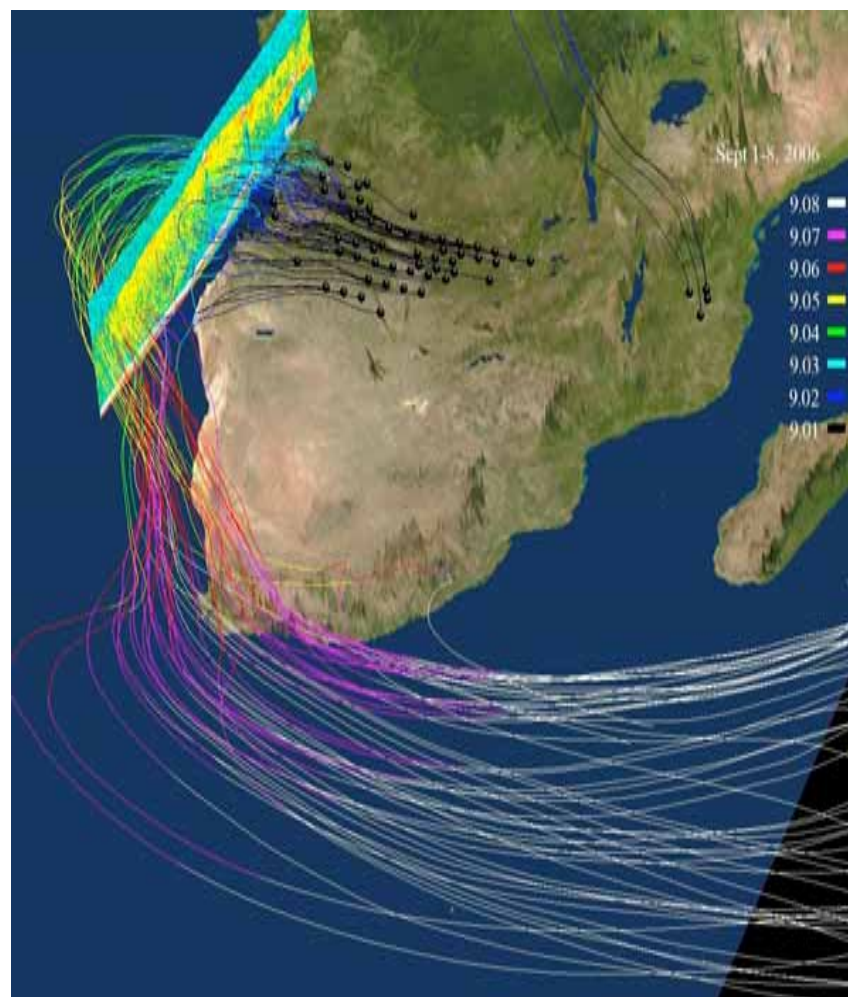
- **Provide report to CEOS Agencies**
 - **Status of Air Quality measurement**
 - **Application of satellite Air Quality data**
 - **Future requirements**
- **Potential topics for ESA, NASA and NOAA solicitations**
- **Decadal Survey preliminary studies**
- **CAMELOT**

- **NOAA provides AQ forecast in collaboration with EPA**
 - Improve emissions inventories
 - Characterize long range transport
 - Model and forecast improvements
 - Compliance and clean air rules
- **Improvement using combined Metop and Aura NO₂ data sets**
 - Common algorithm now running on both data sets
 - Six month data set for evaluation
 - Compare with models
 - *Make operational - 2009*

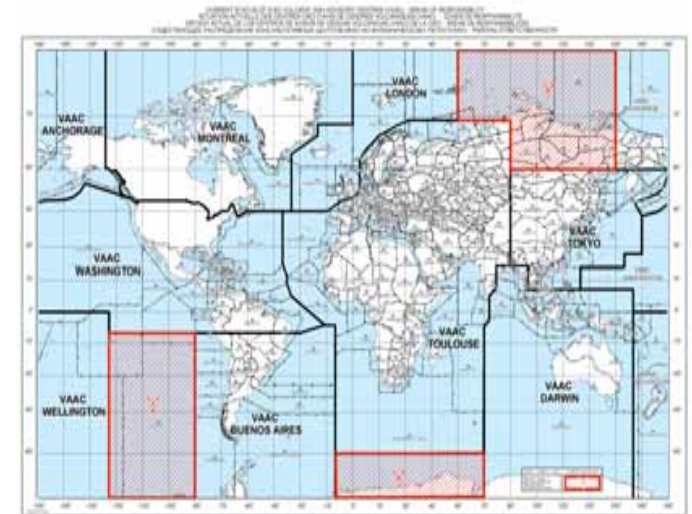


A. Richter, University of Bremen

- **Smoke dust Forecast NASA, NOAA, and EPA collaboration**
 - Automated fire detection algorithm for MODIS
 - AOD algorithm from MODIS and AVHRR
 - Employ trajectory model to predict distribution and location and smoke
 - Possibly include vertical aerosol distribution from CALIPSO
 - NRT ability still to be implemented
 - *Demonstrated aerosol forecast feasibility*
- **Extend to MSG/SEVIRI (Eumetsat)**
- **Deploy service on: *TBD***
<http://servir.nsstc.nasa.gov>
<http://idea.ssec.wisc.edu/>
- **Potential collaboration with PROMOTE/GMES Service**



- Volcanic eruptions impact aviation safety; engine, window and skin damage
- The US (NASA, USGS, and NOAA) and ESA (PROMOTE) support national VAACs by providing alerts based on satellite data
- National services coordinated and extended to provide global service using enhanced capabilities through US and ESA combined efforts
 - Aura, Envisat, and MSG
 - Improved latency and accuracy of SO₂ and ash detection
 - Global alerts
- ESA sponsored workshop in October 2007 and conducted Invitation To Tender for a dedicated project to start in November 2008



Agenda Overview

- 15 June
- 16 June
- 17 June

- **GMES** - *Monitoring and forecasting of air quality is important for the health and well-being of European citizens. Keeping air quality records, monitoring pollen concentrations, developing regional and local air quality forecasts, as well as urban and regional quality assessments will contribute to an improved quality*
- **EEA** - *Under the agreement, the European Environment Agency (EEA) will use a service, which combines and processes satellite data with surface measurements from 29 European countries to deliver accurate information on air quality daily, to support the implementation of European air-quality policies.*