Changing the Perspective: Atmospheric Research on the ISS

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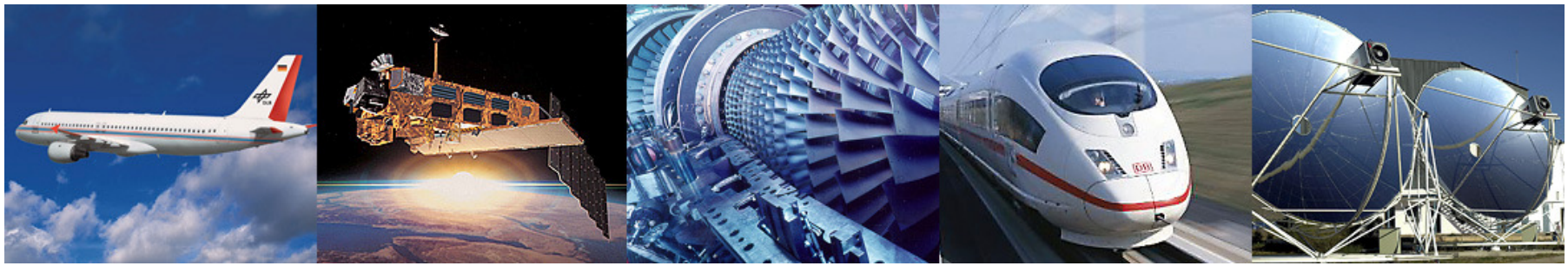
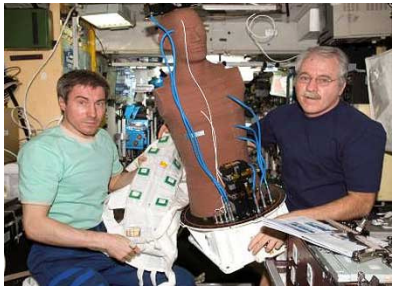
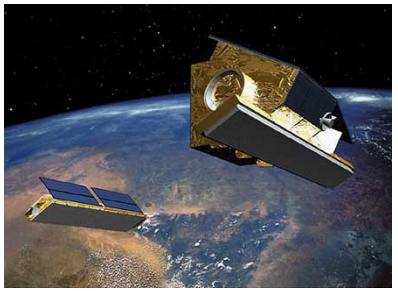


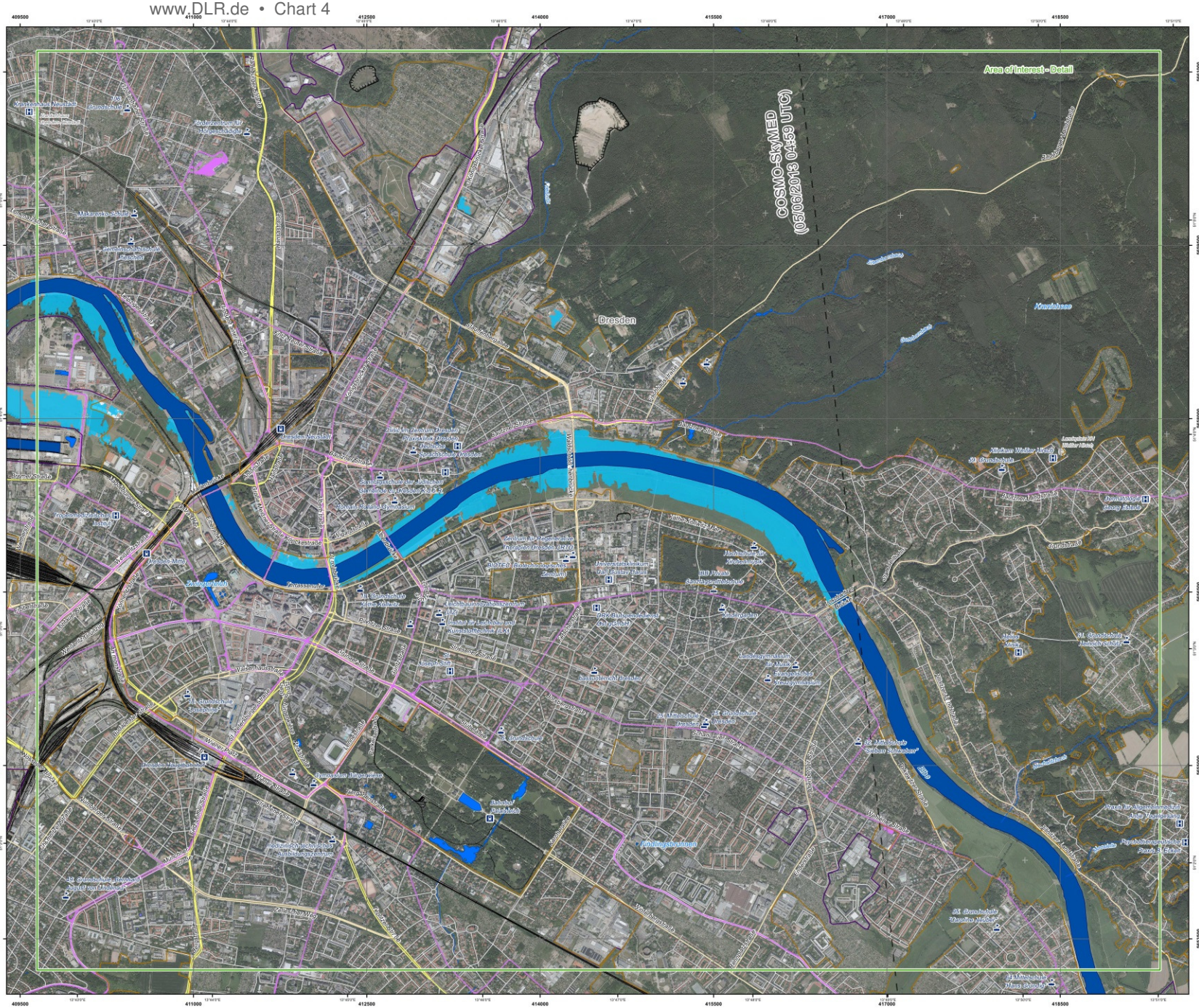
- Research Institution
- Space Agency
- Project Management Agency

DLR Space Research and Technology

- Space exploration
- Zero gravity research
- Earth observation
- Communication and navigation
- Space transport
- Technology of space systems



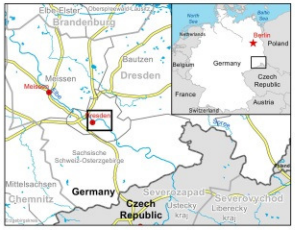


GLIDE number: N/A

Activation ID: EMSR-044
Product N.: 08Dresden, v1

Dresden - GERMANY
Flood - 03/06/2013
Delineation Map - Detail

Production date: 06/06/2013



Cartographic Information

1:15000

Full color ISO A1, high resolution (300 dpi)

0 0.25 0.5 1 km

N

Map Coordinate System: WGS 1984 UTM Zone 33N
Graticule: WGS 84 geographical coordinates

Legend

Crisis Information
- Flooded Area (05/06/2013)

General Information
- Area of Interest
- Satellite Footprint

Settlements
- Populated Place
- Industrial
- Multi-functional

Industry / Utilities
- Quarry

Hydrology
- River
- Stream
- Lake
- Reservoir
- River

Point of Interest
- Educational
- Medical
- Transportation

Transportation
- Heliport
- Railway
- Primary Road
- Secondary Road
- Local Road
- Tramway

	Consequences within the Detail AOI on 05/06/2013			
Estimated Population	4580 inhabitants			
Transportation	0.95 km			
Settlement	Multi-functional	35.26 ha	Industrial	1.72 ha
Land use	Cropland	20.43 ha	Grassland	126.19 ha
	Woodland	0.08 ha		

Map Information

Starting from beginning of June, heavy rainfalls have caused flooding along rivers and lakes in Germany, Austria, Switzerland and the Czech Republic, forcing authorities to issue disaster warnings and reinforce defenses. Several people have already been killed, with water levels expected to continue rising.
In Germany floods have been affecting several towns and villages in both Southern Bavaria and Saxony.
This is a delineation map for the region of Dresden, showing the situation as of 05/06/2013.
The core users of the map are Civil Protection authorities involved in in-field operations.
The potential additional users of the map are other Civil Protection authorities involved in operations.
The scope of the map production is planning and support to logistics.

Data Sources

Inset maps based on: Administrative boundaries (JRC 2013, GISCO 2010, © EuroGeographics), Hydrology, Transportation (Natural Earth, 2012, CCM River DB © EU-JRC 2007), Settlements (Geonames, 2013).
COSMO-SkyMed © ASI (2013) (acquired on 05/06/2013, GSD 3 m) processed by ITHACA.
Background aerial orthoimages © Federal Agency for Cartography and Geodesy (BKG) (GSD 0.40 m, 0% cloud coverage).
Base vector layers based on Openstreetmap, Geonames, Corine Land Cover, Urban Atlas (approx. 1:25.000, extracted on 03/06/2013), refined by ITHACA.
Population estimates based on Landscan 2010 © UT BATTELLE, LLC.
All Data sources are complete and with no gaps.

Dissemination/Publication

No restrictions on the publication of the mapping apply.
Delivery formats are GeoTIFF, GeoPDF, GeoJPEG and vectors (shapefile and KML formats).

Framework

The products elaborated in the framework of current mapping in rush mode activation are realized to the best of our ability, within a very short time frame during a crisis, optimising the available data and information. All geographic information has limitations due to scale, resolution, date and interpretation of the original data sources. The products are compliant with GIO-EMS RUSH Product Portfolio specifications.

Map Production

The present map shows basic topographic features such as transportation, hydrology and settlements in the area of Dresden (GERMANY). These basic topographic features are derived from public datasets, refined by means of visual interpretation of the national official aerial orthoimages © Federal Agency for Cartography and Geodesy (BKG) (GSD 0.40 m, 0% cloud coverage).
Thematic layer assessing the delineation of the flood event has been derived from COSMO-SkyMed post-event imagery (3 m resolution, acquired on 05/06/2013).
The estimated geometric accuracy of this product is 3m CE90 or better, from native positional accuracy of the background satellite image.
The estimated thematic accuracy of this product is 85% or better, based on previous experience in using high resolution SAR imagery for flood extent delineation. Please be aware that the thematic accuracy might be lower in urban and forested areas due to known limitations of the analysis technique.
Land cover data are delivered as vector files and they are not displayed in the map.
Map produced on 06/06/2013 by ITHACA under contract 257219 with the European Commission. All products are © of the European Commission.
Name of the release inspector (quality control): a-GEOS (ODO).
E-mail: rush@ems-gmes.eu

Flood
Civil Protection
Response
Delineation Map - Detail
Planning
COSMO-SkyMed
03-06-2013

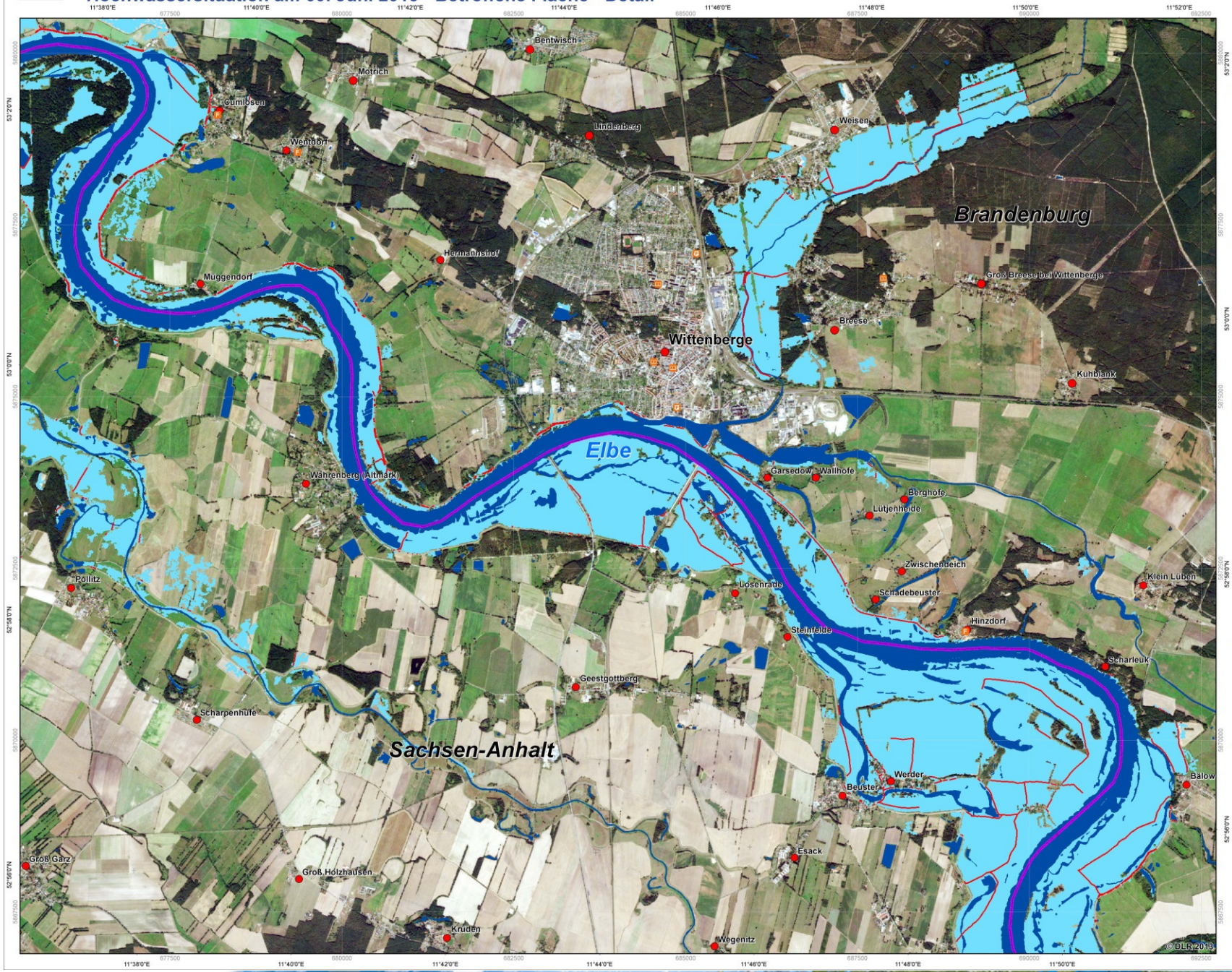
Copernicus

DLR

DEUTSCHLAND - Elbe - Wittenberge

Hochwassersituation am 09. Juni 2013 - Betroffene Fläche - Detail

1:25.000



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That is what we already have today. That is what we can measure and what everybody can see.

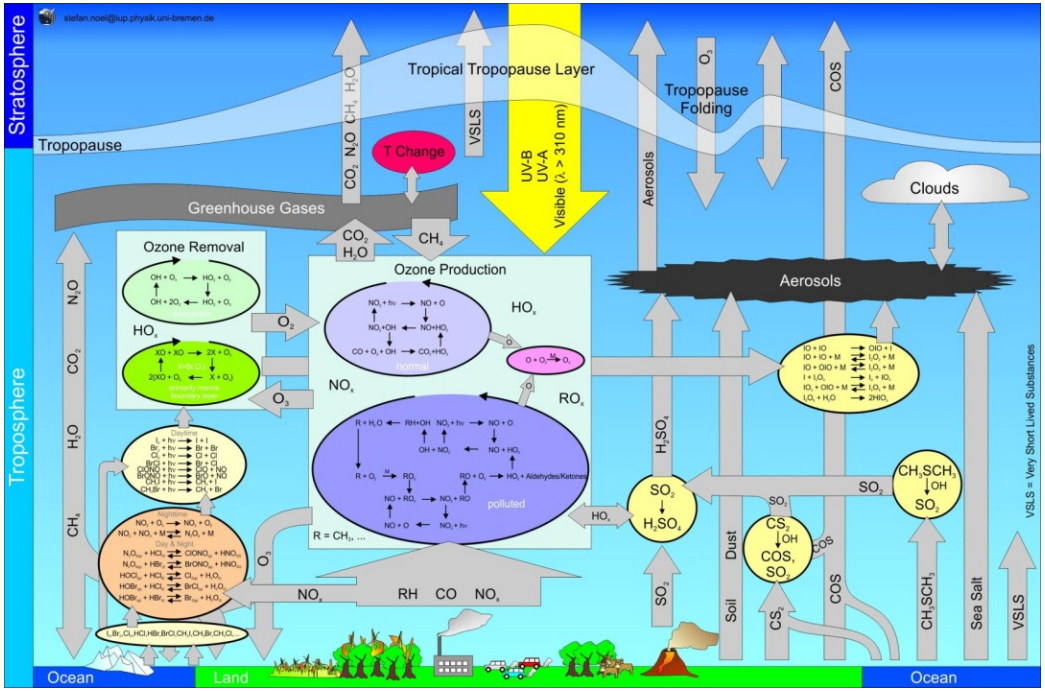
What is not apparent but equally dangerous are the changes in the Earth´s atmosphere.

We still do not have sufficient tools to understand the consequences of global atmospheric processes. And changes in global atmosphere can probably cause bigger catastrophies.

So, we have to be able to develop sufficient capabilities to monitor these atmospheric changes.

The atmosphere: What‘s wrong?

- Conditions in the biosphere depend on the interactions of the Sun, the atmosphere, and earth‘s surface and their non linear feedback.
- Dramatic changes in population and anthropogenic emissions since 1800! Example: of 5 Billion people - since SCIAMACHY has been proposed in 1988 - to a total of over 7 Billion now.
- The atmosphere is changing dramatically as a result of mankind.



Emissions Major Source of Uncertainty

Fossil Fuel

Biomass Burning

Volcanoes

Forests

Soils

Oceans

Lightning

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Why is Earth Observation so important?

- It is impossible to understand or manage what is not measured!
- Atmospheric composition provides early warning of changes to come!
- Environmental / Climate Change requires Global Observations!
- Evidence base for testing our understanding and for policymaking!
- Conclusion: long-time data series for Earth Observation are needed

What is the problem?

•Satellites are too expensive.

•Have a relatively short live time.

•There is a lack of flight opportunities.

•Current planned missions provide limited opportunities for improving atmospheric observation.

•

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The end of a pioneering age – How do we now move forward?

Some of the issues and problems

•In a pioneering age over the past 30 years atmospheric and space scientist have demonstrated that atmospheric and relevant surface phenomena are well measured from space and in particular trends can be well measured. Hugely Successful!

•However much better spatial resolution and temporal sampling is required to improve our knowledge of surface fluxes of atmospheric constituents

•In Europe ESA, EUMETSAT and EU Copernicus (GMES) are slowly progressing to become operational systems, providing global data from low Earth orbit and GEO – geostationary orbit.

•The next planning cycle for follow on to EUMESAT ESA Metop Second Generation and Meteosat Third Generation will begin in the 2020s for launch in the 2035 to 2040 time frame

The end of a pioneering age of earth observation – How do we now move forward – a paradigm shift!

Issues :

•NASA decadal survey proposal being implemented very slowly, if at all.

•The ESA Explorer and related path finder missions provide limited opportunities for improving atmospheric observation

•Lack of flight opportunities for the foreseeable future for new missions addressing the needs for high spatial resolution.

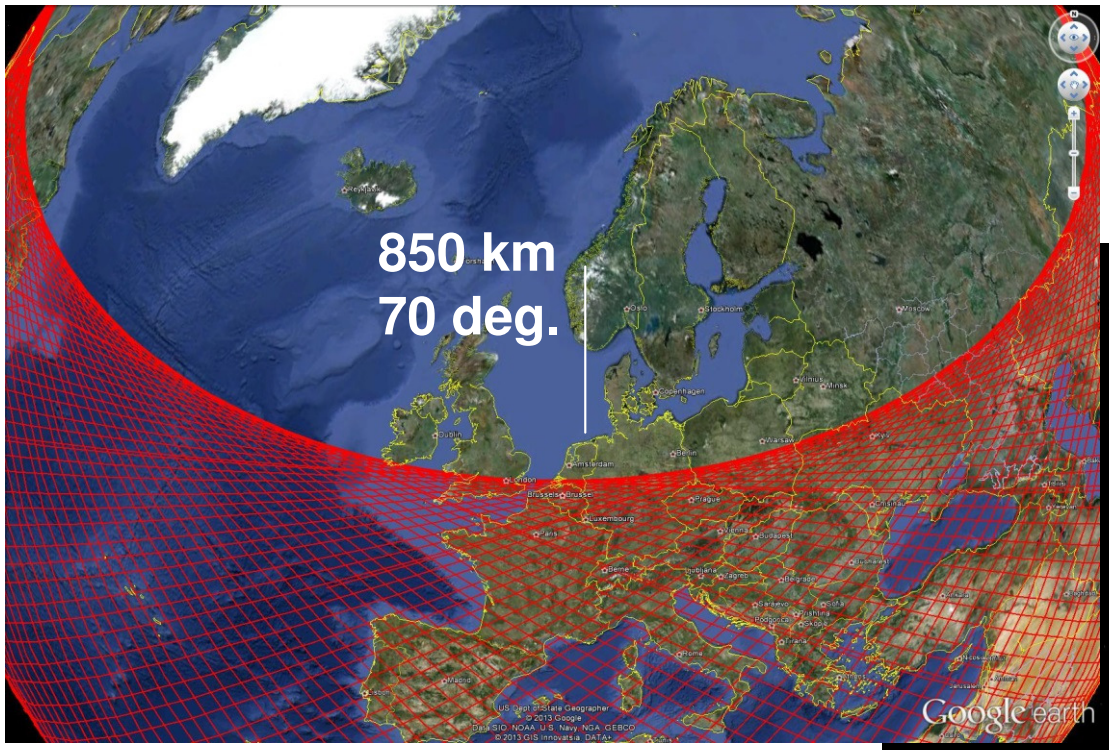
•Loss of competency and human capacity. (No projects for young scientists – see problems of nuclear industry)

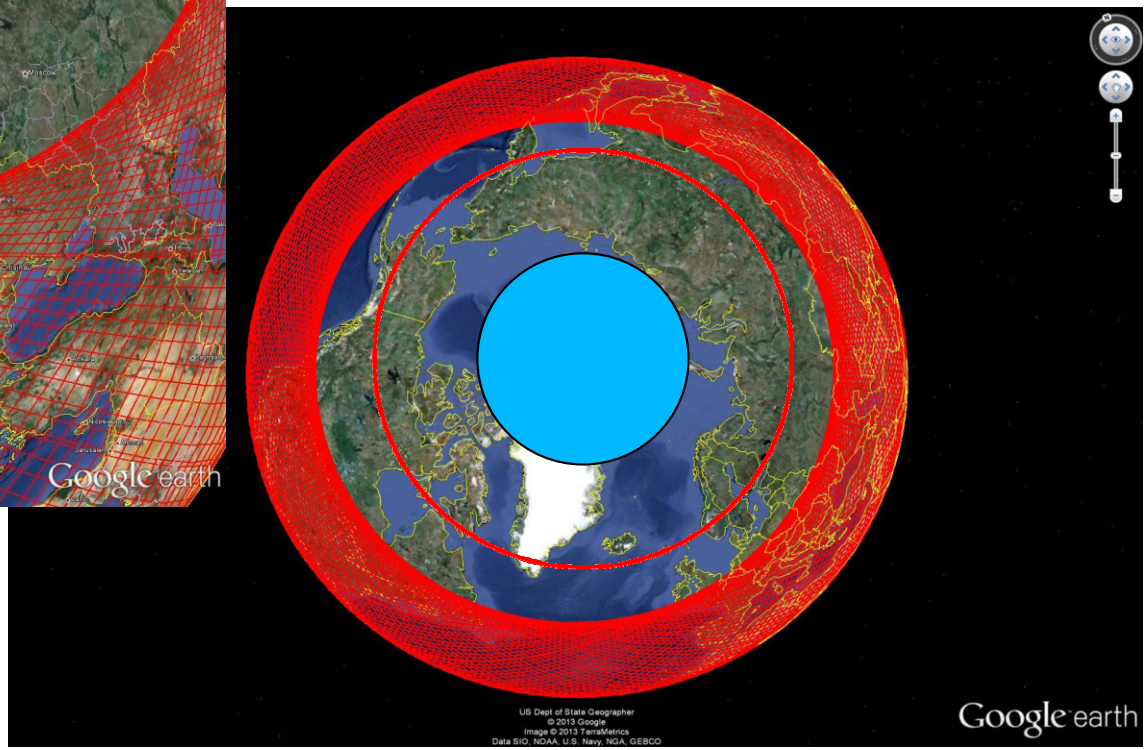
Paradigm Shift – Solution for Short to Medium Term:
Use of ISS as an atmospheric Observatory for science and development

Orbital Track and Coverage of ISS + 70° Scan

Nadir viewing from ISS used for emissions and tropospheric sounding
•Covers 95% of world's population and their emissions including scan
•Not appropriate for Arctic and Antarctic and high boreal region
•Low altitude of orbit facilitates high spatial resolution in nadir viewing
•Asynchronous orbit yields multiple time measurements in the 45°- 60° latitudes and a drifting local time per day.
Limb Viewing and Solar Occultation used for vertical profiling of atmospheric constituents
•Extended viewing to poles successfully used by UARS
•Near Global Coverage, some loss at poles, in occultation see NASA Sage II and JAXA SMILES
Summary
•*complements the planned sun synchronous LEO and geostationary GEO fleet lower spatial resolution instrumentation*
•*facilitates high spatial resolution instrumentation in nadir*

Nadir viewing from ISS used for emissions and tropospheric sounding covers 95% of the world‘s population and their emissions including scan





The International Space Station – a technological platform already in existence!

Paradigm Shift

- Use of ISS as an atmospheric observatory for science and development
- Near global coverage (95% of the world population)
- Low orbit gives opportunity for higher spatial resolution
- Excellent potential concerning power & data transmission
- Possibility of refurbishment on sub-decadal timescale
- Easy access with human assistance
- Relatively cheap in comparison to satellites

Initial Conclusions

- Coverage is good if you don't need the poles
  - Northern latitudes are short-changed
- Low orbit gives opportunity for higher spatial resolution
- Potential for up to 34 instruments
- Power & data rate not a real problem
- Mass is a problem insofar as it has to get to ISS
- Possibility of refurbishment on sub-decadal timescale

ISS Advantageous could for:

- High spatial resolution sounder – possibly steerable
  - Exploit the resolution possibilities
- High data rate measurements
  - FTS or hyperspectral imager etc.
- Active sounding – Lidar, DIAL
  - Possibility of servicing (emitter replacement)
- Not necessarily complex - KISS
  - Occultation FTS/grating like SciSat
- Aerosols and composition combined is important
- Don't forget GPS sounding