Implementation of reliable control mechanisms from Space to ensure the adherence of climate change agreements

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Research from Space must deliver answers regarding the urgent challenges of the 21st century – climate change, safeguarding sufficient food supplies and global migration

These challenges

- affect all mankind
- are a global phenomenon and thus, can only be handled globally

Multi-level approach:

1. Get an overview: which global systems are affected and how
2. Recognize patterns and recurring events
3. Develop (prediction) models
4. Continuous monitoring

All of these should preferably be carried out from space!

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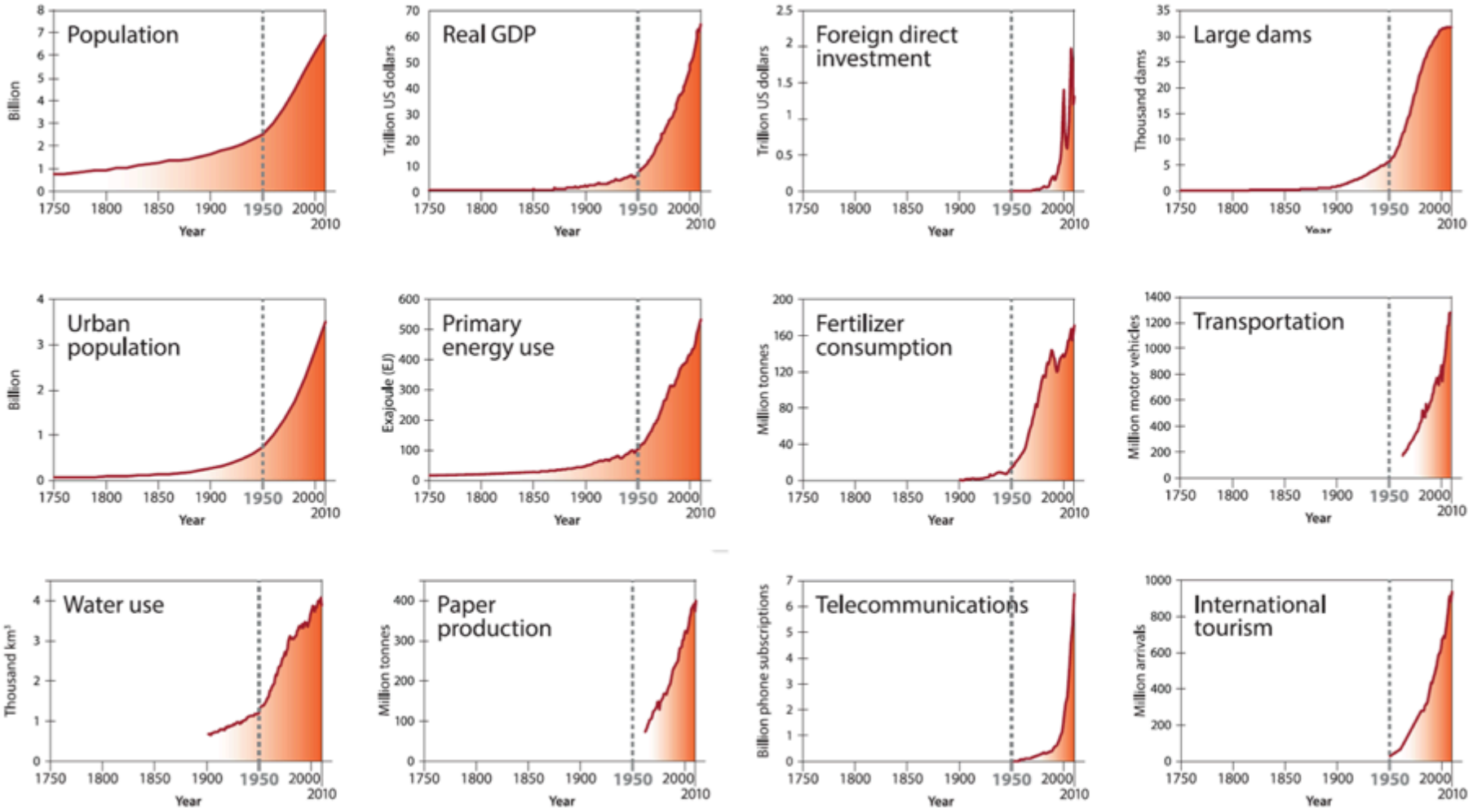
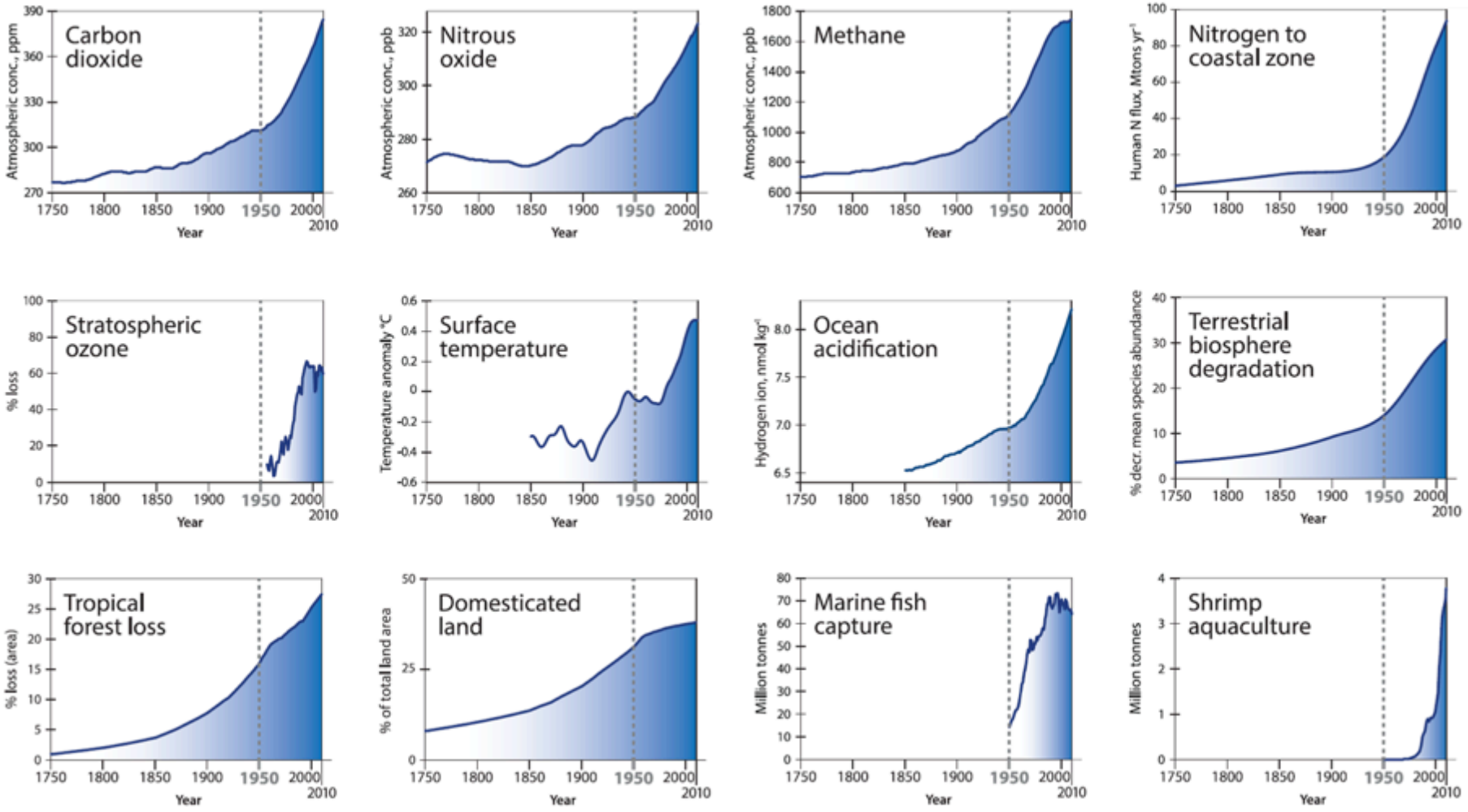
Trends: socio-economic



Steffen et al. (2015): The trajectory of the Anthropocene: The Great Acceleration

Trends: system earth



Steffen et al. (2015): The trajectory of the Anthropocene: The Great Acceleration

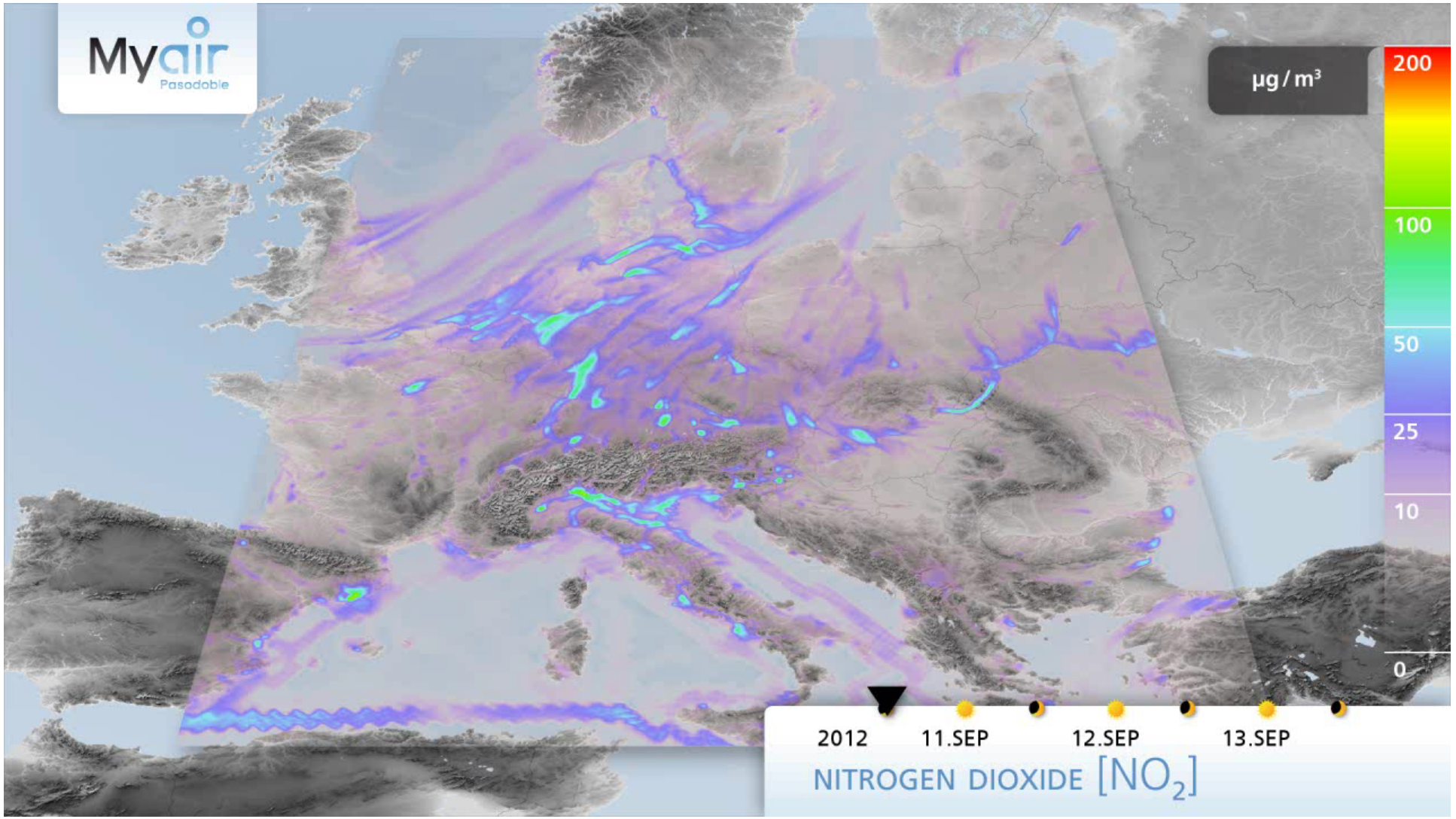
That is what we already know today. That is what we can measure and what everybody can see.

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 develop sufficient tools and models to monitor these atmospheric changes.

Air quality in Central Europe



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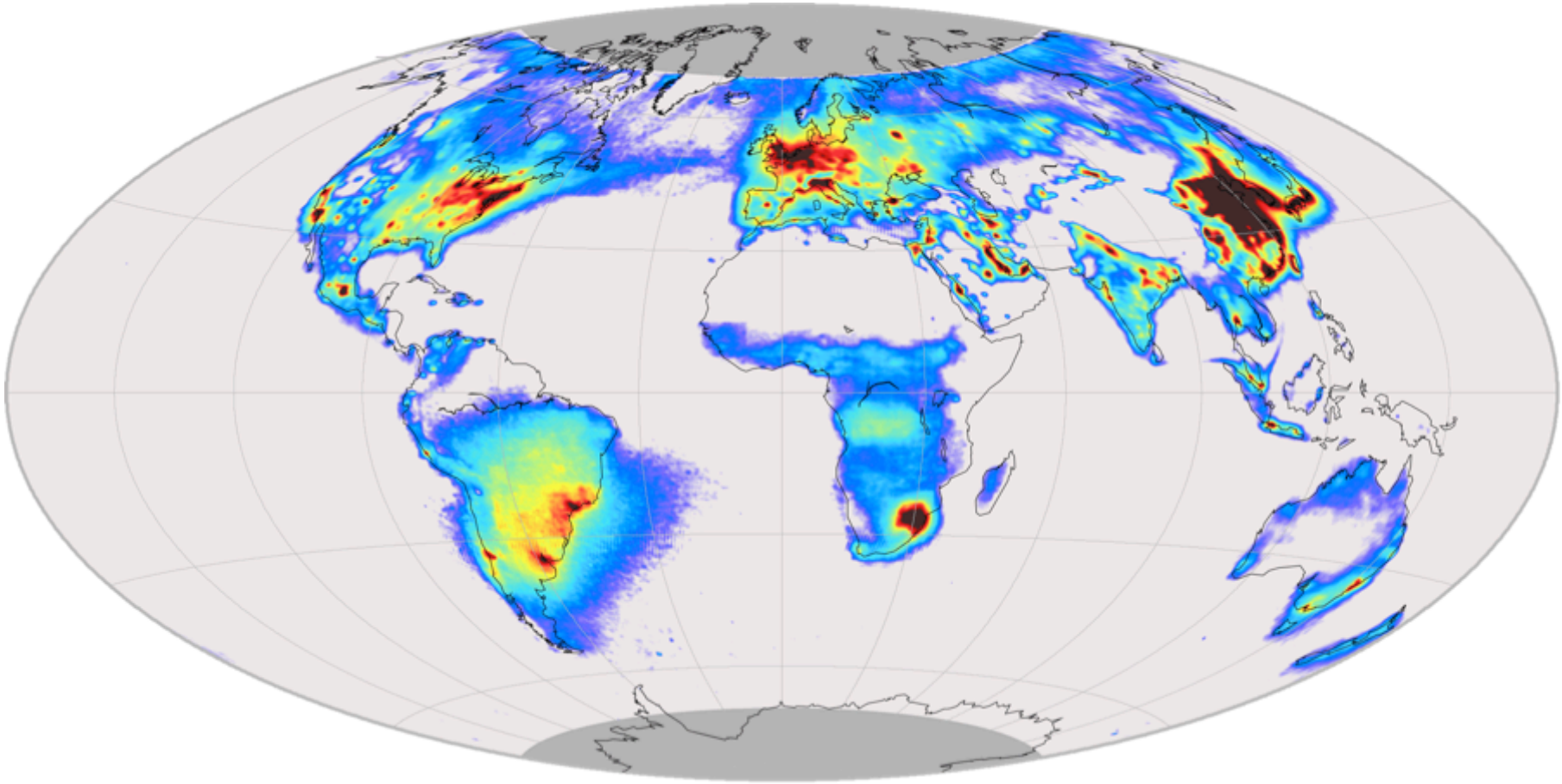
Global Monitoring of NO_2 Emissions:
A mirror of anthropogenic combustion processes



MetOp/GOME-2
2007 - 2013

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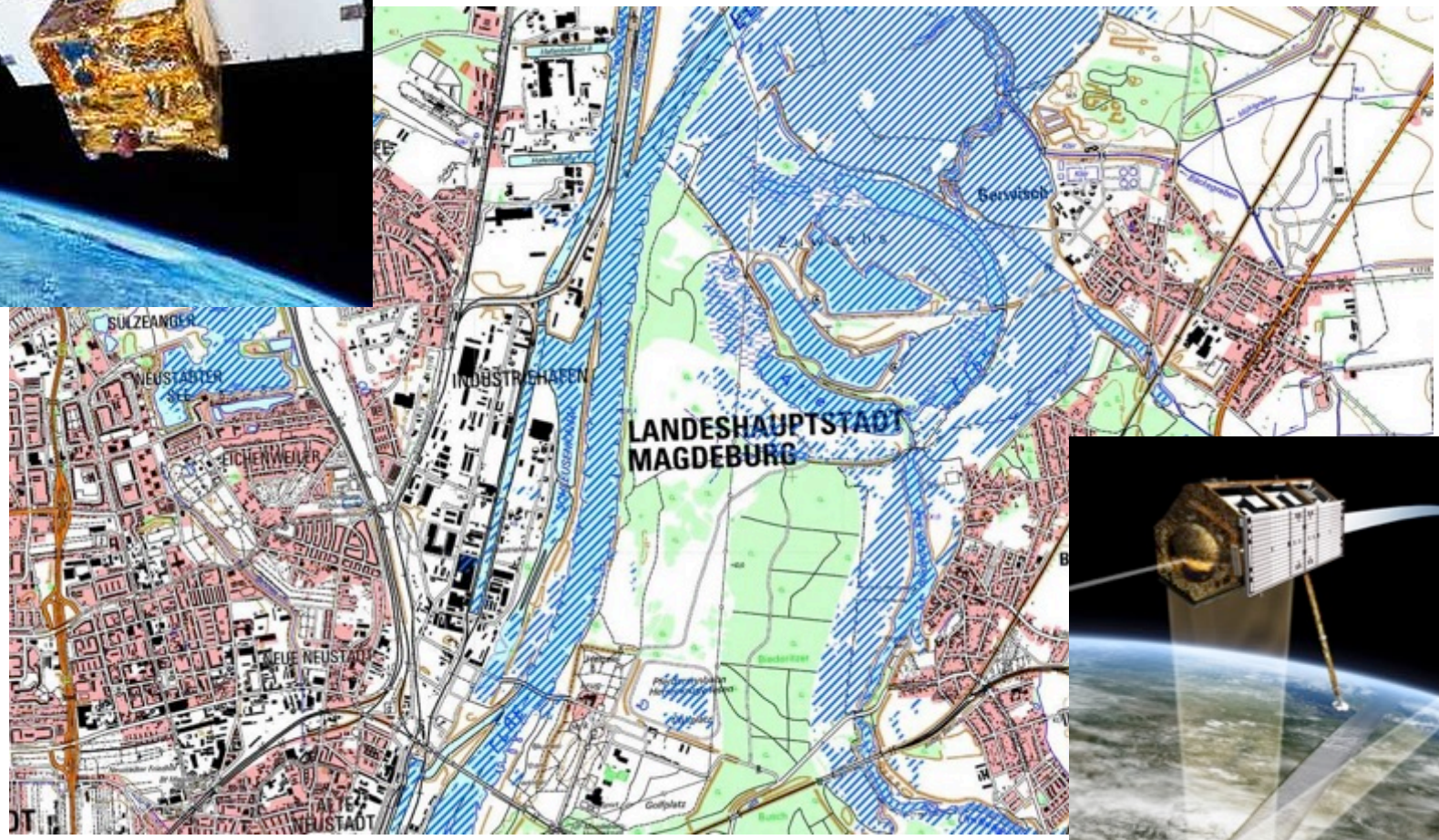
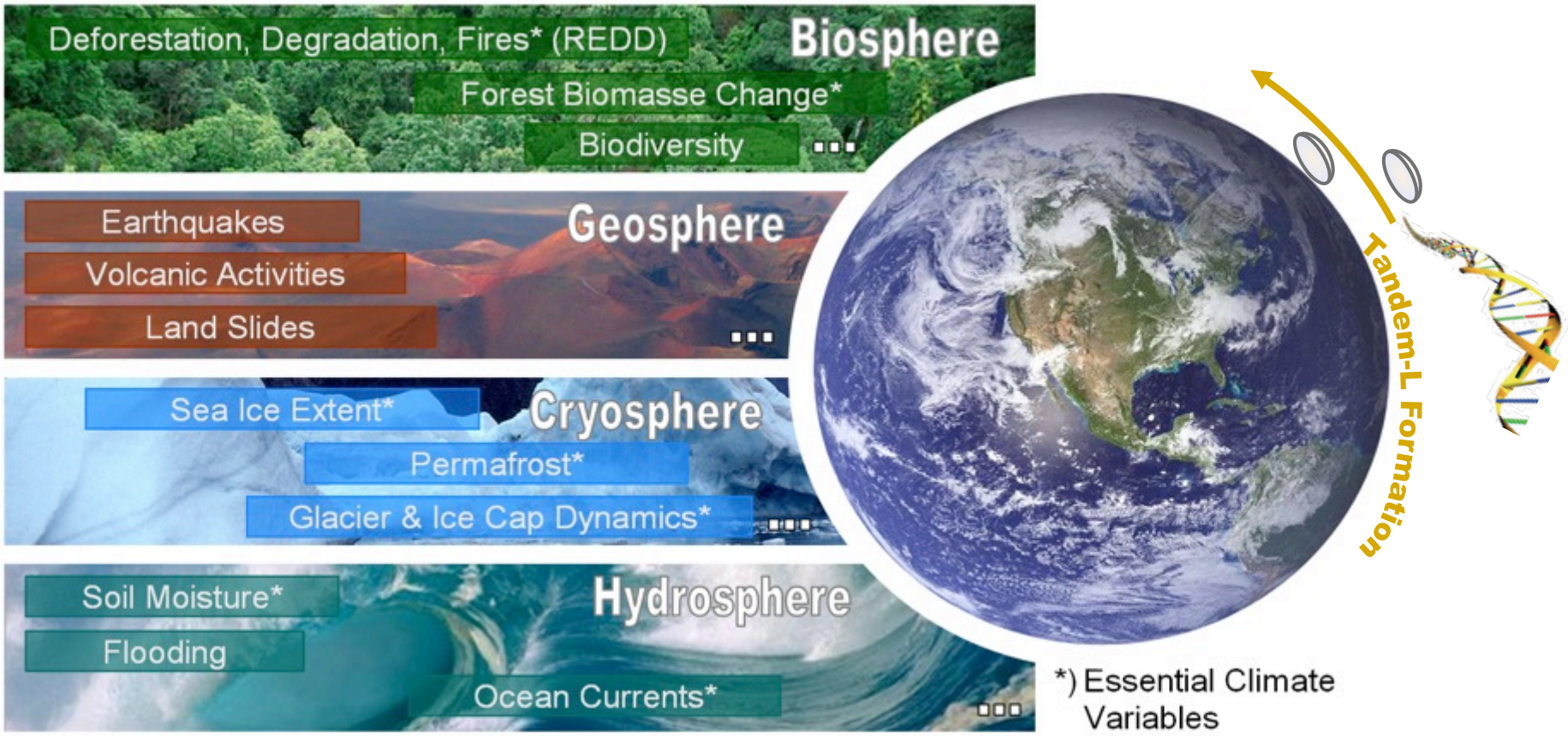
Satellites - Monitoring the Earth Today




DLR Satellites - Monitoring the Earth Tomorrow
Tandem-L
HELMHOLTZ
GEMEINSCHAFT
DLR
JAXA

Tandem-L mission objectives



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Future needs

- Visualization of climate trends and complex data
- Global standardized sustainable monitoring
- Supervision of climate protection agreements
- Response to trends
- Services for society and decision-makers

Future challenges

- Continuity of earth observation systems
  - Long-term measurements
  - Cross-calibration of new sensors
- Standardization of algorithms
- Archives covering a long-term time period
- Fast and standardized access to data

What are the known limitations of Earth observation?

- Building, launching and operating satellites is still too expensive.
- Satellites have a relatively short life-time.
- There is a lack of launch opportunities.
- Elapsed time from demand to launch and operation of satellites is long

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

Some of the issues and challenges from a provider's point of view:

- In the pioneering age over the past 30 years scientist have demonstrated that atmospheric and relevant surface phenomena are well measured from space, and especially trends can be well measured (very successful and very reliable)!

- The next planning cycle to create follow-ons to EUMESAT ESA Met-Op Second Generation and Meteosat Third Generation will begin in the 2020s for launch in the 2035 to 2040 time frame.

- Thus, it is time for a Paradigm Shift

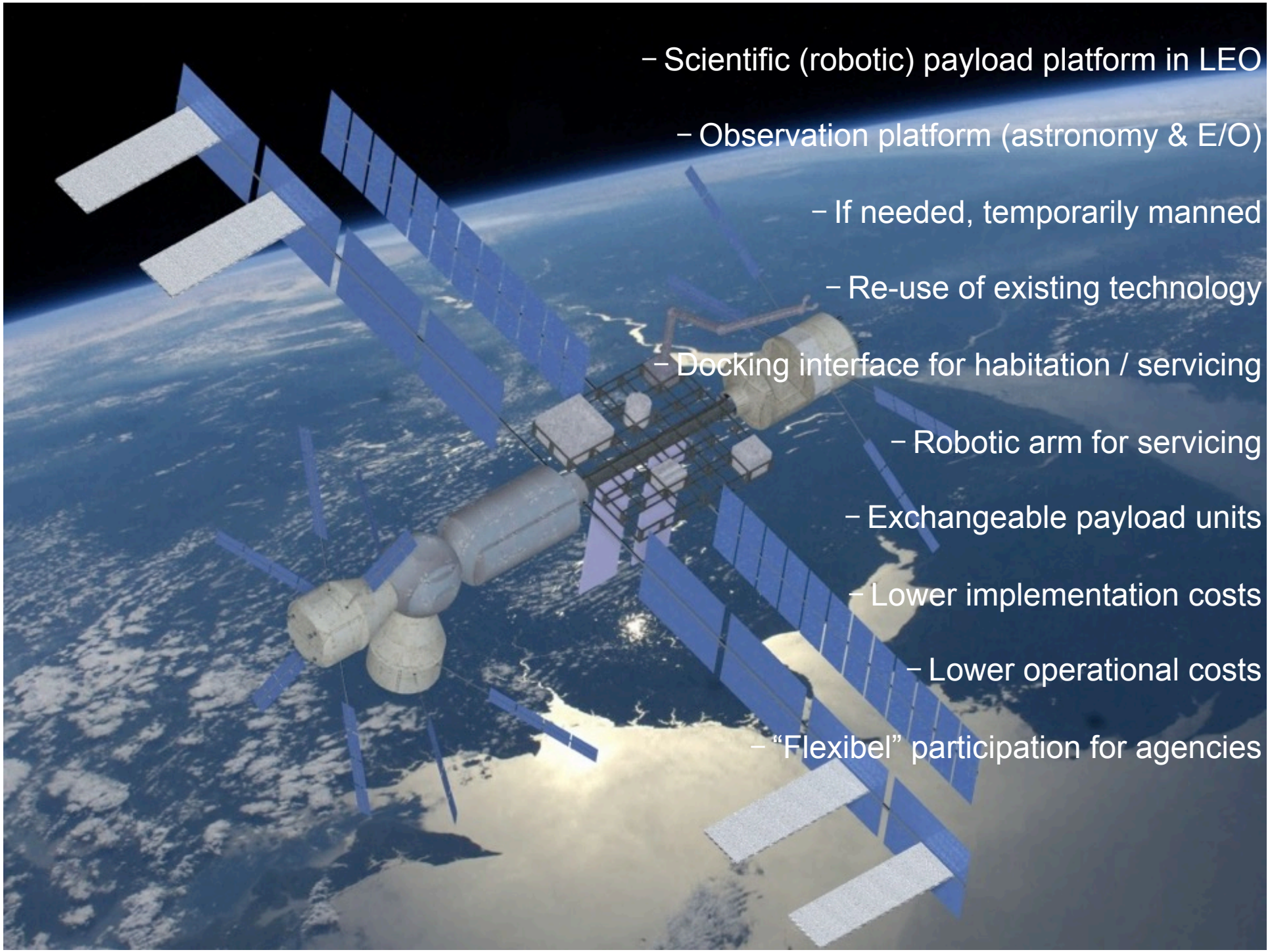
The International Space Station – a technological platform already in existence!

Advantages:

- 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

Practical advantages

- Coverage is good if you don't need to see the North or South Pole
- 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 as it has to get to the ISS
- Possibility of refurbishment on sub-decadal timescale


– Scientific (robotic) payload platform in LEO
– Observation platform (astronomy & E/O)
– If needed, temporarily manned
– Re-use of existing technology
– Docking interface for habitation / servicing
– Robotic arm for servicing
– Exchangeable payload units
– Lower implementation costs
– Lower operational costs
– “Flexibel” participation for agencies


docking option
to comply with
user requirements
Free-Flyer
approx. 20 tons
1 launch
(platform deployable)
Base Station
approx. 38.6 tons
3 launches
+ 2 launched crews


Free-Flyer
Base Station
flight
direction


Save the Date!!!
UNOOSA/DLR Climate Change Conferen
Challenges for Atmospheric Research
5 – 7 April 2016
Cologne, Germany
Save the Date!!!