



Space and Climate

Integrated Space Technology Applications for Climate Change

Graz, Austria

12 Sept 2016

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European Space Agency

www.esa.int

UN Sustainable Development Goals



SUSTAINABLE DEVELOPMENT
KNOWLEDGE PLATFORM



TRANSFORMING OUR
WORLD:
THE 2030 AGENDA FOR
SUSTAINABLE
DEVELOPMENT

1 NO
POVERTY



2 ZERO
HUNGER



3 GOOD HEALTH
AND WELL-BEING



4 QUALITY
EDUCATION



5 GENDER
EQUALITY



6 CLEAN WATER
AND SANITATION



7 AFFORDABLE AND
CLEAN ENERGY



8 DECENT WORK AND
ECONOMIC GROWTH



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



10 REDUCED
INEQUALITIES



11 SUSTAINABLE CITIES
AND COMMUNITIES



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



13 CLIMATE
ACTION



14 LIFE
BELOW WATER



15 LIFE
ON LAND



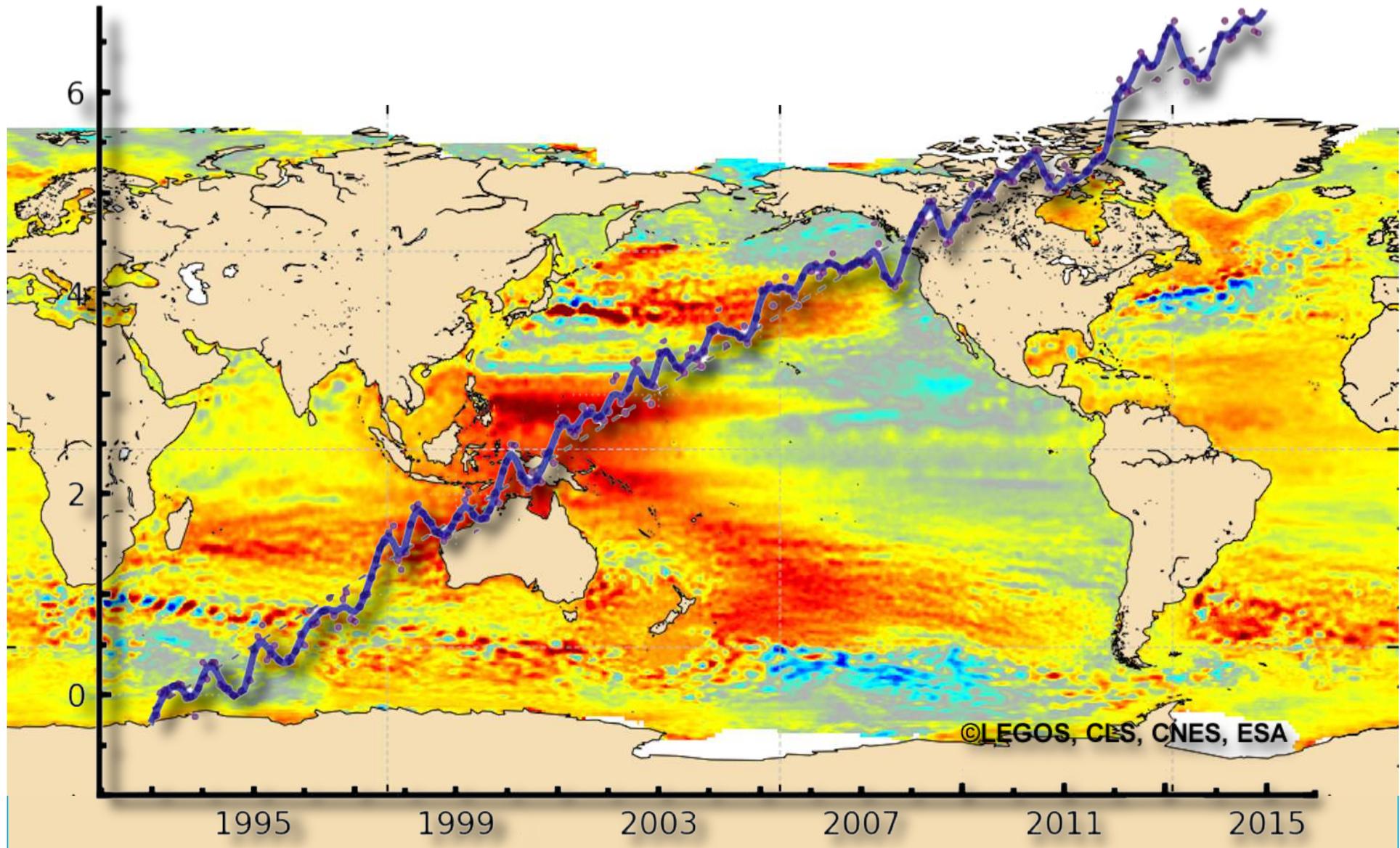
16 PEACE, JUSTICE
AND STRONG
INSTITUTIONS



17 PARTNERSHIPS
FOR THE GOALS



Facts from Space



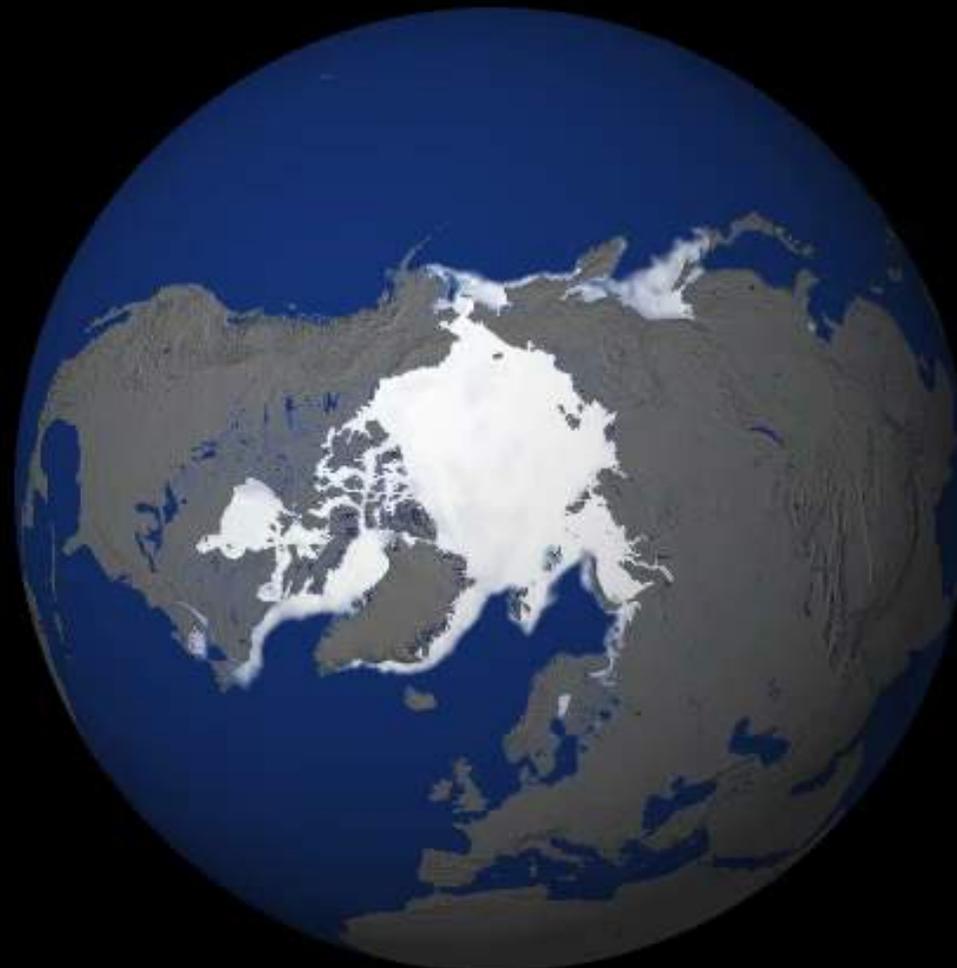
Arctic sea ice cover 1972 - 2014



cci  Sea Ice



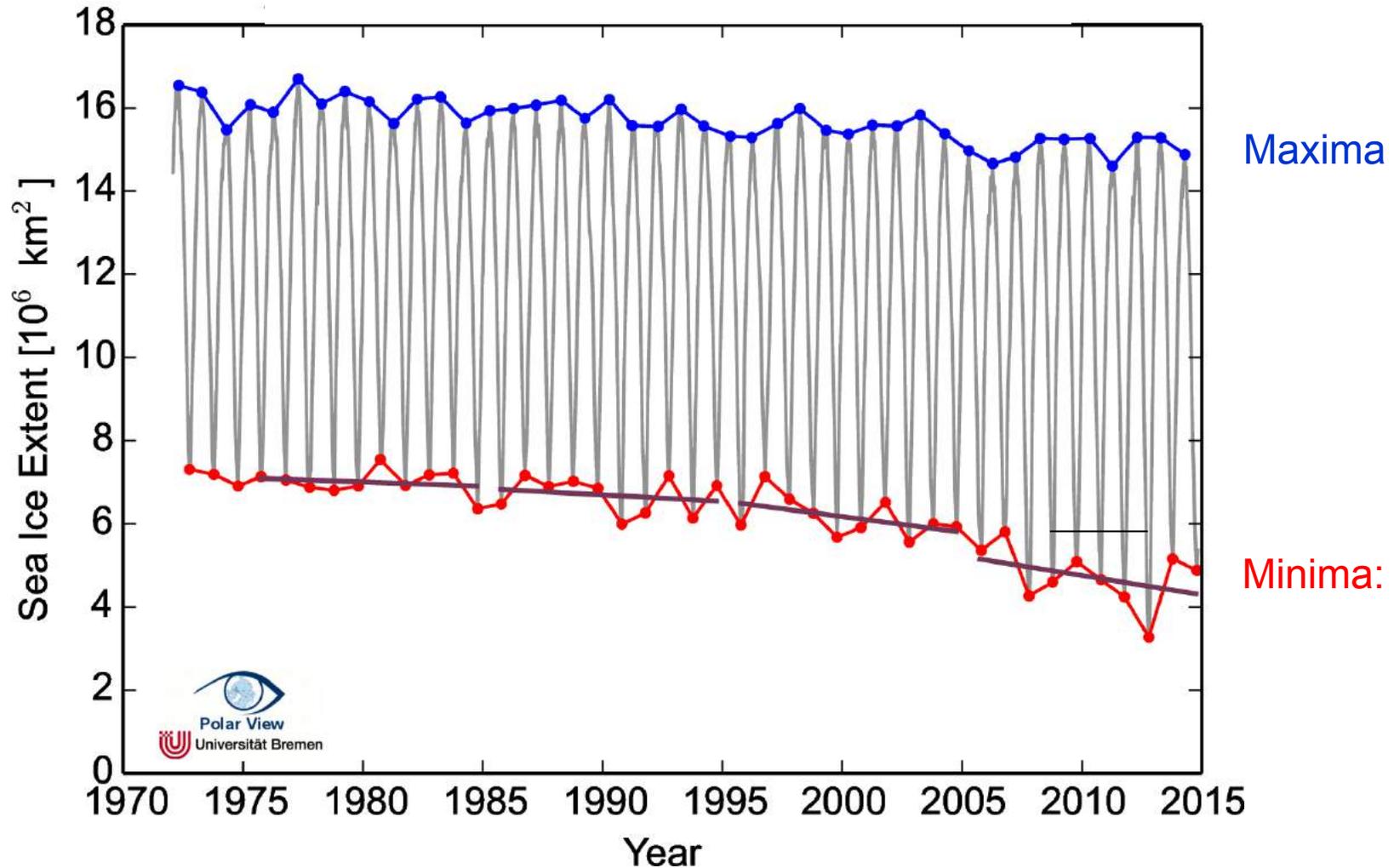
Sea Ice Concentration



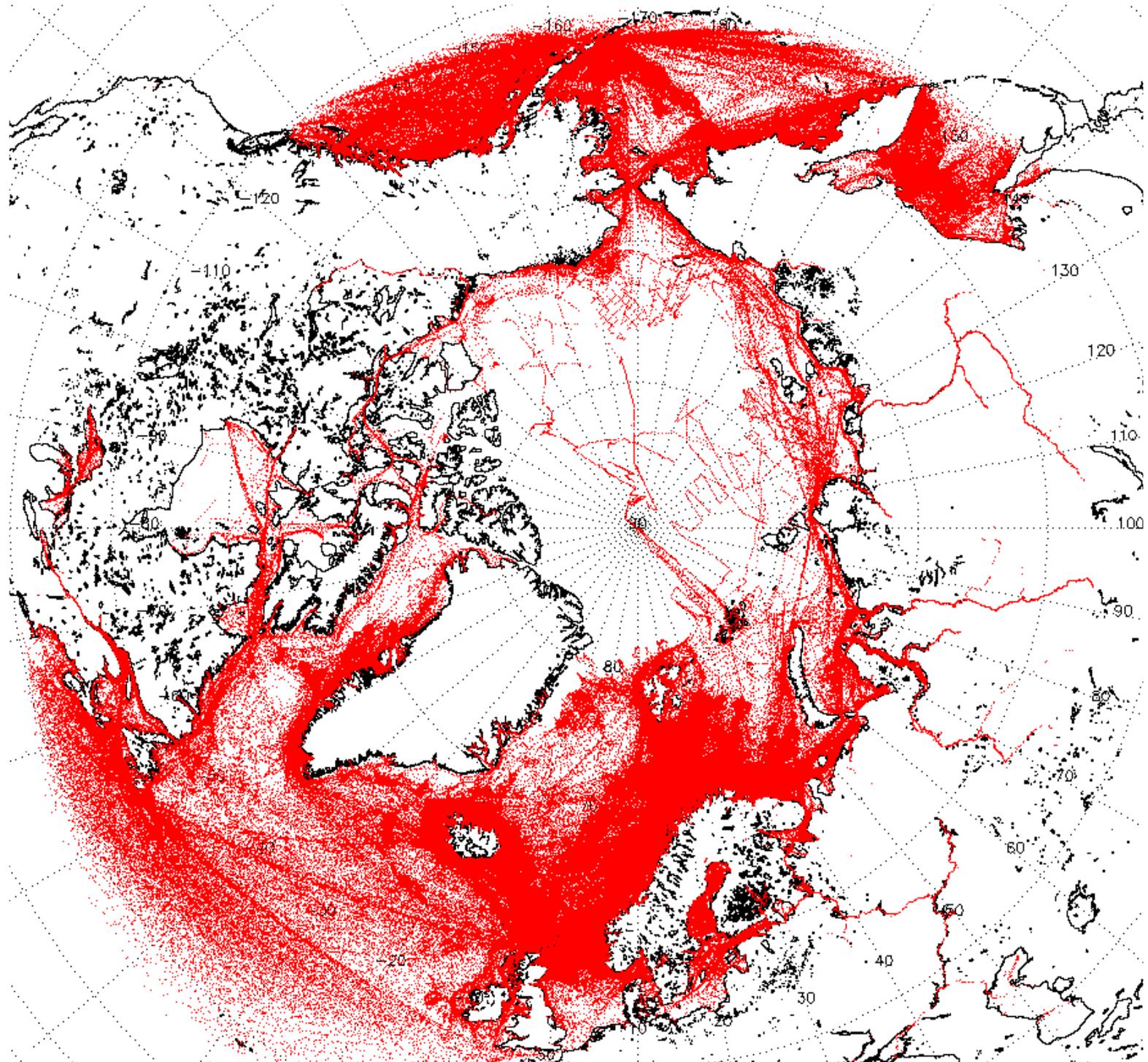
2000-02-18

1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008

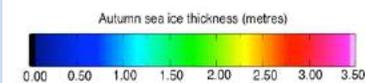
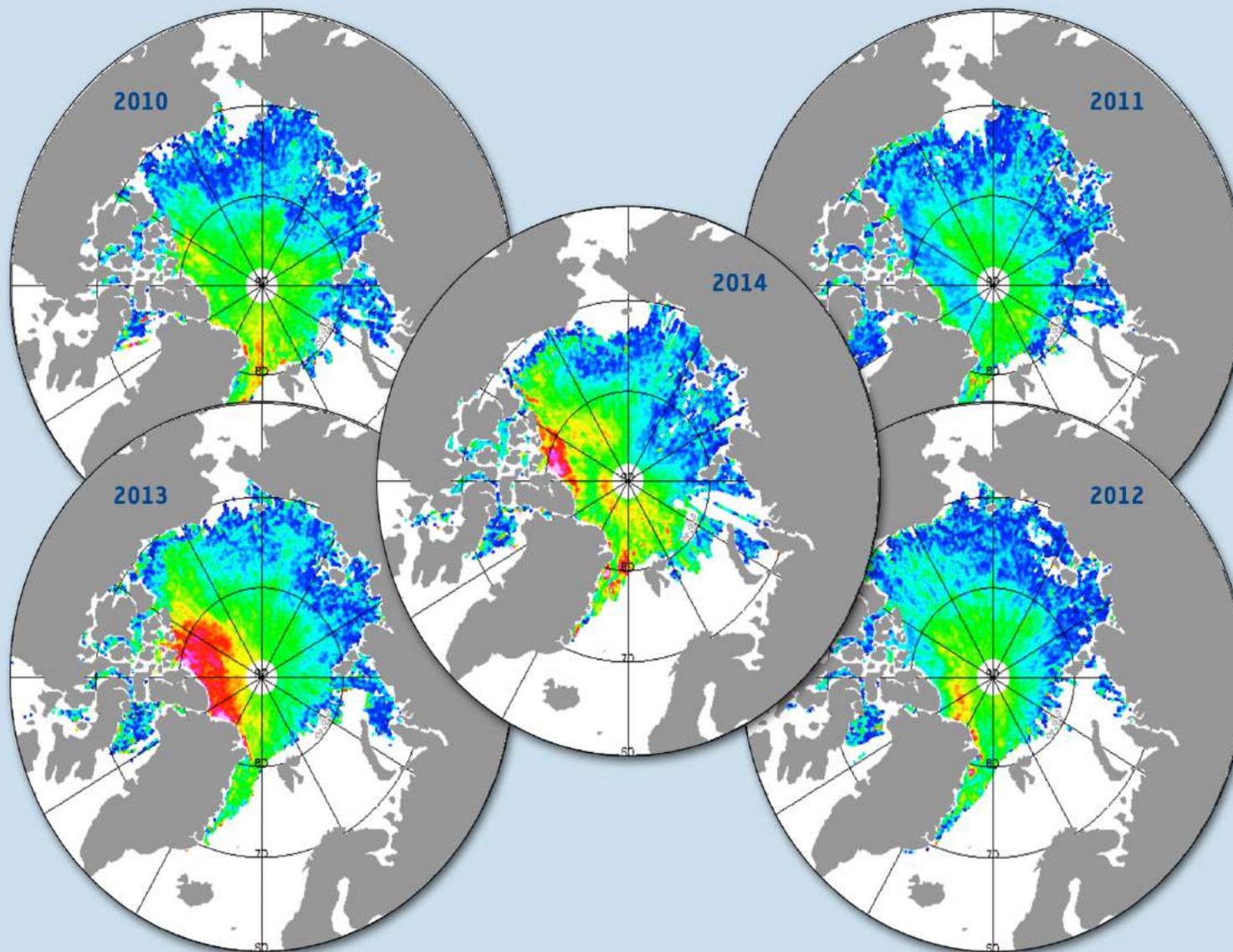
Declining Arctic sea ice extent 1972 - 2015







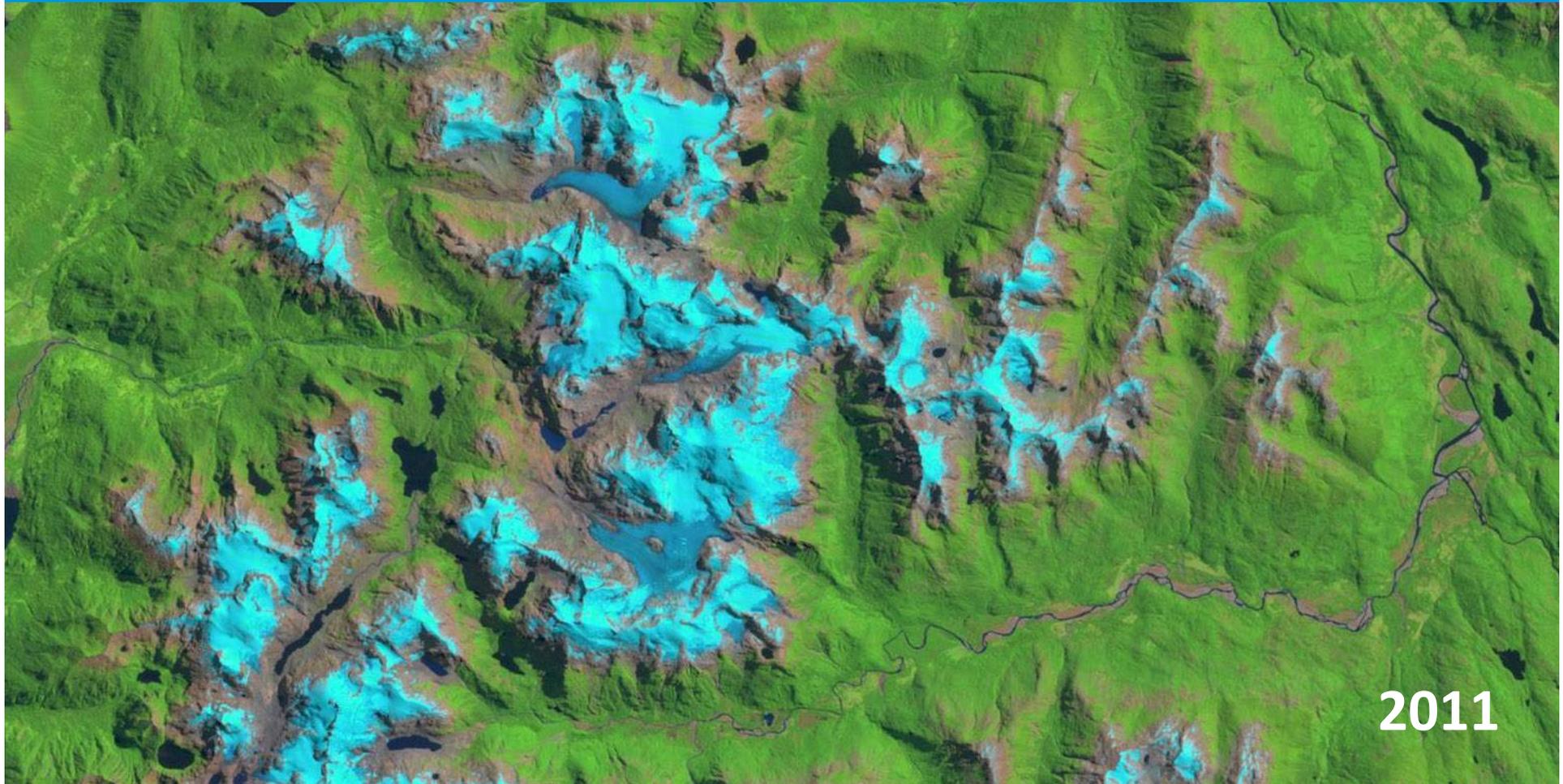
Cryosat: Arctic Sea Ice Volume



European Space Agency

Nature Geoscience

Retreating glaciers



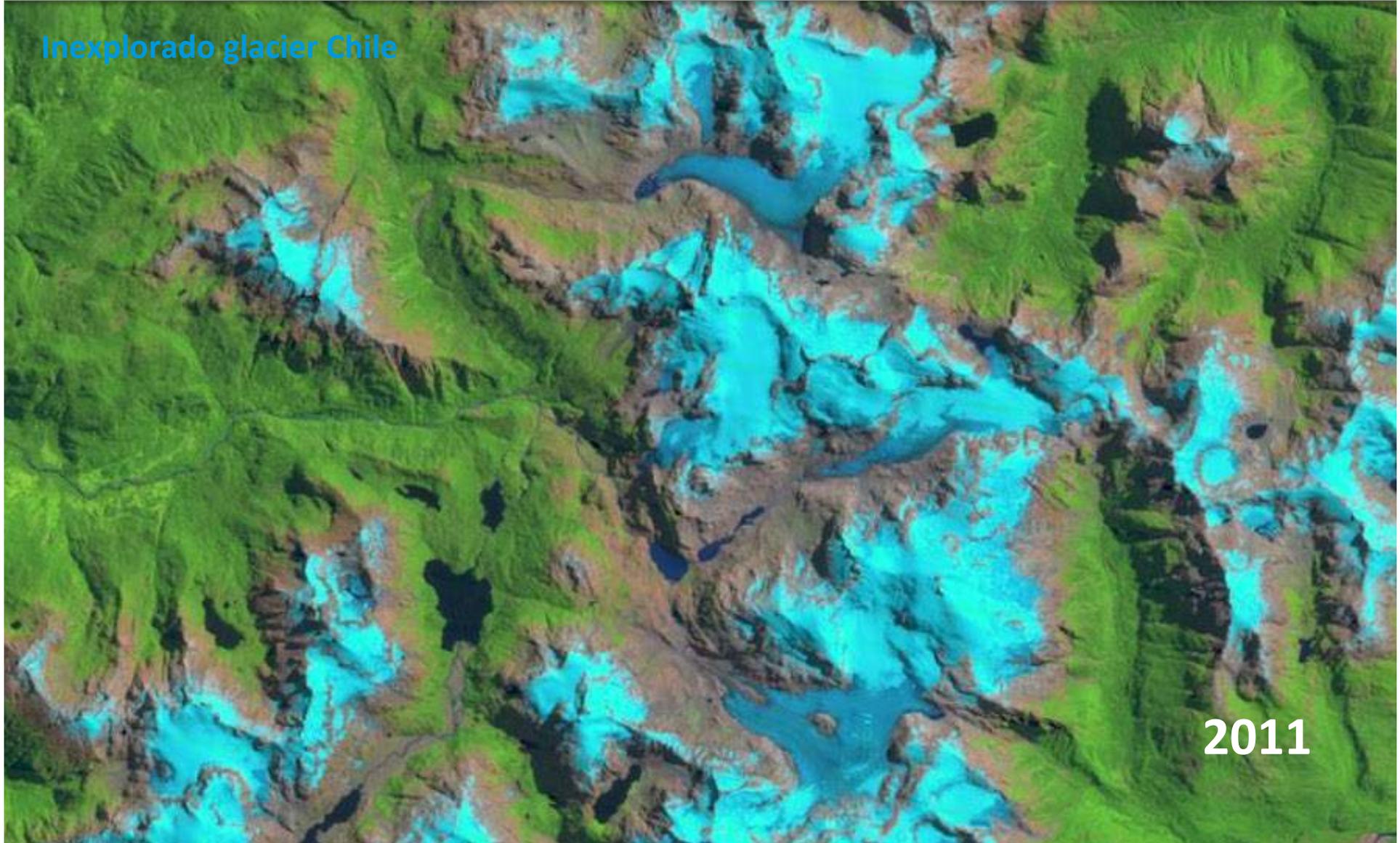
2011

Inexplorado glacier Chile

Retreating glaciers

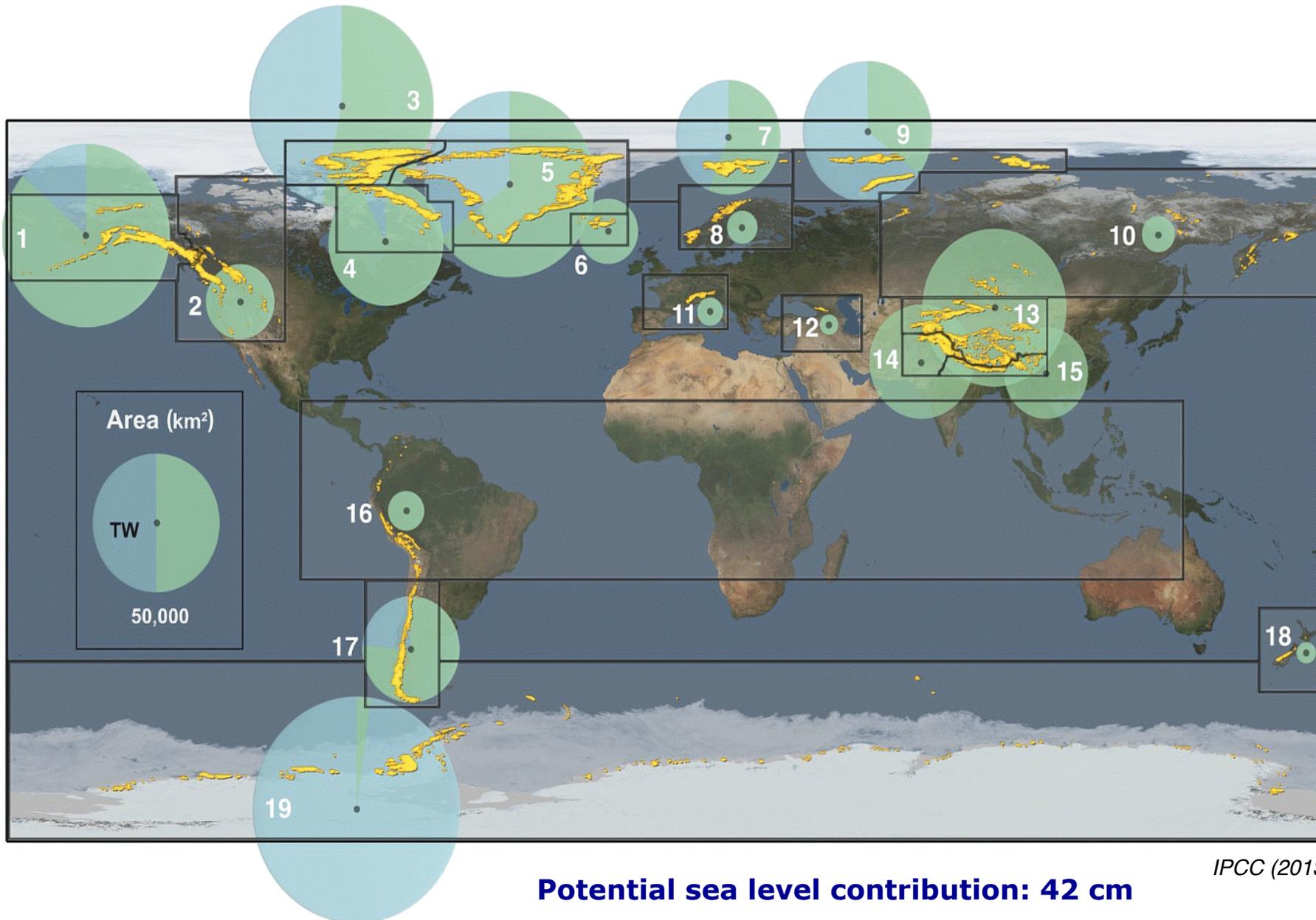


Inexplorado glacier Chile

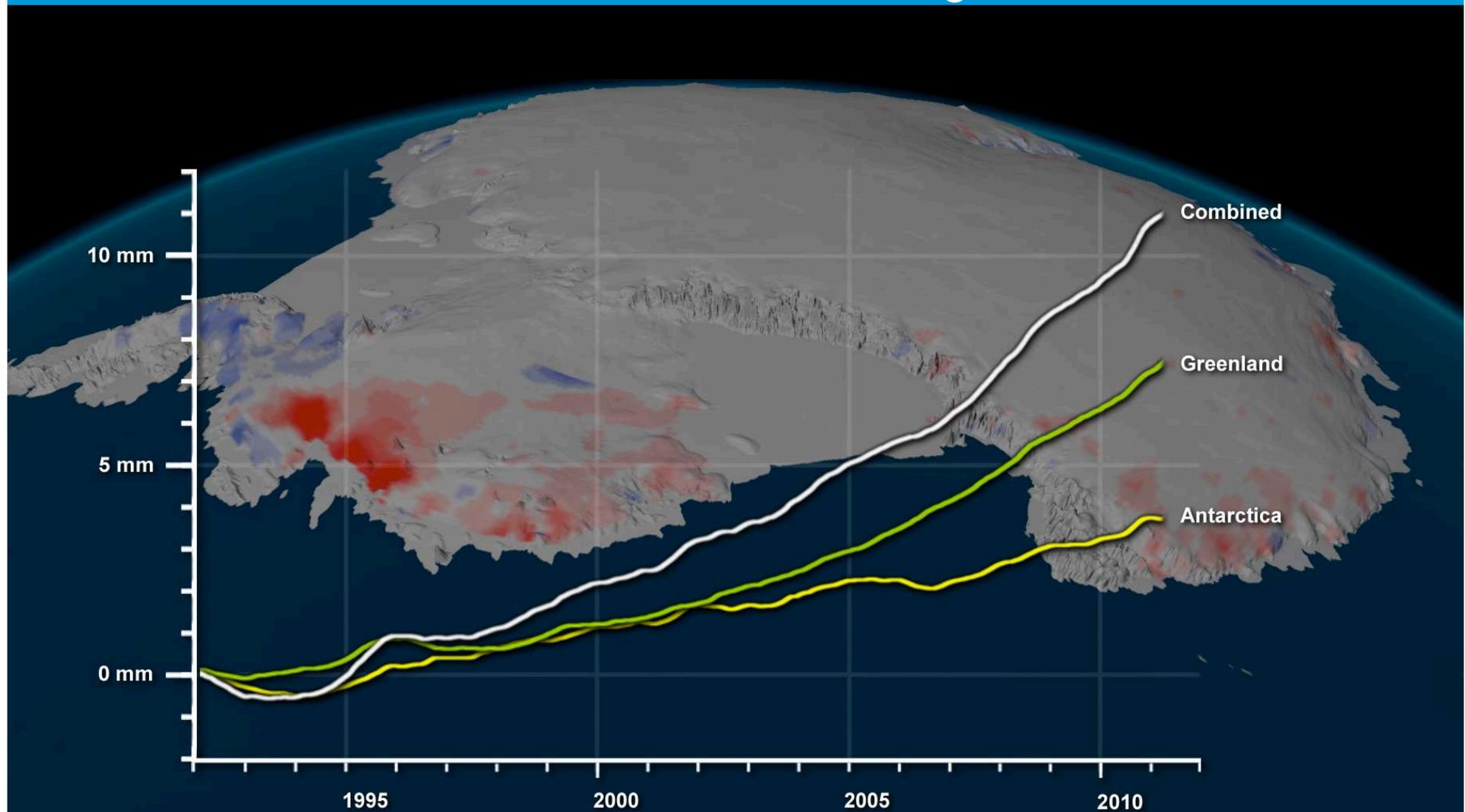


2011

Randolph Glacier Inventory

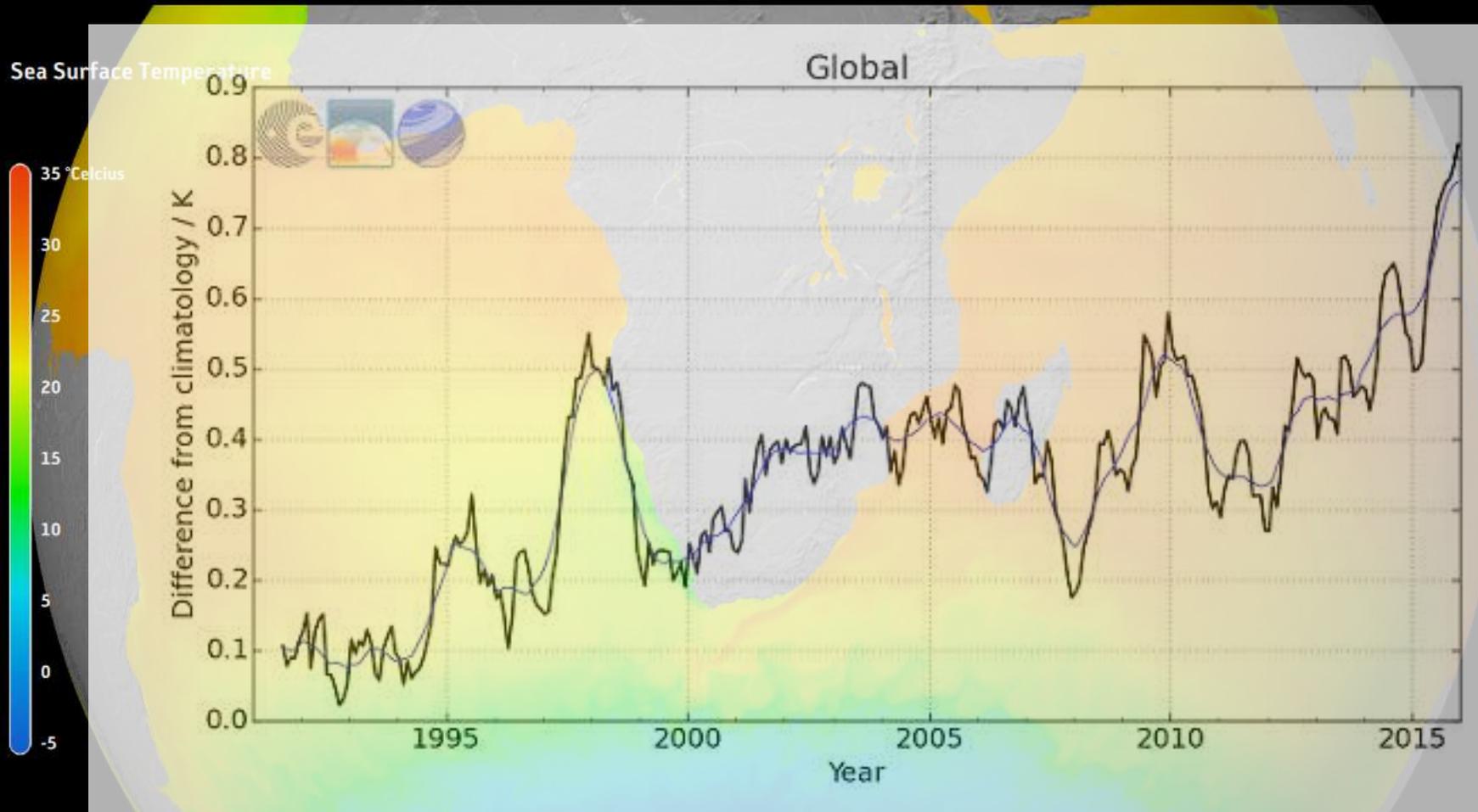


Ice sheet mass losses contribution to sea level change



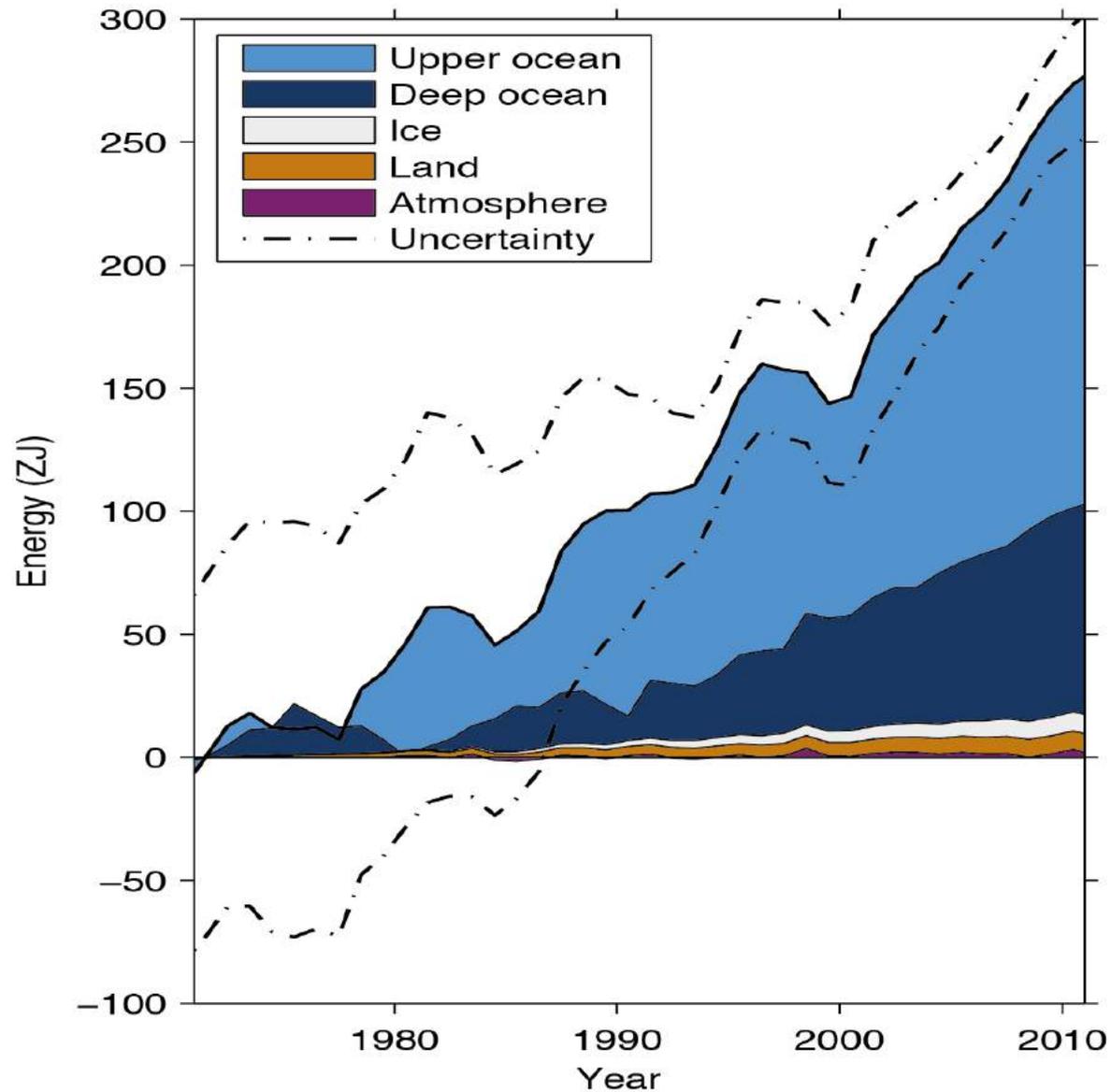
ESA / NASA / Planetary Visions

Global sea surface temperature trends

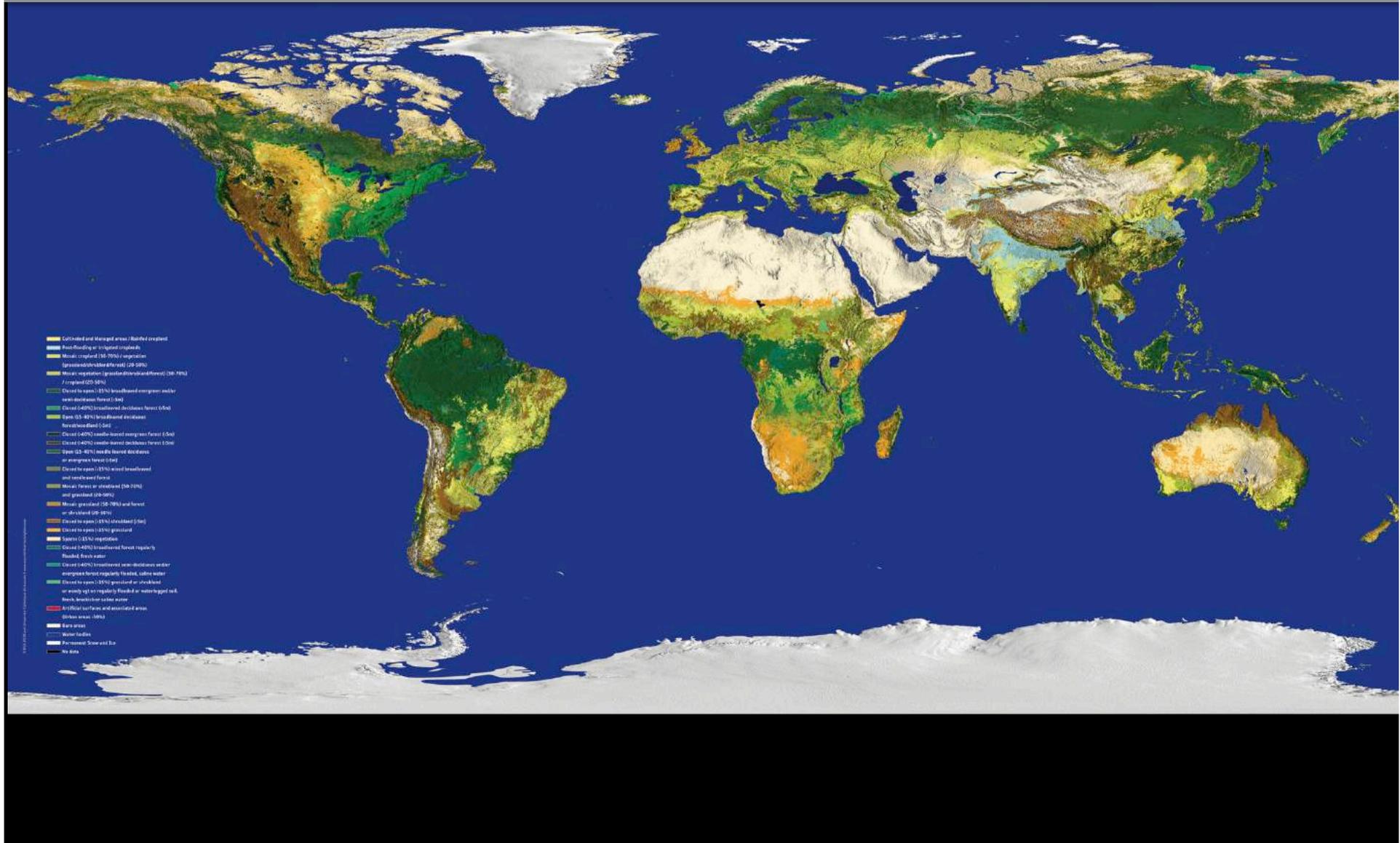


2008-01-29

Ocean Heat Content (IPCC AR5 2013) (from in-situ measurements)

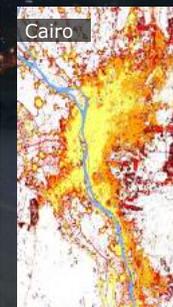
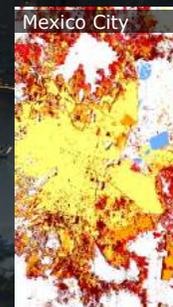
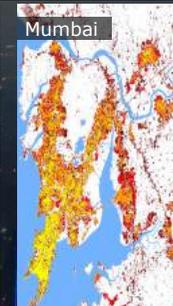
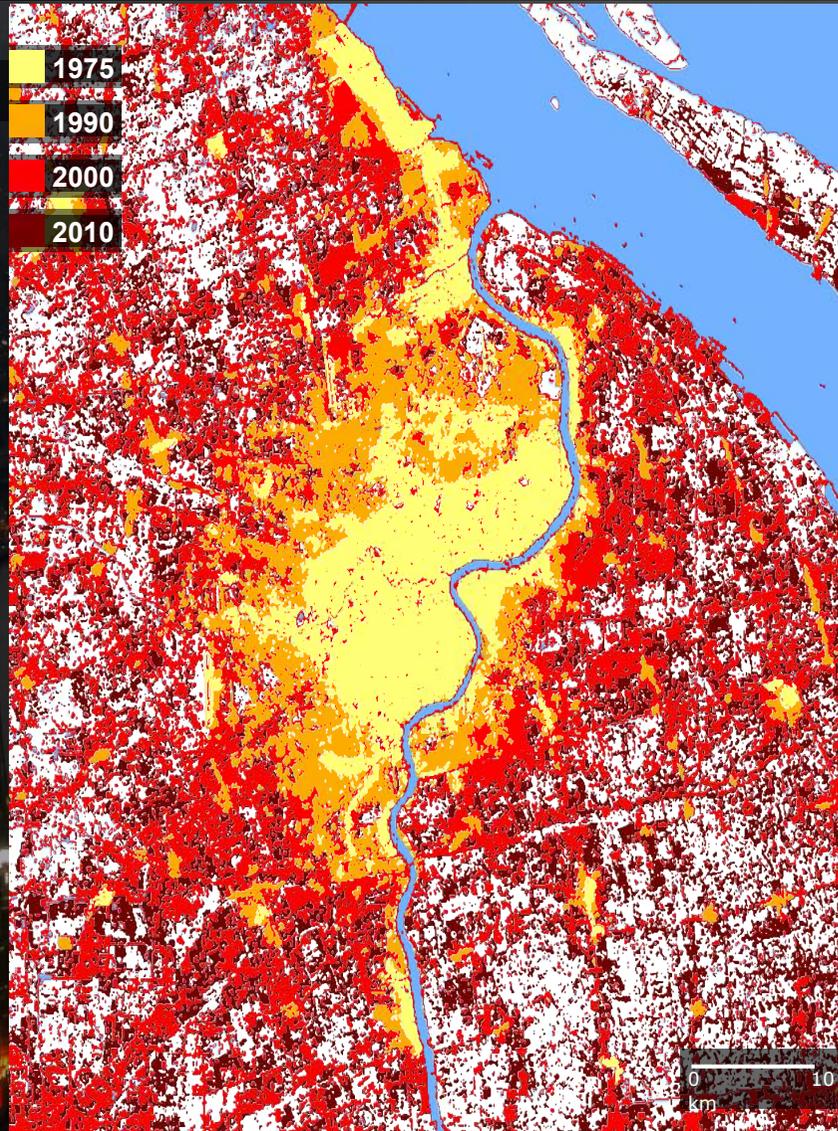


Global land cover

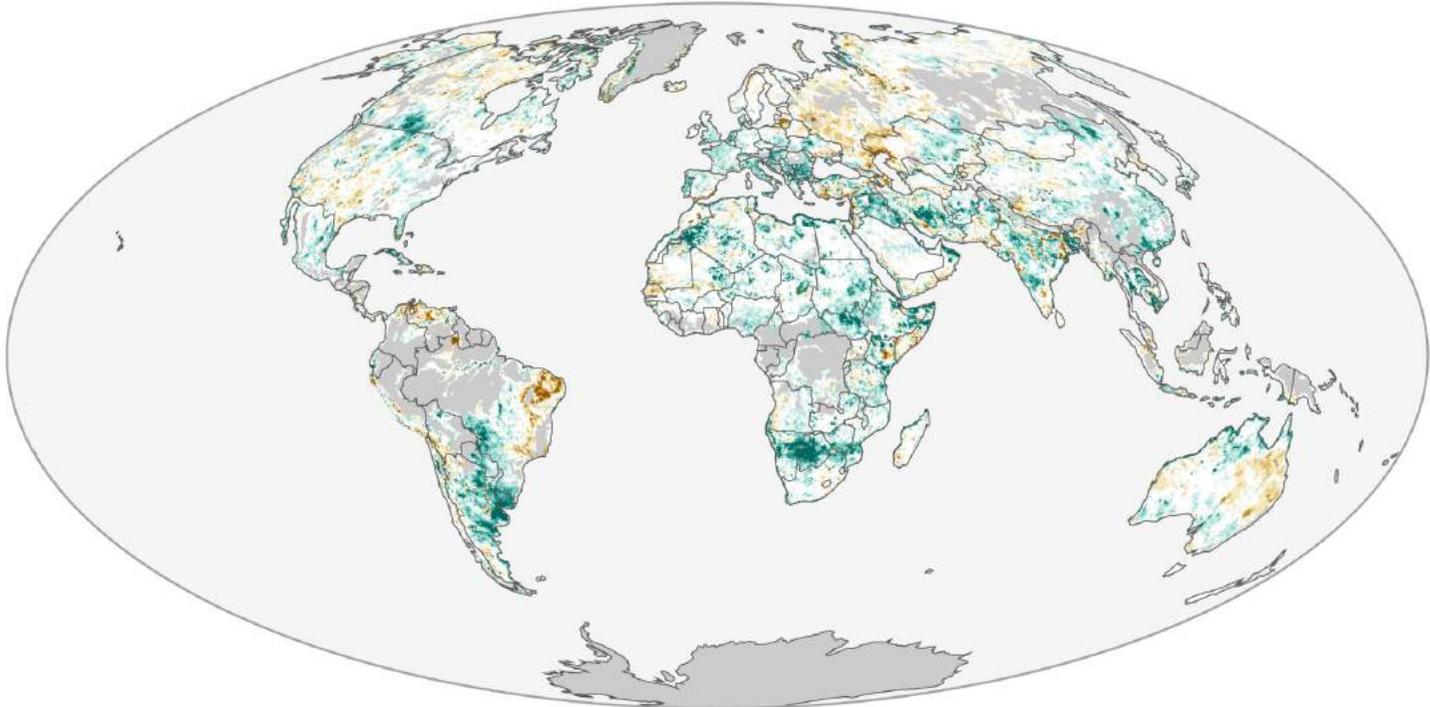


Urban development

Shanghai



Global Soil Moisture

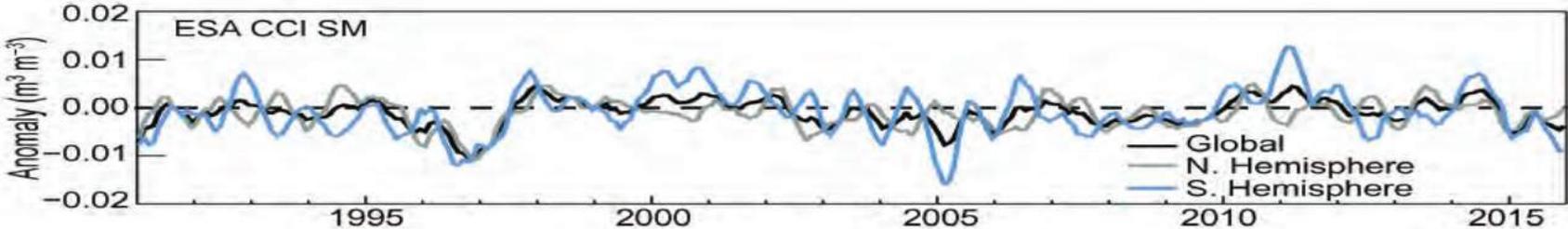
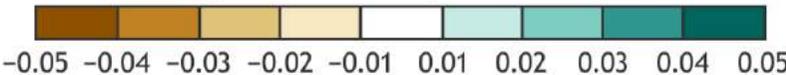


2014 anomalies



NOAA Climate.gov

Difference from average soil moisture (meters³ of water per meters³ of soil)



trends
ency

ipcc
INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2013

The Physical Science Basis

WG I

WORKING GROUP I CONTRIBUTION TO THE
FIFTH ASSESSMENT REPORT OF THE
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE





The Paris Agreement

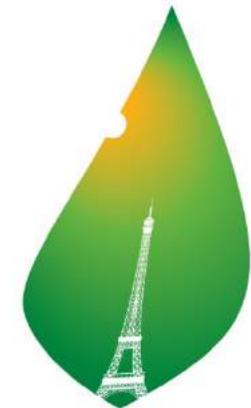


Bridges today's policies and climate-neutrality before end 2000s

- *Enters into force 2020*
- *194 countries + EU*

Agreement:

- **Climate Mitigation**
- **Climate Adaptation**
- **Transparency, Global Stocktake**
- **Loss and Damage**
- **Support**



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Space brings key contributions for all issues

Mitigation



Paris Agreement

- A long-term goal of keeping the increase in global average temperature to **well below 2°C** above pre-industrial levels and aim to **limit the increase to 1.5°C**
- Global **emissions should peak as soon as possible**, recognising that this will take longer for developing countries
- Undertake rapid reductions thereafter in accordance with the **best available science**

Space:

- Support mitigation measures with **timely, traceable, consistent data, information, tools and knowledge:**
 - **REDD+**
 - **Land use change**

Adaptation



Paris Agreement

- Strengthen society's ability to deal with the **impacts of climate change**
- Each country *shall* formulate and implement **national adaptation plans** (assessing climate impacts and vulnerability, aiming to build resilience of socioeconomic and ecological systems). To be updated periodically.
- Provide continued and enhanced **international support to developing countries** for adaptation

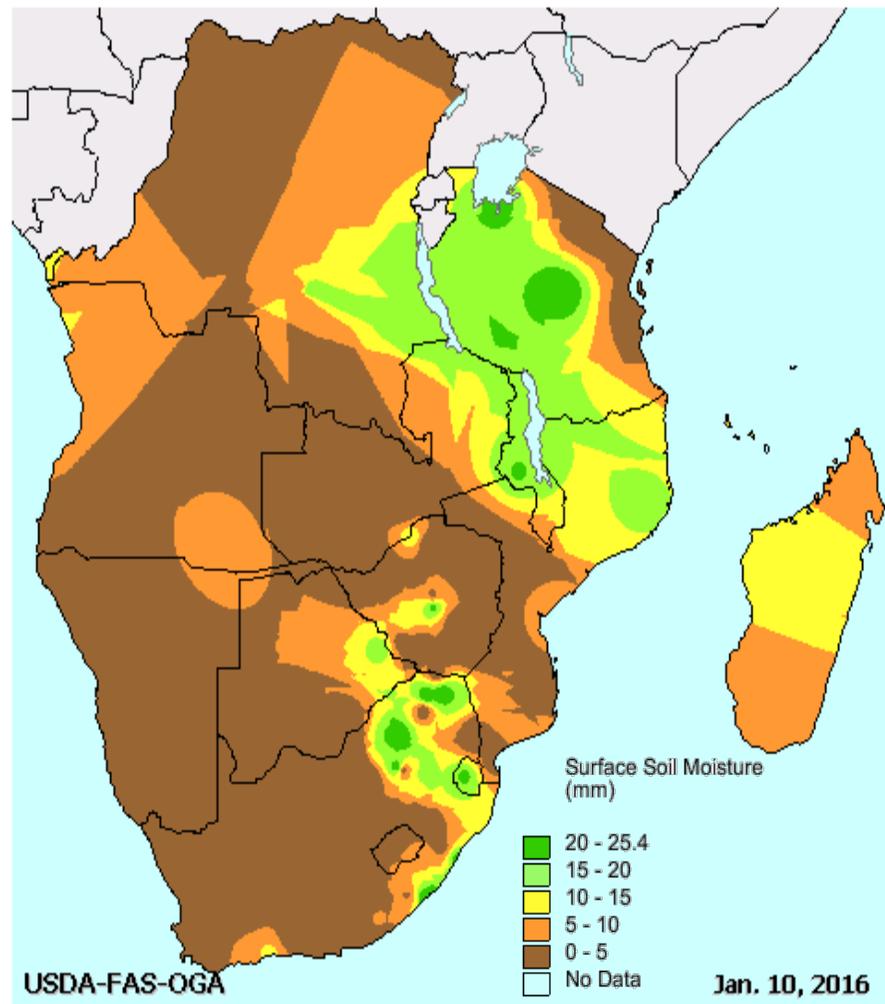
Space;

- **Support adaptation measures** by providing geo-spatial data locally
- Guide future policy by providing data on **effectiveness of implementations of adaptation** measures –political benefit
- Support indicators and targets of **Sustainable Development Goals** related to climate change (many of them)

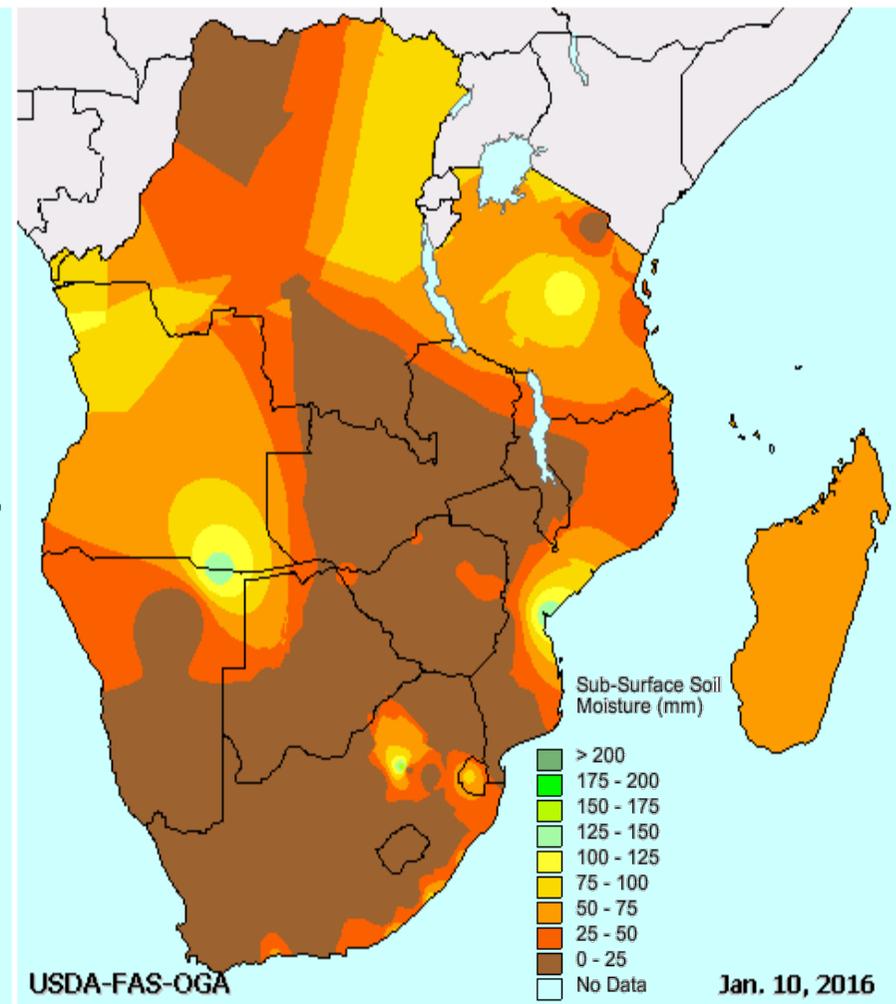
Improved Soil Moisture for crop yield predication



WMO soil moisture data during 2015/16 ElNino drought in Southern Africa (Jan. 1 to Jan. 10, 2016)



WMO Surface Soil Moisture

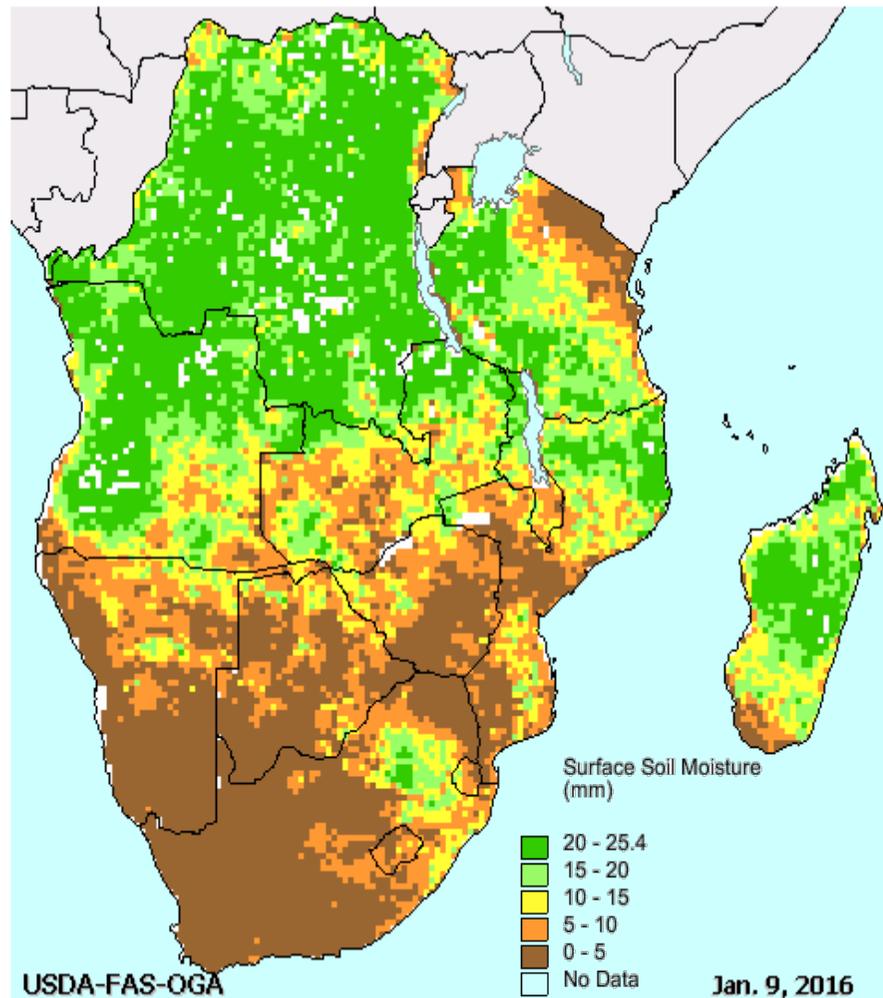


WMO Subsurface Soil Moisture

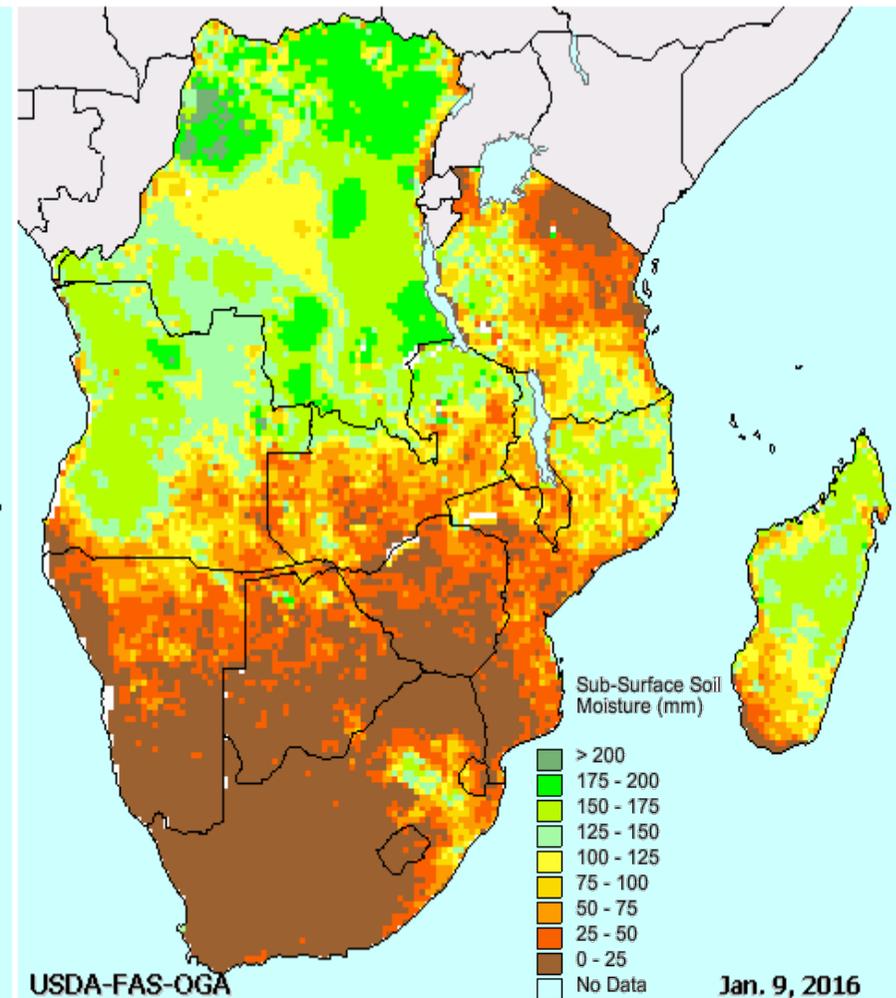
Improved Soil Moisture for crop yield predication



SMOS soil moisture data used to detect drought and improve crop yield prediction during 2015/16 ElNino drought in Southern Africa.

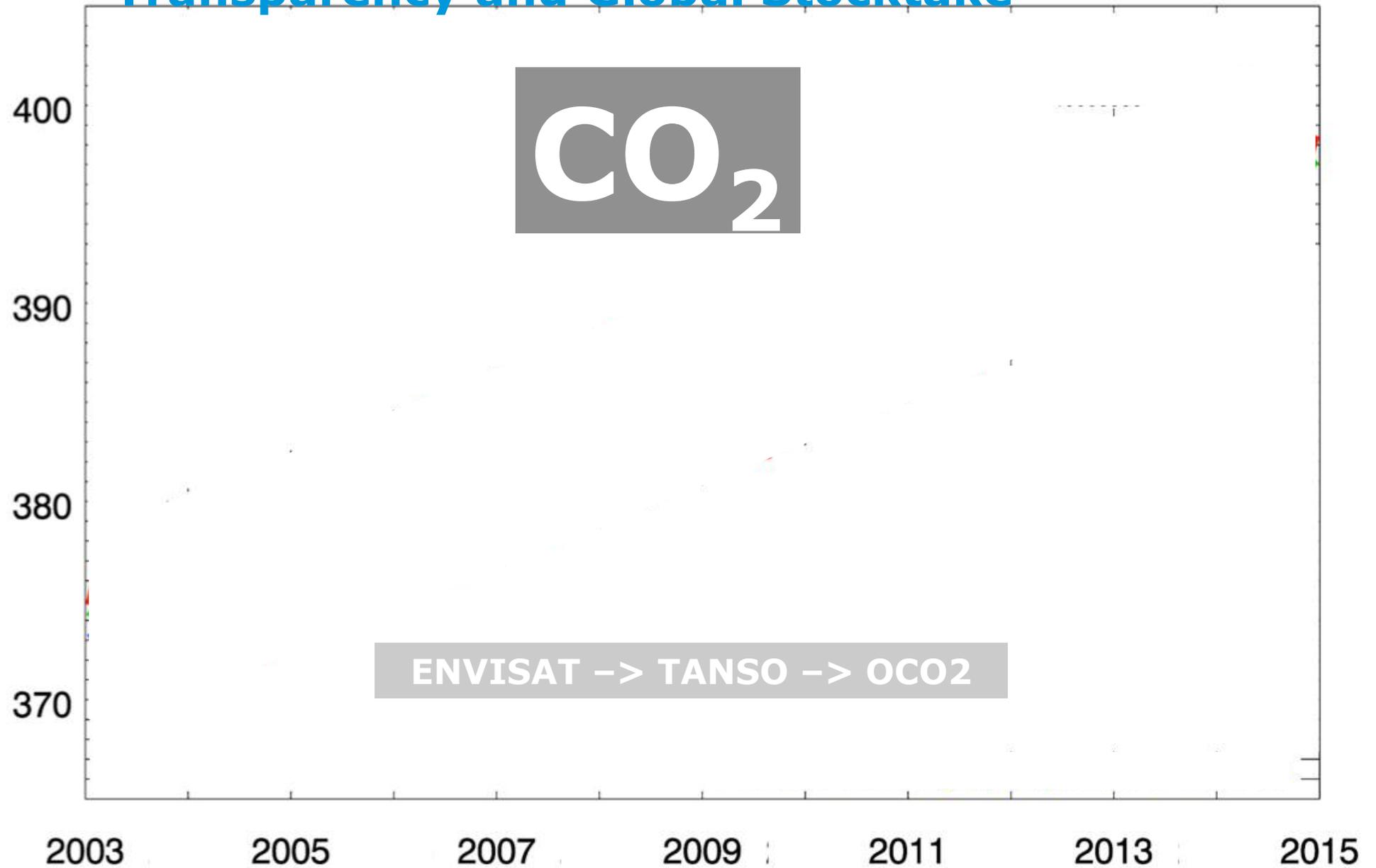


SMOS Surface Soil Moisture



SMOS Subsurface Soil Moisture

Transparency and Global Stocktake



Transparency and Global Stocktake



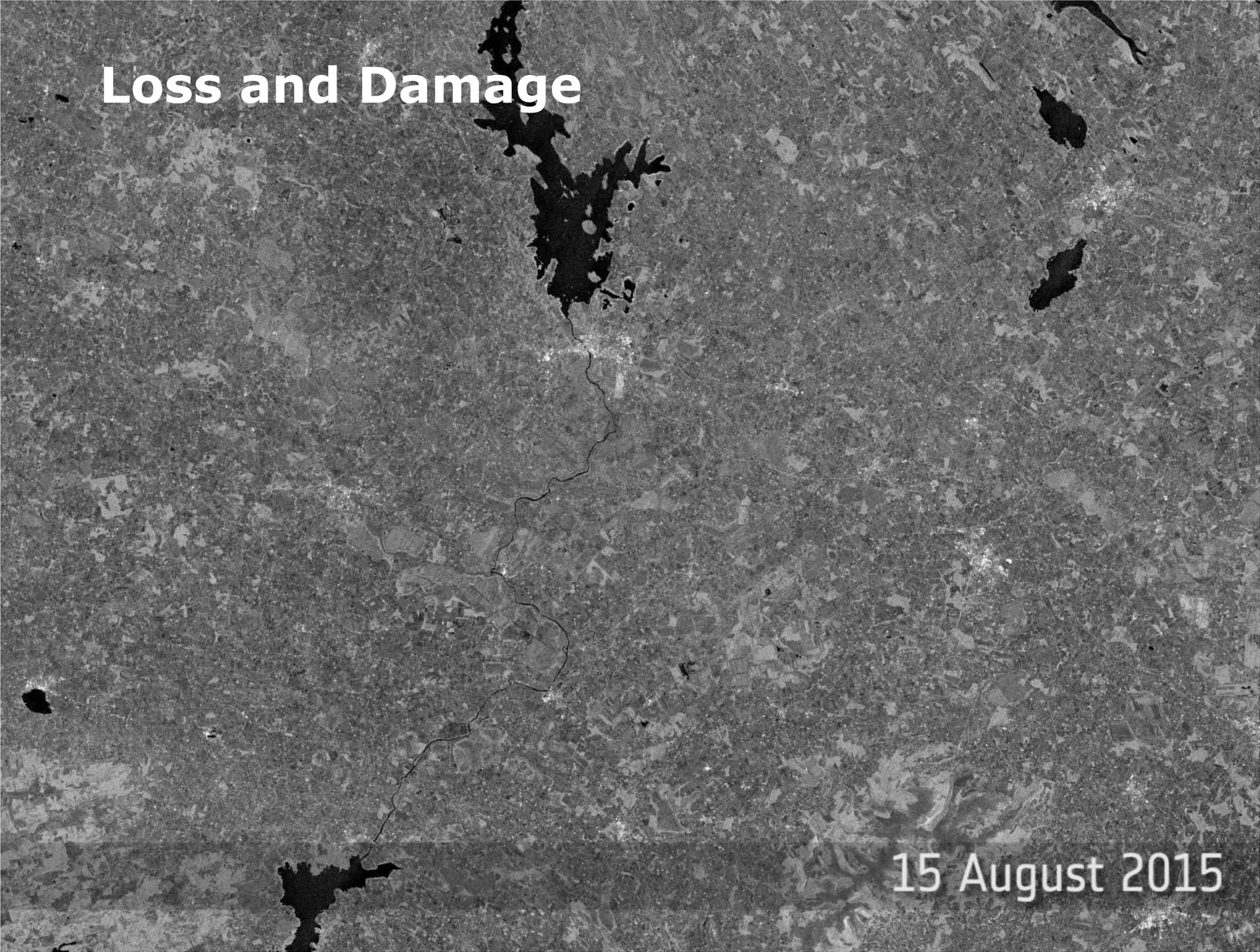
Paris Agreement

- Come together every 5 years to set more ambitious targets as informed by science; **first stocktake 2023, thereafter 5 yearly**
- **Report to each other and the public** on how well they are doing to implement their targets
- Track progress towards the long-term goal through a **robust transparency and accountability** system.

Space:

- Support development of **stocktaking methods**
- Support parties reporting on **Nationally Determined Contributions** (NDCs)
- provision of **anthropogenic emissions data** and methods
- **>>Global Carbon Emissions monitoring system<<**: CO₂, land use change
- **integrated data & models**: field; satellite; transport; chemistry; assimilation
- Contribute to **informing the public**

Loss and Damage

An aerial photograph showing a coastal area with significant flooding. A large, dark, irregularly shaped area of water is visible in the upper left and center, extending towards the right. The surrounding land is a mix of light and dark gray tones, indicating varying levels of damage and debris. The overall scene depicts a major disaster, likely a storm surge or hurricane impact.

15 August 2015

Paris Agreement

- Recognise the importance of **averting, minimising and addressing loss and damage** associated with the adverse effects of climate change
- Acknowledge the need to cooperate and enhance the understanding, action and support in different areas such as **early warning systems, emergency preparedness and risk insurance.**

Space:

- Support “loss and damage” via timely **information for early warning systems**
- Continue to provide data to support **disaster risk reduction, management and recovery**
- Engage with **Business Sectors**

06 January 2016

Extreme Events

Support to relief and reconstruction



Mariana Islands Flood Areas - TerraSAR-X Scene Data Capture and Flood Analysis: 16 May 2015

Charter Call: 532



Legend

- Flooded Areas
- TerraSAR-X Scene Extent

Interpretation

This map shows floods near the western portion of Mariana Island region.

Cartographic Information

0 0.5 1 Kilometers
0 0.5 1 Miles

Projection and 50,000-meter grid: UTM Zone 58N, Datum WGS 84
Latitude and Longitude: UTM, Datum WGS 84

Data Sources

TerraSAR-X © 2015 DLR

Disclaimer

Products generated for this Rapid Mapping Activity are developed with a very short time frame to the best of our ability, without available resources. All geographic information has limitations due to the scale, resolution, date and interpretation of original data source materials. No liability concerning the content or use thereof is assumed by the producer of this product.

Credits

TerraSAR-X/TanDEM-X © 2012 German Aerospace Center (DLR), 2012 Airbus Services / Infoterra GmbH

Map produced on 21 May 2015 by the Center for Geographic Information Science and Technology (CGIST), Department of Information Science and Technology, Ho Chi Minh Institute of Technology as part of the International Center on Storm and Major Disasters.



Paris Agreement

- The EU and other developed countries will continue to **support climate action** to reduce emissions and build **resilience to climate change impacts in developing countries**
- Other countries are encouraged to provide or continue to provide such support voluntarily

Space

- Further support **climate change research** by enhanced data provision
- Sustain **long-term continuity** of observations (decades)
- Extend **coordinated response** to GCOS (WG Climate)
- Support research for **IPCC 6th Assessment** and Special Reports
- Underpin development of **climate services**

Cumulative Volume Loss

3000 cubic km

1000

-1000

2010

2011

2012

2013

2014

2015

2 metres

6

12



Space and Climate

=> **An effective international framework**



UNFCCC

197 Parties

Subsidiary Body for Scientific and Technical Advice
'Systematic Observations'

GCOS

'Essential Climate Variables' requirements for UNFCCC

CEOS/CGMS

WG Climate: Coordinated Global Observations from
Space

WMO

World Climate Research Programme
Global Framework For Climate Services

GEO

Data Sharing Principles

ESA contribution => long term commitment

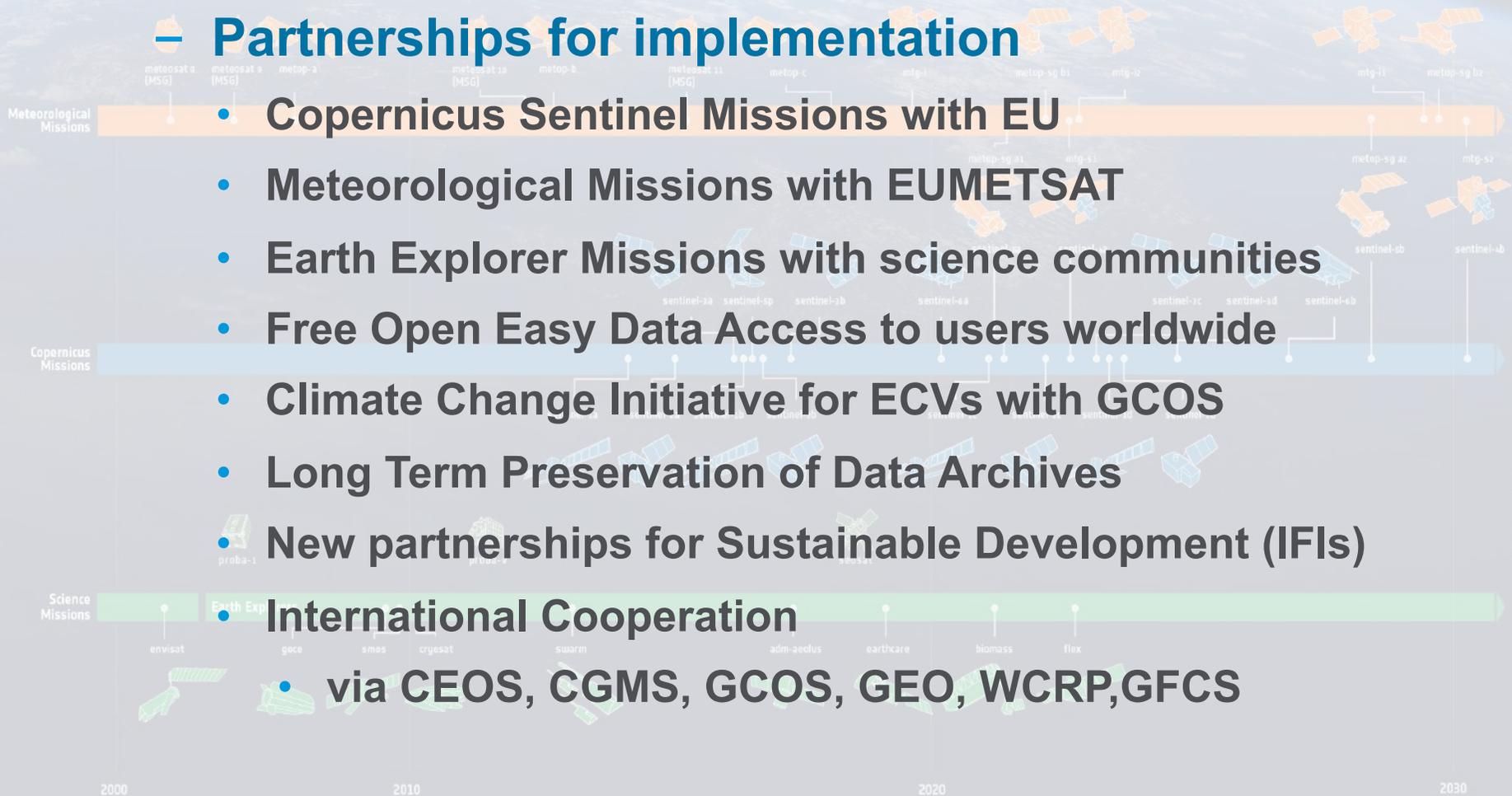


– Partnerships for implementation

- Copernicus Sentinel Missions with EU
- Meteorological Missions with EUMETSAT
- Earth Explorer Missions with science communities
- Free Open Easy Data Access to users worldwide
- Climate Change Initiative for ECVs with GCOS
- Long Term Preservation of Data Archives
- New partnerships for Sustainable Development (IFIs)

• International Cooperation

- via CEOS, CGMS, GCOS, GEO, WCRP, GFCS



UN Sustainable Development Goals



SUSTAINABLE DEVELOPMENT
KNOWLEDGE PLATFORM



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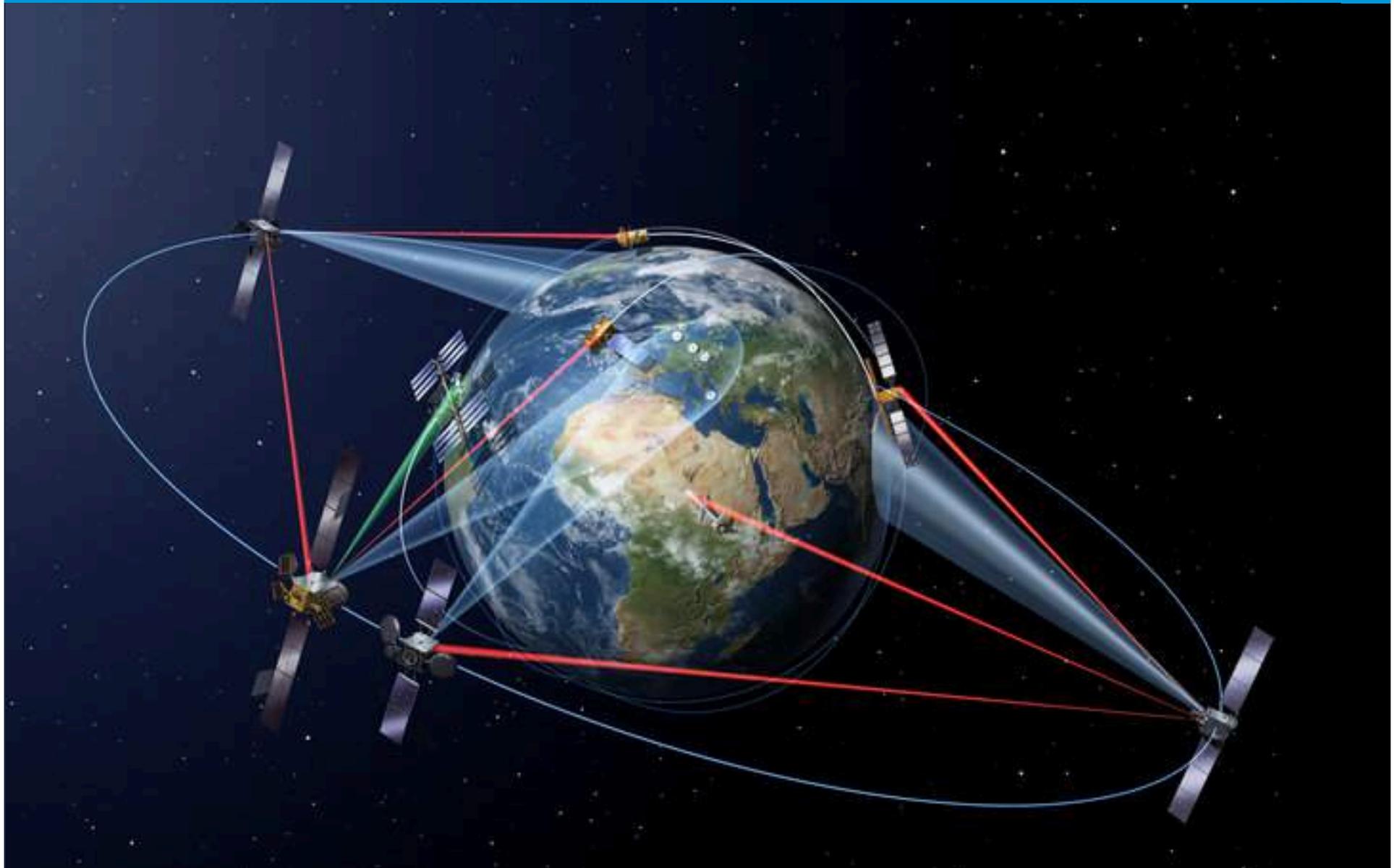
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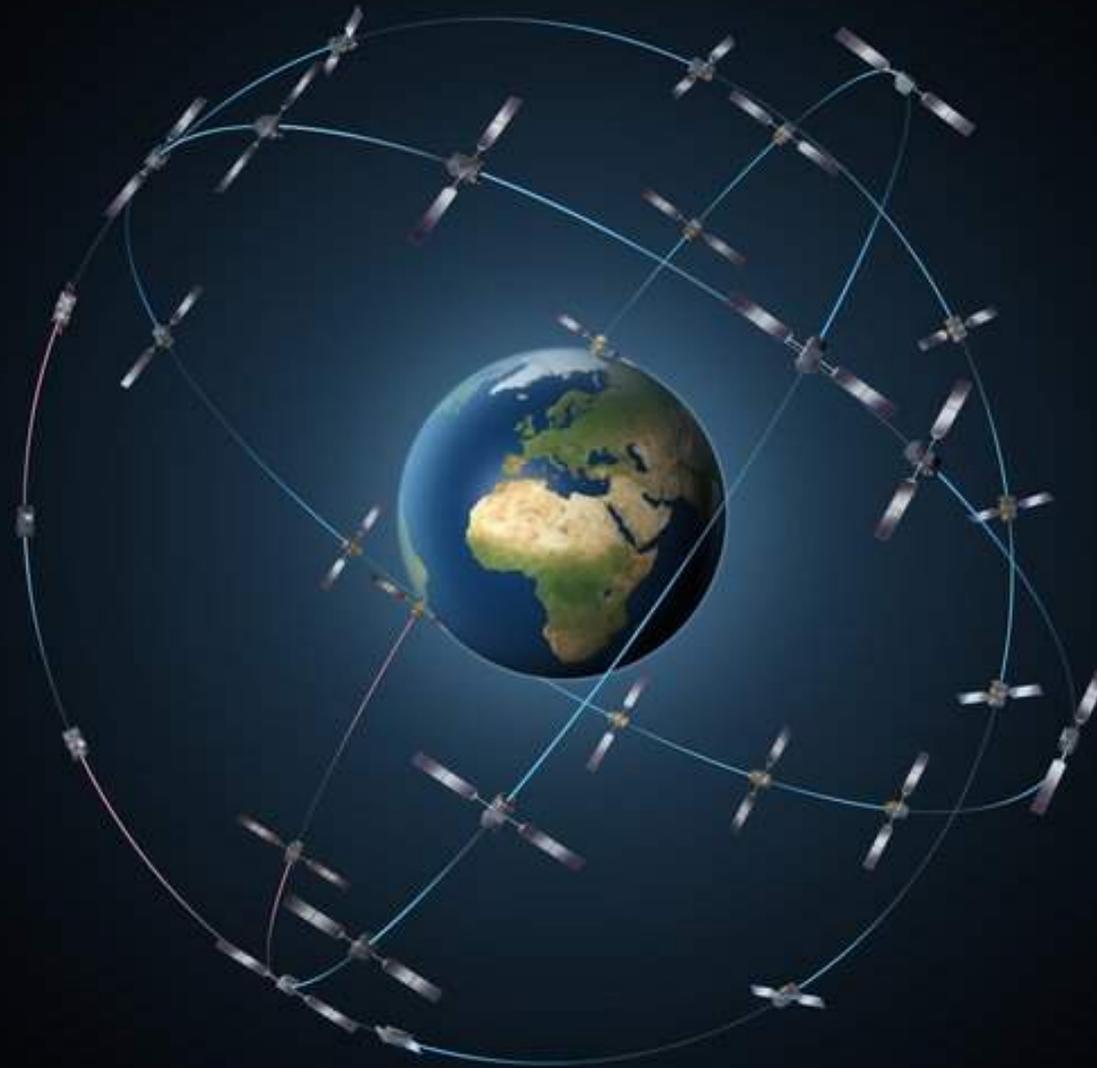


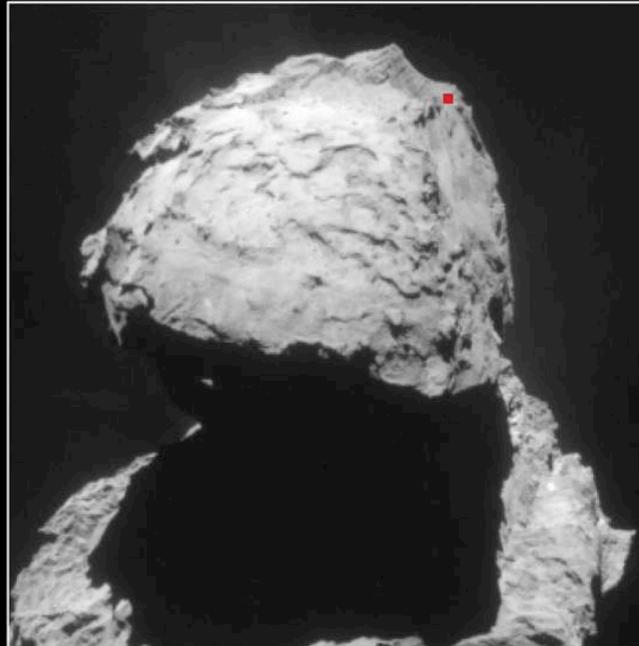
17 PARTNERSHIPS
FOR THE GOALS



Telecommunications







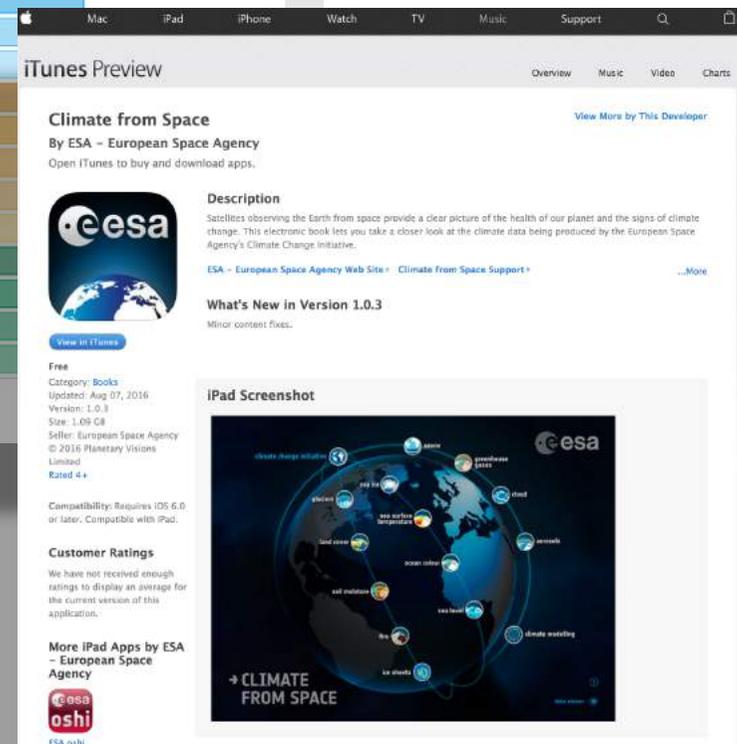
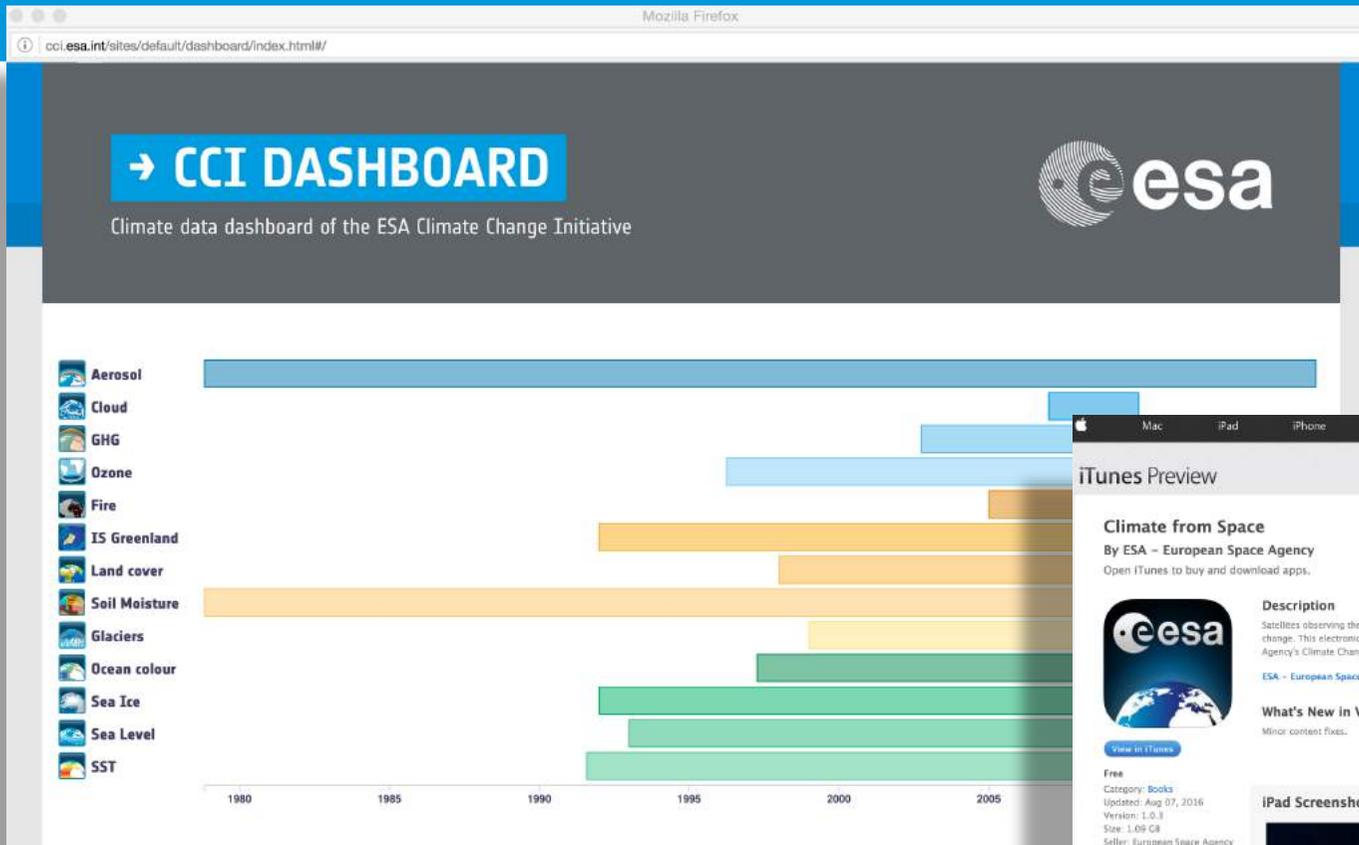


**with cooperation
and inspiration**



**we can achieve the
seemingly impossible**

Thank you



iTunes Preview

Climate from Space

By ESA - European Space Agency

Open iTunes to buy and download apps.

Description
Satellites observing the Earth from space provide a clear picture of the health of our planet and the signs of climate change. This electronic book lets you take a closer look at the climate data being produced by the European Space Agency's Climate Change Initiative.

What's New in Version 1.0.3
Minor content fixes.

iPad Screenshot



→ CLIMATE FROM SPACE

climate data & visualizations