Space and Climate

Integrated Space Technology Applications for Climate Change
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UN Sustainable Development Goals

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
Arctic sea ice cover
1972 - 2014
Declining Arctic sea ice extent
1972 - 2015
Cryosat: Arctic Sea Ice Volume
Retreating glaciers

Inexplorado glacier Chile
Randolph Glacier Inventory

Potential sea level contribution: 42 cm

IPCC (2013)
Global sea surface temperature trends
Ocean Heat Content (IPCC AR5 2013) (from in-situ measurements)
Global land cover
Urban development
Global Soil Moisture

2014 anomalies

Difference from average soil moisture (meters$^3$ of water per meters$^3$ of soil)

-0.05 -0.04 -0.03 -0.02 -0.01 0.01 0.02 0.03 0.04 0.05
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

*Space brings key contributions for all issues*
Mitigation
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)
WMO soil moisture data during 2015/16 ElNino drought in Southern Africa (Jan. 1 to Jan. 10, 2016)
SMOS soil moisture data used to detect drought and improve crop yield prediction during 2015/16 ElNino drought in Southern Africa.
Transparency and Global Stocktake

$\text{CO}_2$

ENVISAT $\rightarrow$ TANSO $\rightarrow$ OCO2
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](https://www.unfccc.int/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

15 August 2015
Loss and Damage

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**
Extreme Events
Support to relief and reconstruction

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

we can achieve the seemingly impossible
Thank you
Climate data & visualizations