

Systematic Observations from Space

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Earth Observation Programmes

Forests in Africa @ COP27
9 November 2022



United Nations
Climate Change

Paris Agreement



Transparency Framework

Global Stocktake

Mitigation

Adaptation

Means of
Implementation:
Finance, Technology,
Capacity Building

Cross-cutting:
Response measures,
Loss & Damage,
Equity



Systematic Observations



Systematic Observations Community



WORLD
METEOROLOGICAL
ORGANIZATION



EUROPEAN COMMISSION



The Committee on Earth Observation Satellites



GLOBAL CLIMATE OBSERVING SYSTEM



ECMWF



DLR



bc³



EUMETSAT



GROUP ON
EARTH OBSERVATIONS



Global Systematic Observations include space-based and ground-based observations



Space-based measurements from a growing fleet of satellites provides high spatial and temporal resolution and greater and more frequent coverage of the globe.

Ground-based and airborne data provide accurate estimates of weather, climate, air quality, greenhouse gases, forest, agriculture, etc. on local scales world wide



Copernicus Sentinels for operational monitoring




250 TB
satellite data
distributed per day



full, free & open
data policy

sentinel-1

→ RADAR VISION

sentinel-2

→ COLOUR VISION

sentinel-3

→ A BIGGER PICTURE

sentinel-4

→ EUROPEAN AIR MONITORING

sentinel-sp | sentinel-5

→ GLOBAL AIR MONITORING

sentinel-6

→ SURFING THE SEAS

Mission Status: <https://sentinels.copernicus.eu/web/sentinel/missions>



+ THE EUROPEAN SPACE AGENCY



PROGRAMME OF THE
EUROPEAN UNION

•esa

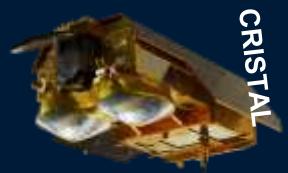
**Food Security and
Water Management**

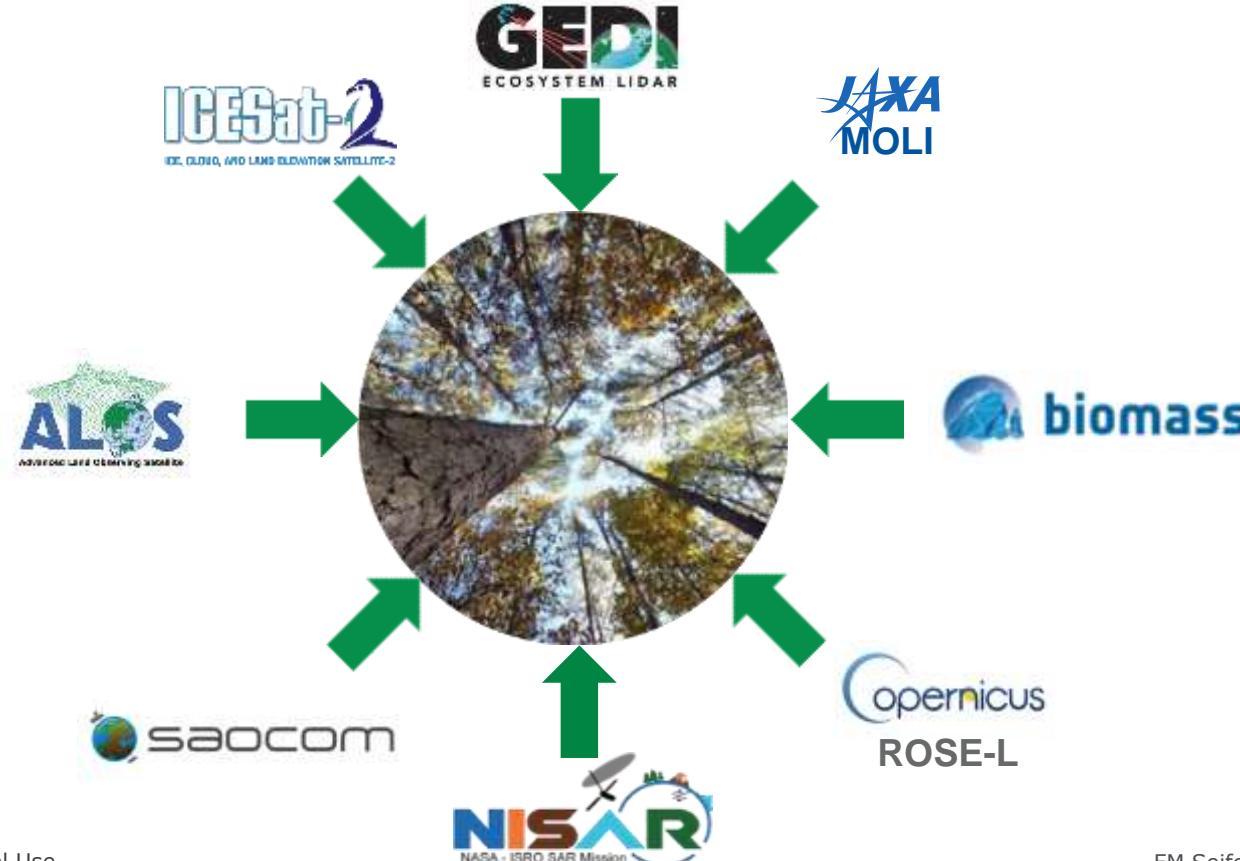
**Monitoring Land
and Natural Resources**

**Combatting
Climate Change**

Strengthening Systematic Observations with the Sentinel Expansion Missions

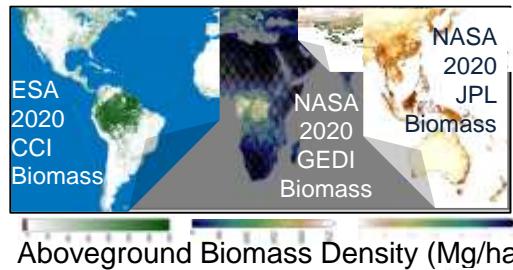
**Safeguarding
the Arctic**





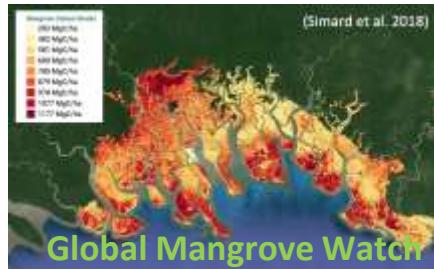
Mitigation - AFOLU

Agriculture, Forestry and Other Land Use (AFOLU) contributes the second largest source of emissions (after fossil fuel use) globally, and is the primary source of emissions in many developing nations

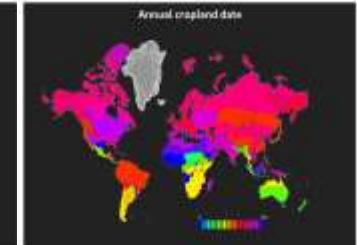
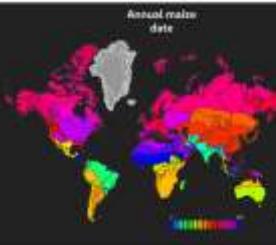
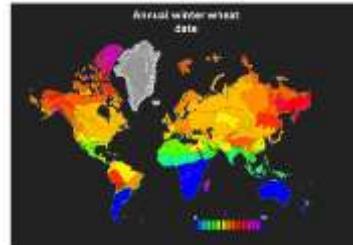


Forests

Land Cover



Mangroves



Agriculture



WorldCover

Global 10 meters land cover
2020 & 2021 (just released)
Based on Sentinel-1 & 2
Fast generation
11 classes
5 Key end-users
75% OA, Independent validation



WORLDCOVER 2020 – 10M



- Global maps 2010, 2017 & 2018
- 2020 map under validation
- Consistency: a decade of change



JAXA partial column GHG product

- JAXA developed a new retrieval algorithm to derive the partial column.
- GOSAT observes both solar reflected light and thermal emission.
- Products are free available (https://www.eorc.jaxa.jp/GOSAT/Global_GHGs_Map/index.html).

Upper troposphere:

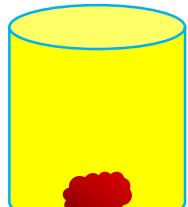
Serves as a **new reference** (background) CO₂ concentration for local analysis.

Lower troposphere:

Better reflects CO₂ changes due to local

emissions.
Conventional
Method

Use only solar reflected light



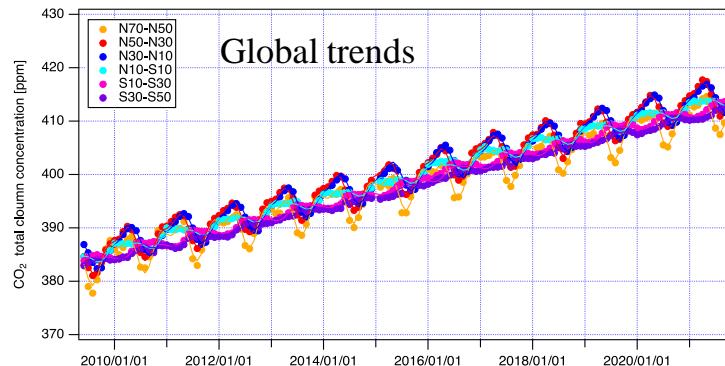
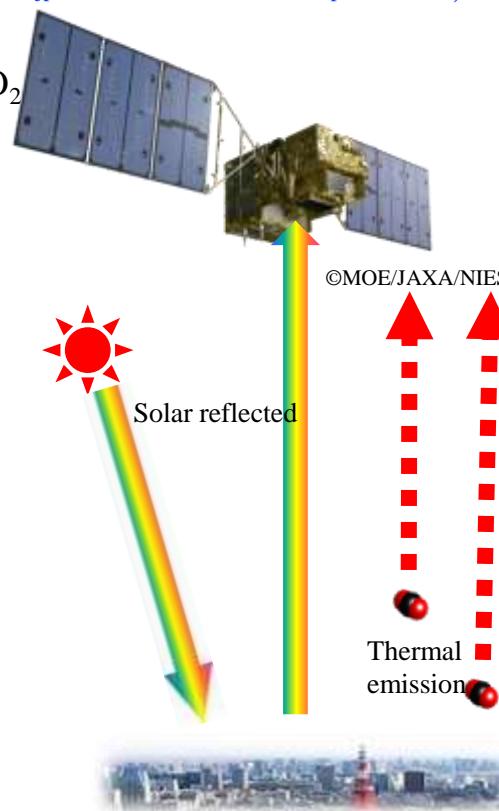
**JAXA/EORC
new Method**

Use both solar reflected light & thermal

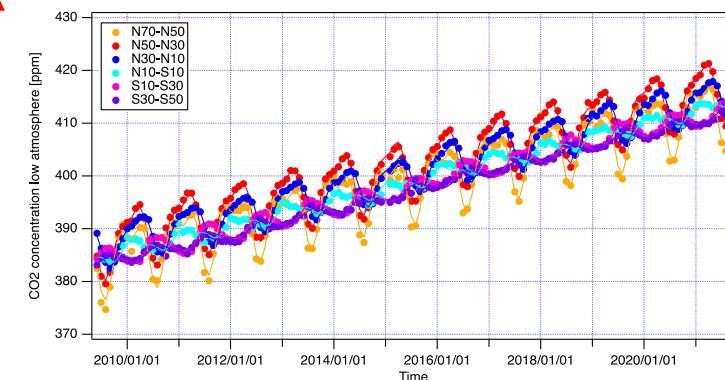
$0.2P_{\text{sur}} \approx 12\text{km}$

$0.6 * P_{\text{surf}} \approx 4\text{km}$

CO₂ emission and enhanced density of the lower troposphere

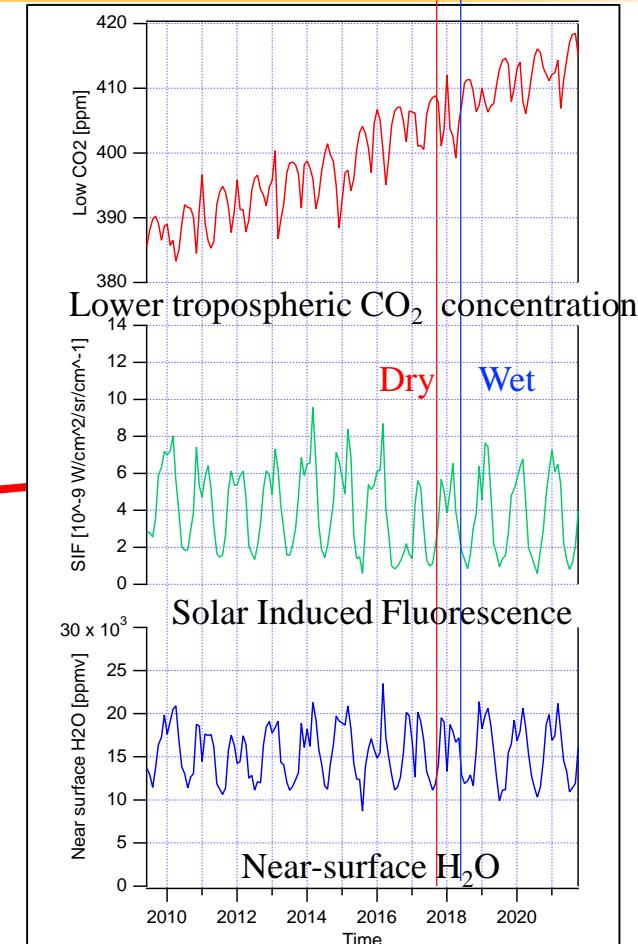
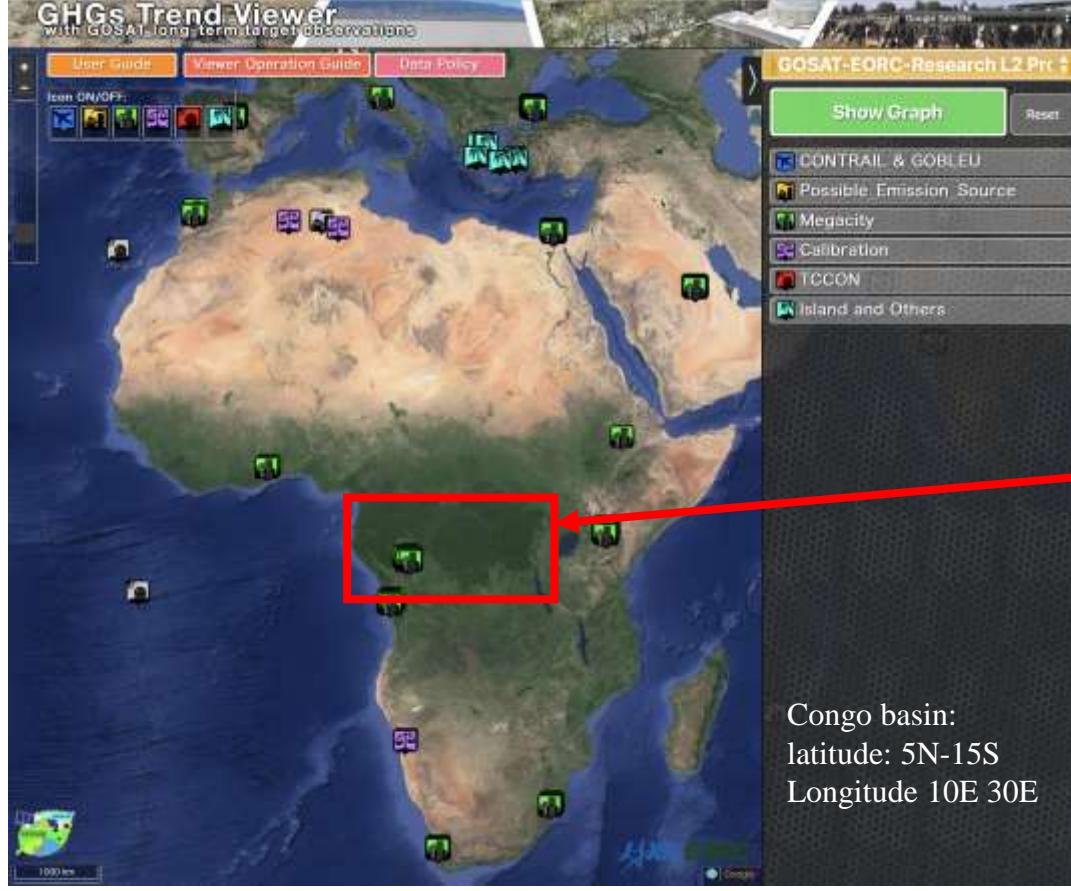


Total column concentration



Lower tropospheric concentration

Visualizing of GHG trend by GOSAT



Take Home Message

- **Systematic Observations** underpin climate science and services for mitigation and adaptation
- We are in a "**Golden Age**" of dedicated missions for forest monitoring and biomass estimation
- Large **variety of sensors**: multi- and hyperspectral optical, LIDAR, and SAR (P-, L-, C- and S-band)
- Increased knowledge on **forest dynamics** and the terrestrial global **carbon stock**
- **Open data and knowledge exchange** support the Enhanced Transparency Framework and the GST
- **Cooperation and coordination** is key: In-situ data, validation and accuracy assessment
- **Long-term Systematic Observations** are means for implementation – together!

