

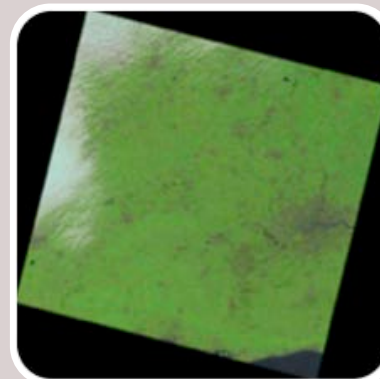
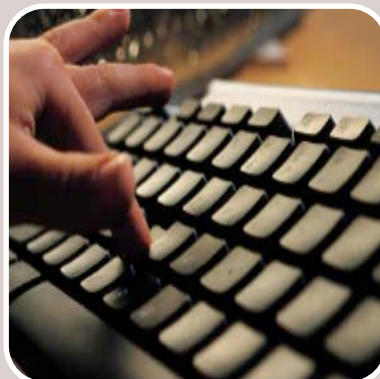
# Global Forest Observations Initiative – Space Data Coordination and R&D Activities

Frank Martin Seifert (ESA), Martin Herold, Brice Mora (Wageningen University)

SBSTA Side Event, Bonn, 20 May 2016



# GFOI Components



## Space Data

- GFOI works with space agencies through CEOS to ensure the long-term, global acquisition of core satellite data
- helps countries meet their individual data needs

## Capacity Building

- GFOI provides capacity building in coordination with others such as UN-REDD. It supports the use of satellite and ground data to monitor forests, and estimate GHG emissions.

## Methods and Guidance

- Guidance on integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests.

## Research and Development

- Identifying and promoting R&D needed for improved practical, global implementation of National Forest Monitoring

## GFOI Office at FAO, Rome

- Coordination and Management

# GFOI Space Data Coordination

## Implementation of Baseline Global Data Acquisition Strategy

- Assuring the availability of **consistent time-series** of optical and radar (SAR) satellite data over global forest cover.
- At least **one annual national cloud-free optical coverage** over each country.
- Publicly open (“core”) satellite data, phased implementation - **full global coverage** in 2016

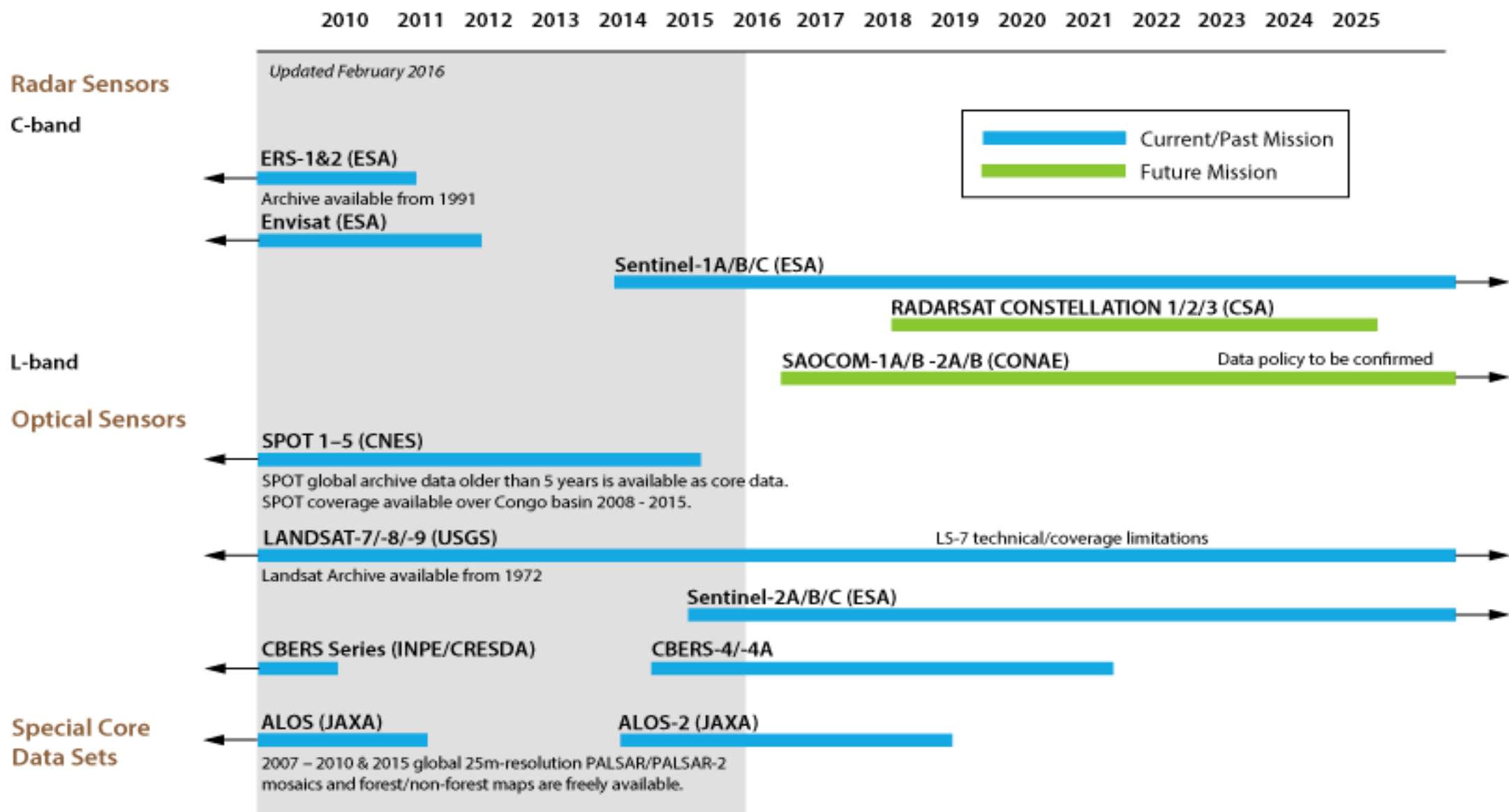
## Space Data Services Available

- A coordinated strategy for national data acquisitions accommodating countries’ specific technical **requirements, heritage, or experience**.
- Demonstrating data exploitation solutions e.g. **data cube, cloud computing**.
- Covers a wider range of satellite data sources, including **commercial**.

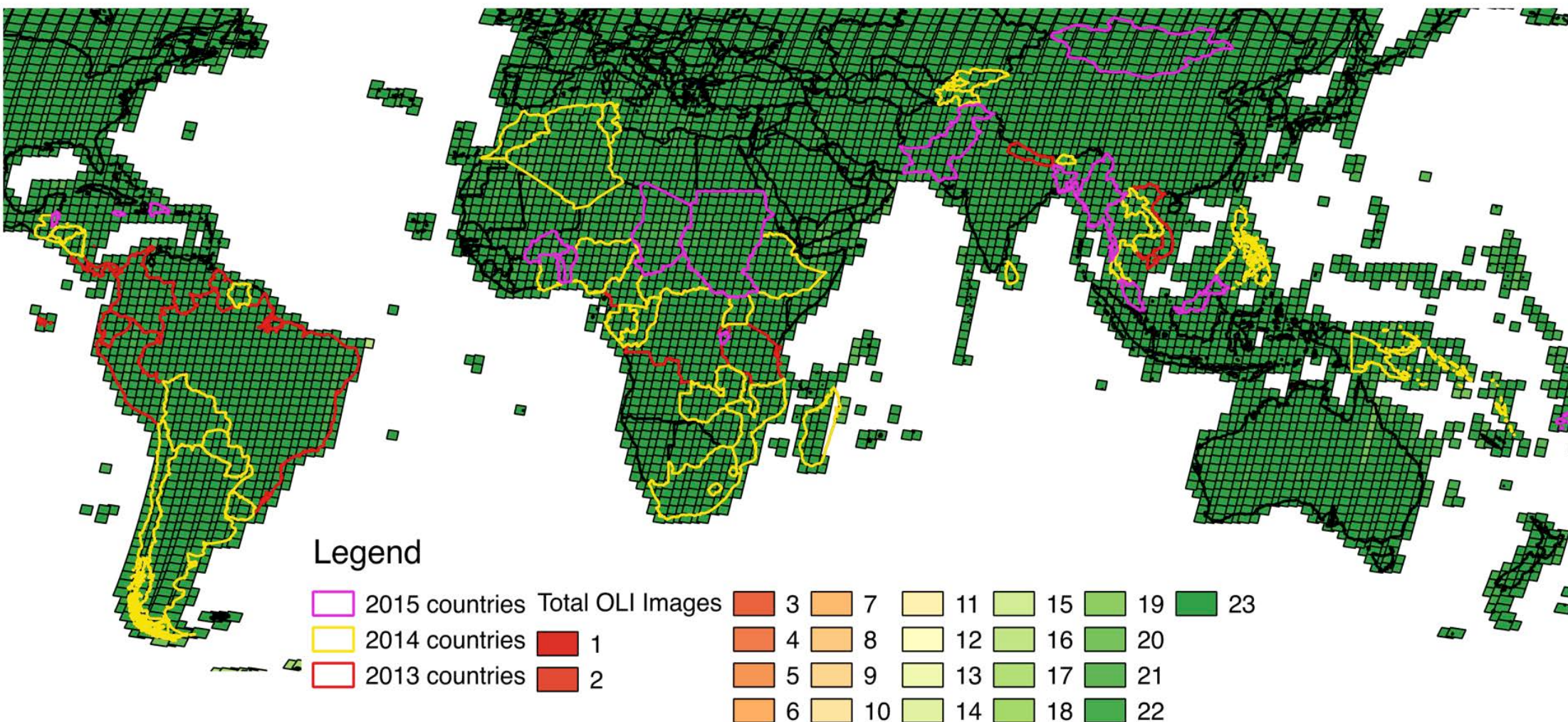
## Data Supply in Support of GFOI R&D Activities

- Includes support for **science studies** assisting the development and evolution of the MGD for GFOI.

# GFOI Global Baseline Core Satellite Data



## Landsat 8 OLI Number of Images per Scene 2015-01-01 to 2016-01-03



# Copernicus: A European Space Flagship

Sent-1A/B



Sent-2A/B



Sent-3A/B



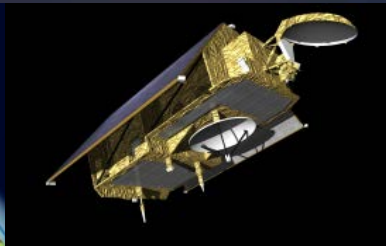
Sent-4A/B



Sent-5/5P

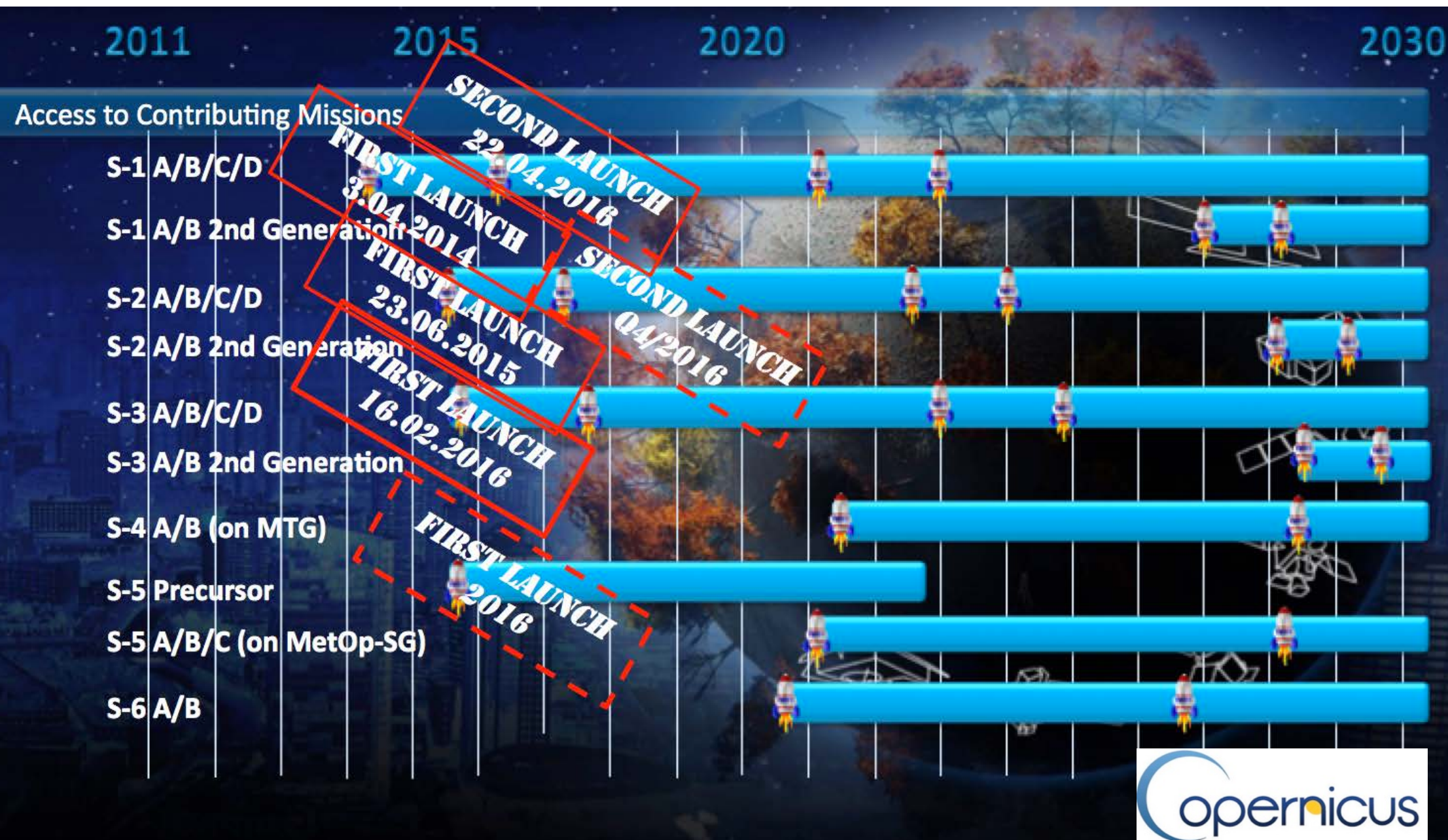


Sent-6/Jason-CS



- Copernicus is a **European space flagship programme** led by the European Union
- ESA coordinates the space component
- Copernicus provides the necessary data for **operational monitoring** of the **environment** and for **civil security**
- Data policy: **free and open access**

# Copernicus securing EO data for the next decades

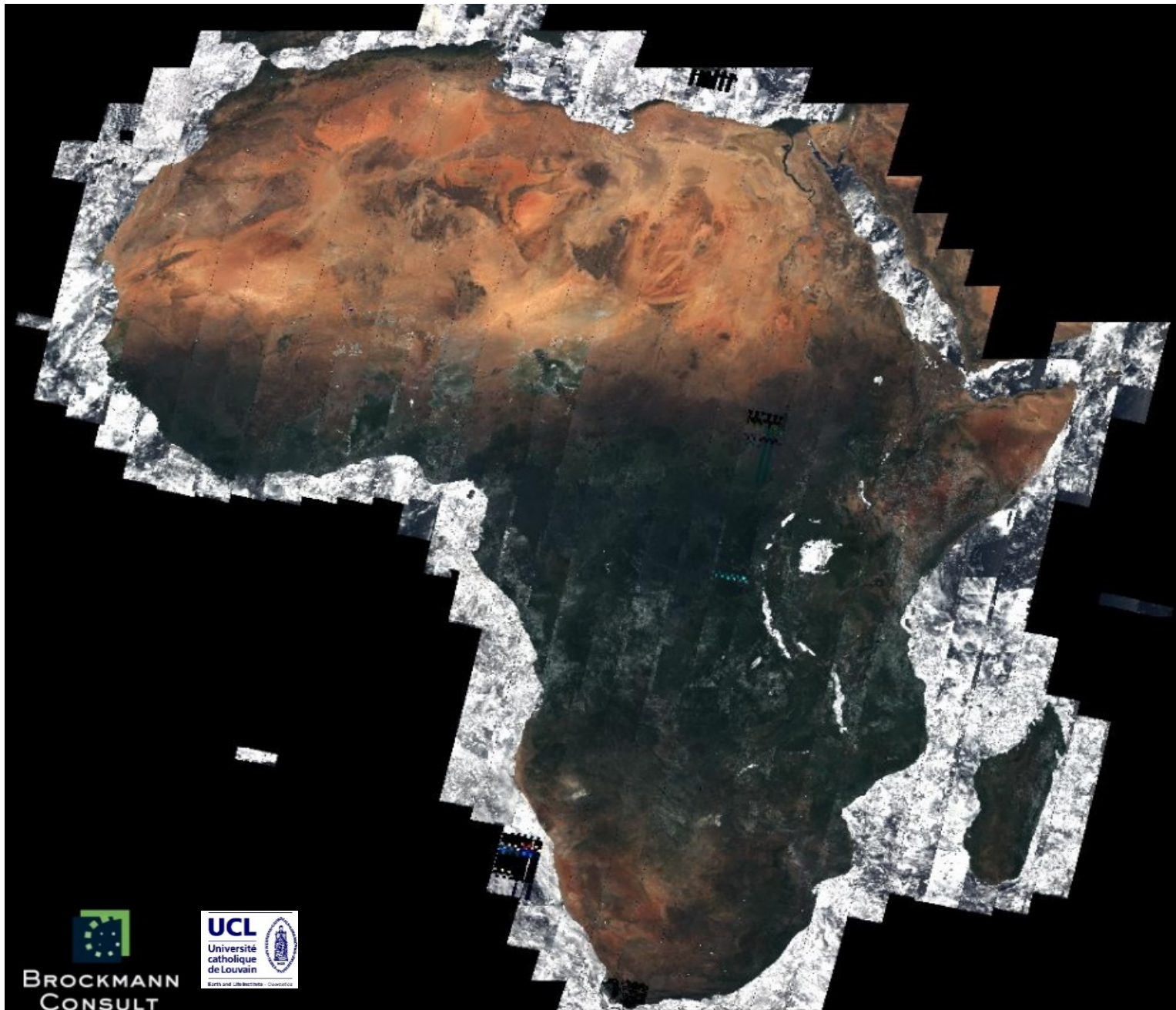




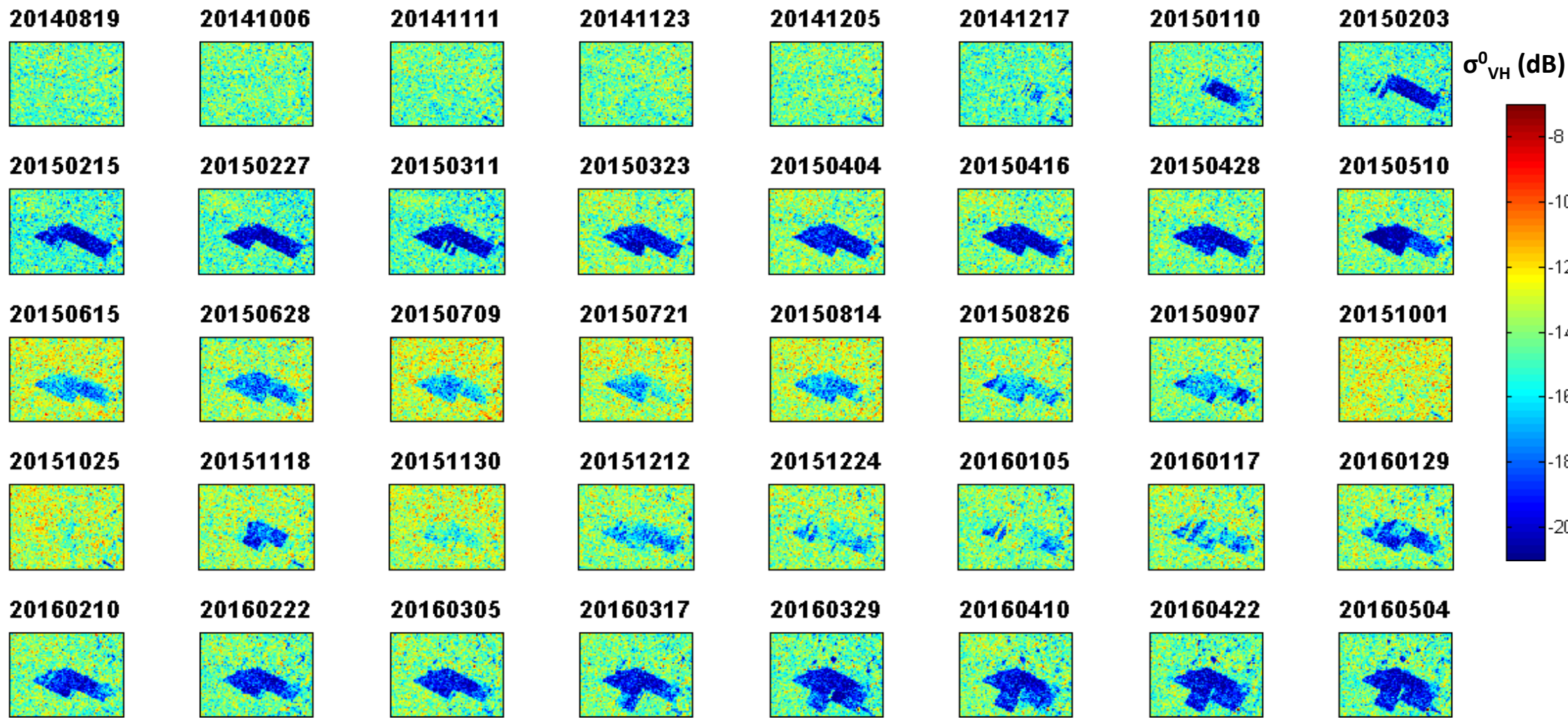
# First CCI Land Cover Sentinel-2 TOA reflectance composite over Africa

Max-NDVI composite  
of TOA reflectance  
from all available  
Sentinel-2 images  
(~7000) acquired  
from August 2015  
to April 2016

( ~32 TByte of data)

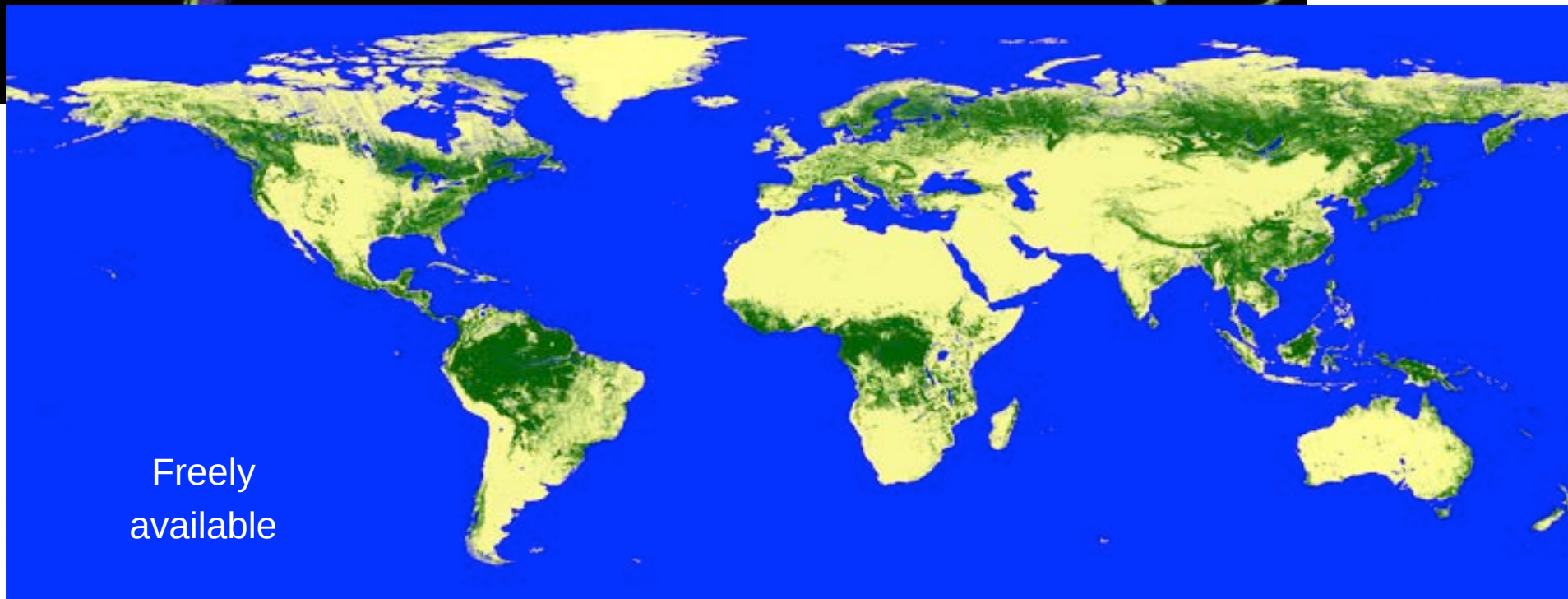
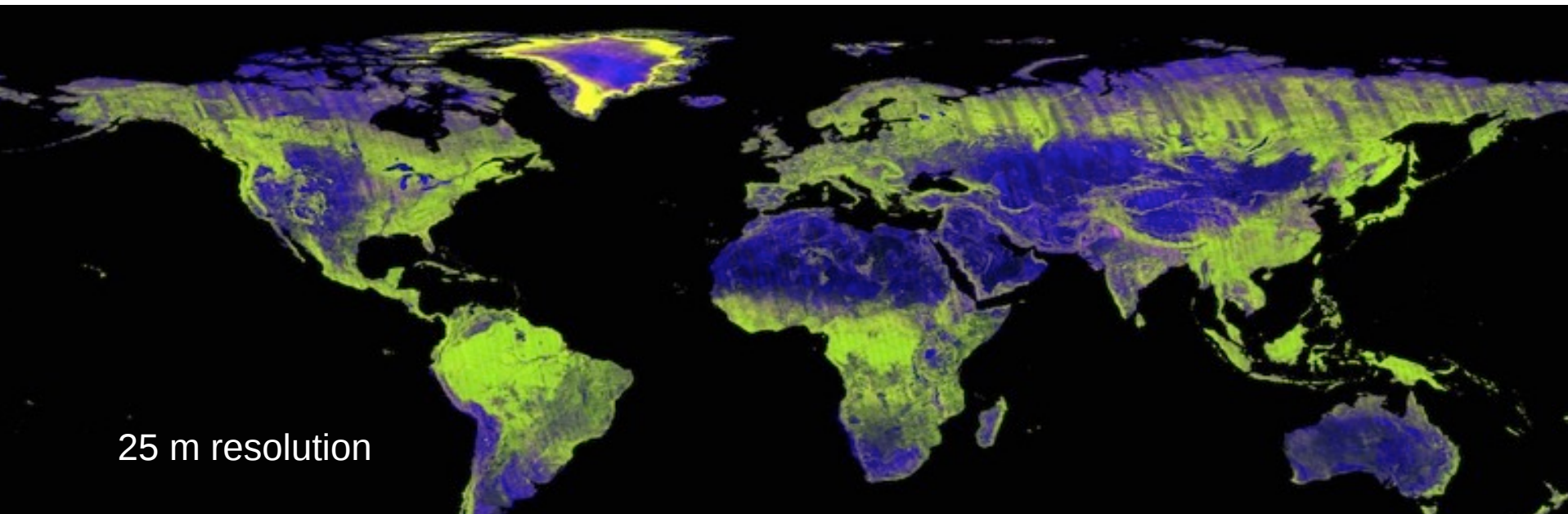


# GFOI Sentinel-1 Time Series to Monitor Forest Logging in Vietnam

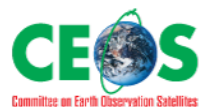


Dense Sentinel-1 time series in dual polarisation:  
VH channel most adequate to detect logging activities

# GFO | ALOS-2 PALSAR-2 Global Mosaic



# GFOI Contributing Data Streams



## Further Missions of Interest



2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Updated September 2015

### Radar sensors

#### C-band



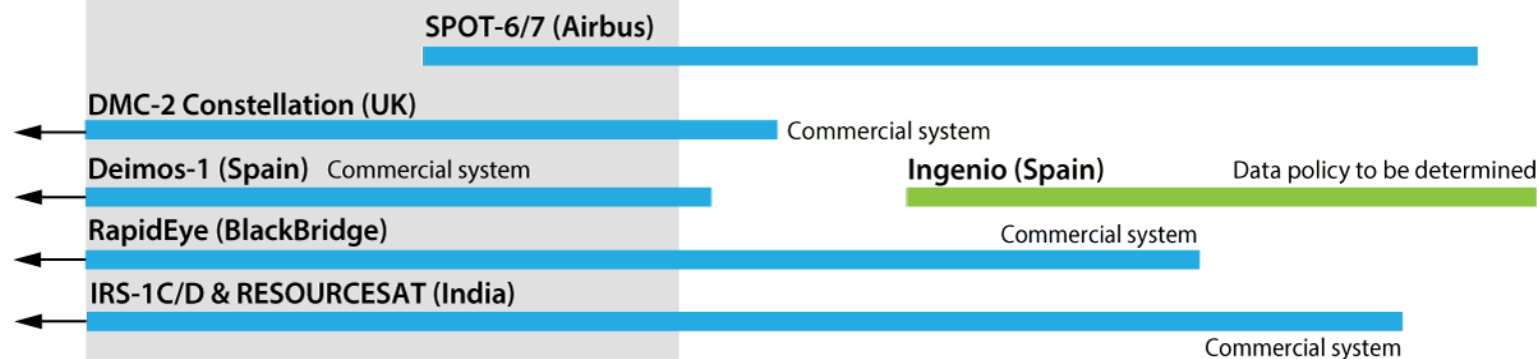
#### L-band



#### X-band



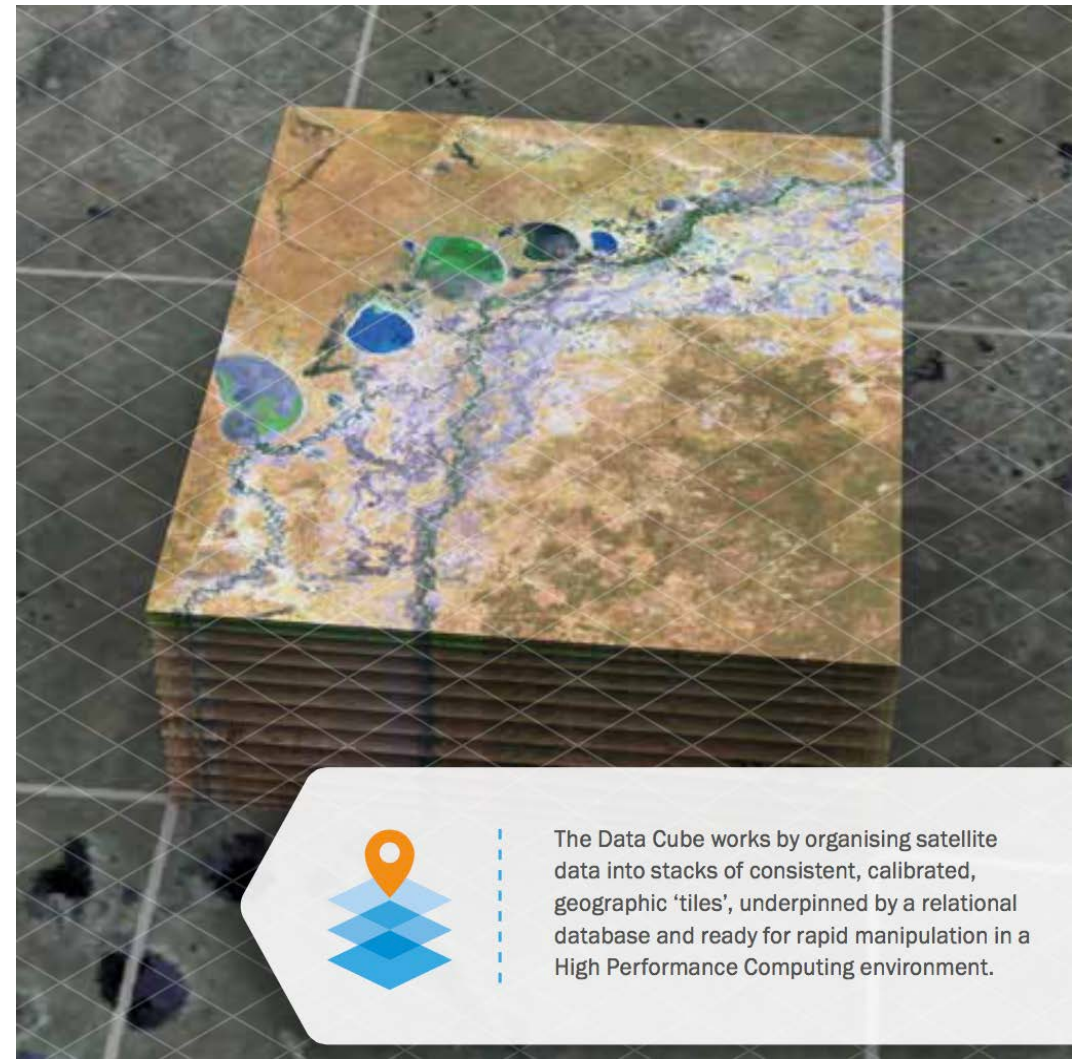
### Optical sensors



There are also numerous missions in planning by several countries that may be of value – including many high resolution missions of interest for validation. Few datastreams will have the capacity to provide routine global coverage, but many more will be able to contribute to national and regional coverages.

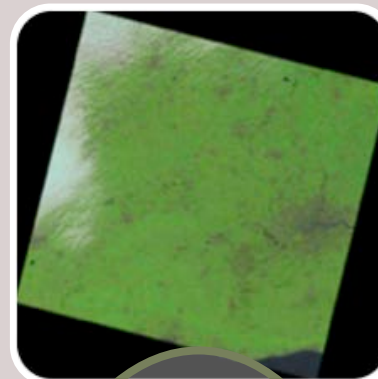
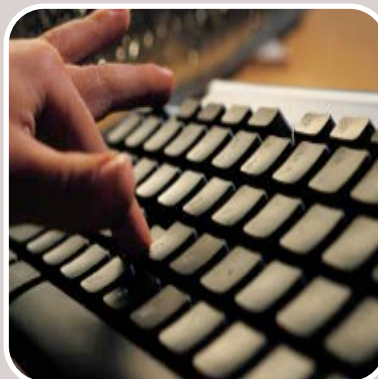
# GFOI Space Data Management System / Data Cube

- **Removing obstacles** to country uptake of satellite data through cloud computing and data storage, novel computing and database technology
- Countries can focus on **data applications** and not on data handling
- Pilot projects underway – notably the **Kenya** and **Colombia** Cube in support of their NFMS.
- New **GFOI Space Data Portal** for all countries is being developed.



The Data Cube works by organising satellite data into stacks of consistent, calibrated, geographic 'tiles', underpinned by a relational database and ready for rapid manipulation in a High Performance Computing environment.

# GFOI Components



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Methods and Guidance only includes operational methods and approaches.



Component aims to stimulate R&D on developing approaches that are not operational but could be widely available and useful



R&D Workshops to discuss major topics, on-going work and how to promote further development, in cooperation with GOFC-GOLD



Identifying and provision of space data to meet R&D needs is under discussion by CEOS & SDCG

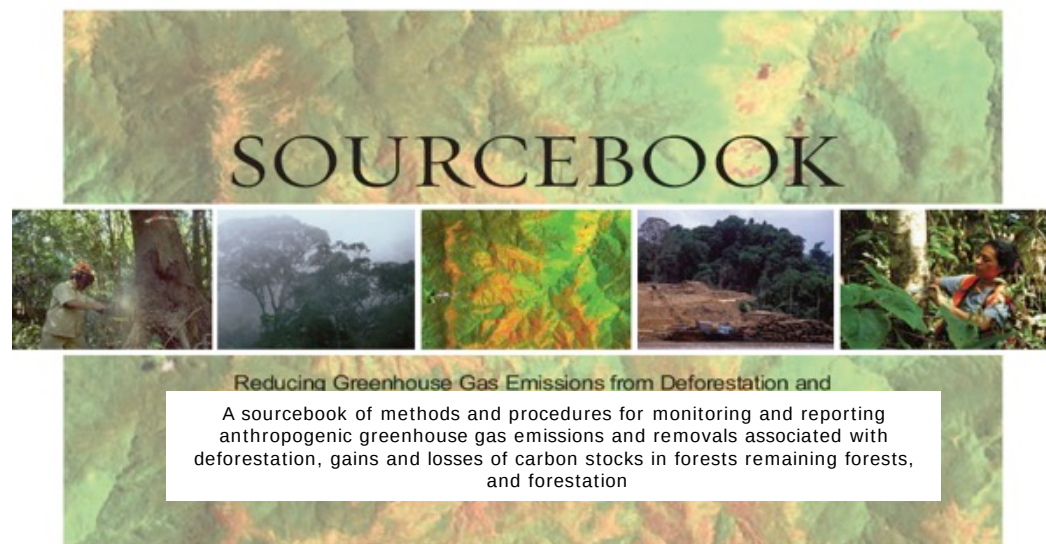


Identification of new approaches that can be included in future versions of the Methods and Guidance



Identifying funding opportunities

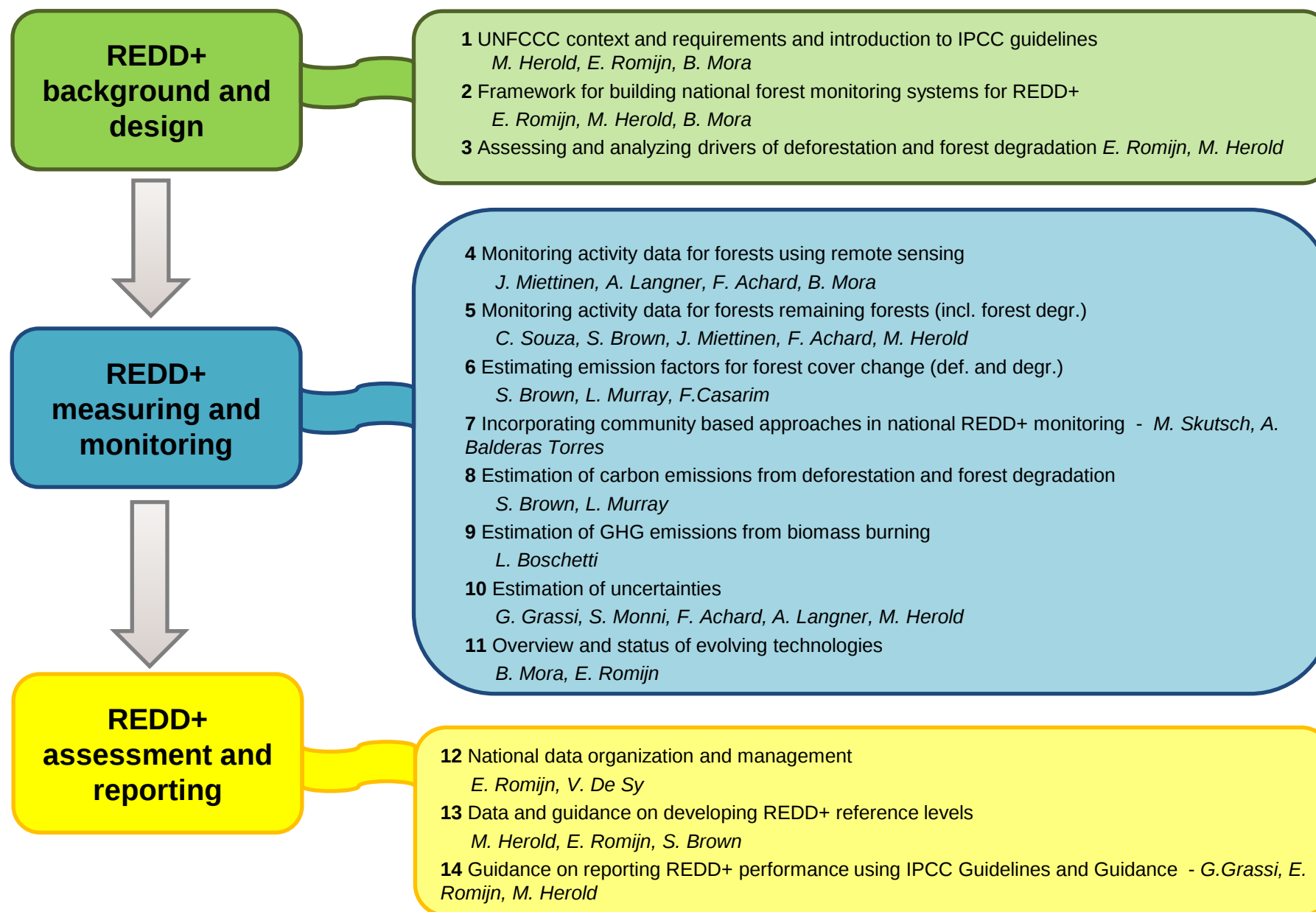
- Sensor interoperability
- Forest degradation
- Biomass estimation
- Accuracy assessment
- Use of global data sets



- ➔ Conducting Expert Workshops
- ➔ Supporting R&D sites and studies
- ➔ Input to GOFC-GOLD REDD+ Sourcebook and when mature into GFOI MGD



# GFOI Training material for REDD+ Monitoring and Reporting



- Currently 15 teams looking after 32 multi-disciplinary sites, addressing multiple GFOI Priority R&D topics



| Site Code  | Site name             | Country                  | Coordinates |              |
|------------|-----------------------|--------------------------|-------------|--------------|
|            |                       |                          | lat         | long         |
| Priority 1 |                       |                          |             |              |
| BRA-1      | Mato Grosso           | Brazil                   | S11.75      | W54.25       |
| CAR-1      | Mbalki                | Central African Republic | N3.872      | E17.98       |
| GAB-1      | Gabon                 | Gabon                    | N0.0181     | E10.1906     |
| FCT-COL-3  | Pacifico-Bajo_Mira    | Colombia                 | N1.65       | W78.76       |
| FCT-COL-5  | Andes-Antioquia       |                          | N7.83       | W76.45       |
| COL-6      | Caqueta               |                          | N1.4079     | W73.5747     |
| COL-7      | La Victoria           |                          | N6.26       | W74.64       |
| ETH-1      | Kafa BR               | Ethiopia                 | N7°30'29"   | E35°54'29"   |
| FJI-1      | Lololo & Nakavu       | Fiji                     | S17.833     | E177.833     |
| PER-1      | Peru                  | Peru                     | S11.1       | W74.3        |
| GFC-1      | GFC Site 1            | Guyana                   | N3.3069     | W-59.6672    |
| GFC-2      | GFC Site 2            |                          | N6.4856     | W-58.9471    |
| FCT-BOR-3  | Mawas                 | Indonesia                | S2.24       | E114.48      |
| FCT-SUM-2  | Harapan               |                          | S2.20       | E103.38      |
| FCT-TNZ-5  | Amani                 | Tanzania                 | S5.13       | E38.63       |
| FCT-TNZ-6  | Liwale                |                          | S9.50       | E38.17       |
| PNG-1      | Kokoda                | PNG                      | S9.184      | E147.374     |
| PNG-2      | Milne bay             |                          | S10.598     | E150.185     |
| FCT-MEX-2  | Chiapas-1             | Mexico                   | N16.45      | W91.40       |
| MEX-8      | Durango               |                          | N23.74      | W105.49      |
| AU-4       | Robson Creek (QLD)    | Australia                | S17.119     | E145.631     |
| AU-5       | Injune (QLD)          |                          | S25.5       | E147.7       |
| CAN-1      | Site 1 NW Territories | Canada                   | N61.4       | W121.3       |
| CAN-2      | Site 2 NW Territories |                          | N62.53      | W116.53      |
| KAL-1      | Central Kalimantan    | Indonesia                | S2°24'      | E114°6'30"   |
| SUM-1      | South Sumatra         |                          | S2°29'30"   | E103°28'30"  |
| BRA-2      | Novo Progresso        | Brazil                   | S7°02'4.07" | W55°24'1.82" |
| SUR-1      | Kabo                  | Suriname                 | N5.255928°  | W55.76682°   |
| MAL-1      | Malinau               | Indonesia                | N3.0217°    | E116.3601°   |
| MAD-1      | Mahafaly              | Madagascar               | S24.0304°   | E43.7651°    |
| SA-1       | Lowveld / Kruger N.P. | South Africa             | S24°59'45"  | E31°35'30"   |
| SA-2       | Eastern Cape          |                          | S33°36'     | E25°40'      |

|                   |                  |           |          |           |
|-------------------|------------------|-----------|----------|-----------|
| <b>Priority 2</b> |                  |           |          |           |
| FCT-COL-4         | Amazonia-Tinigua | Colombia  | N2.17    | W74.15    |
| GFC-3             | GFC Site 3       | Guyana    | N7.4660  | W-60.0742 |
| PNG-3             | Yus              | PNG       | S6.028   | E146.745  |
| FIN-1             | Hyttälä          | Finland   | N61.85   | E24.32    |
| FIN-2             | Sodankylä        |           | N67.48   | E26.34    |
| ICE-1             | Hallormsstadir   | Iceland   | N65.12   | W14.68    |
| RUS-1             | Pechora-Ilych    | Russia    | N62.18   | E59.18    |
| FCT-AU-3          | Warra (Tasmania) | Australia | S43.1046 | E146.6560 |

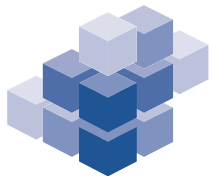
# GFOI | Three ESA Innovator Projects for GFOI R&D

In response to **GFOI's Research & Development Agenda** ESA runs three projects investigating key research areas exploiting amongst others the recently launched Copernicus satellites **Sentinel-1** and **Sentinel-2**.



**innovators**  
formosa

- **BlackBridge** (CA), Wageningen University (NL)
- Forest degradation, sensor interoperability for REDD+
- Users: FAO and national REDD focal points



**innovators**  
accu**carbon**

- **VTT** (FI), University of Helsinki (FI)
- Biomass estimation, sensor interoperability
- Users: Min Environment in Chiapas and Durango (Mexico)



**innovators**  
sar**forredd**

- **NORUT** (NO)
- Forest mapping, sensor interoperability for REDD+
- Users: OSFAC (DRC)

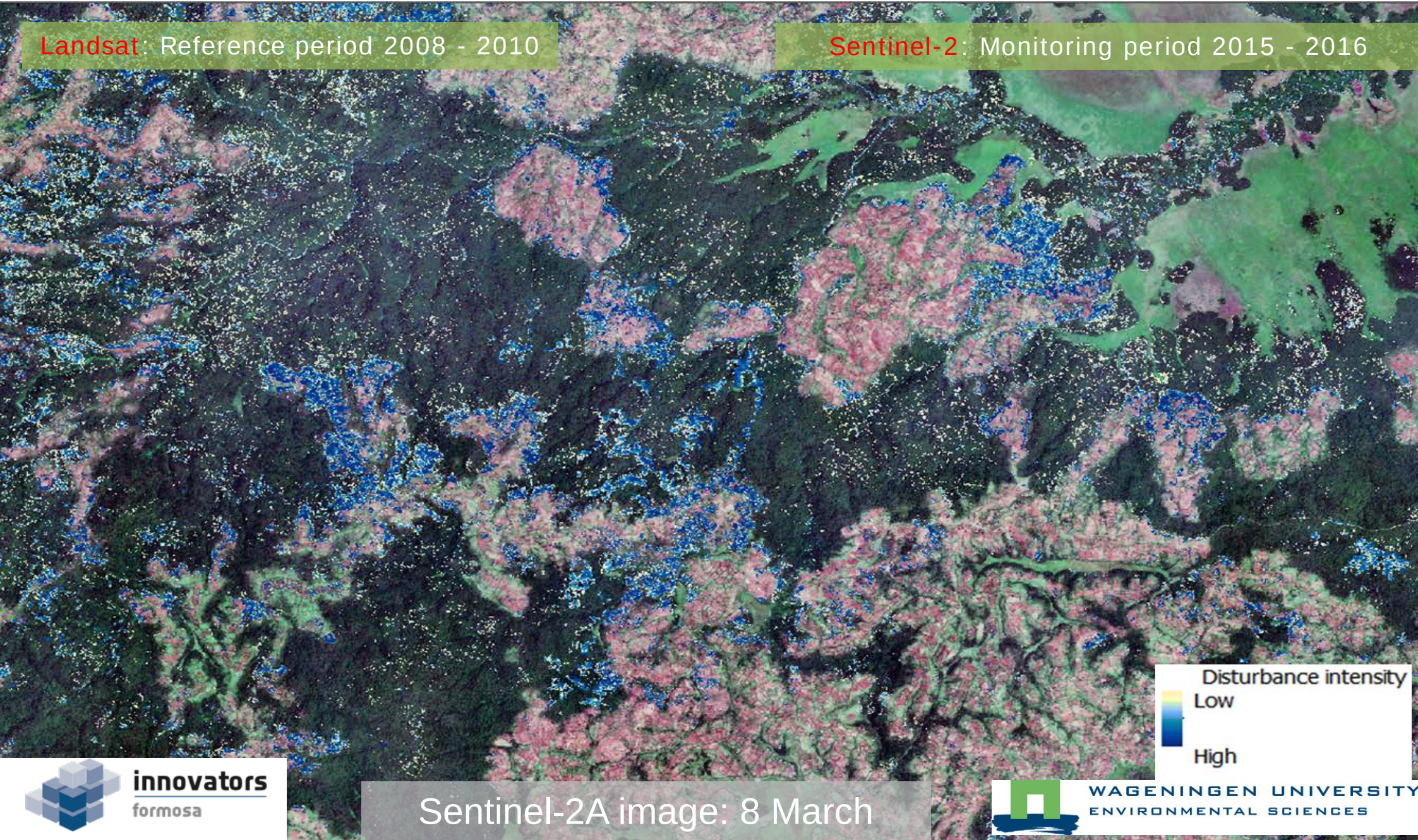




# Monitoring forest cover loss using Landsat and Sentinel-2 time series in Kafa, Ethiopia

**Landsat:** Reference period 2008 - 2010

**Sentinel-2:** Monitoring period 2015 - 2016



# GFOL Take Home Message

- Today **globally all forests** are covered multiple with optical and radar sensors annually enabling operational forest monitoring world-wide;
  - EO data availability is secured for the **next decades**, where wall-to-wall mapping can be based on a **free and open data policy**;
  - Increase of **country specific services** to support build up national forest monitoring systems;
  - Dedicated **R&D activities** addresses **operational challenges** and **specific country needs**;
- ➔ **GFOL is ready to share and collaborate**