

Perspectives of using Sentinel-2 data for the assessment of forest degradation in tropical countries

JRC with inputs from Copernicus programme

Content

- Characteristics of Sentinel-2 mission
- Modalities for accessing Sentinel-2 data
- Added value of Sentinel-2 for REDD+ needs



S1: Radar Mission



S2: High Resolution Optical Mission



S3: Medium Resolution Imaging and Altimetry Mission



S4: Geostationary Atmospheric Chemistry Mission



S5P: Low Earth Orbit Atmospheric Chemistry Precursor Mission



S5: Low Earth Orbit Atmospheric Chemistry Mission



S6 (Jason-CS): Altimetry Mission

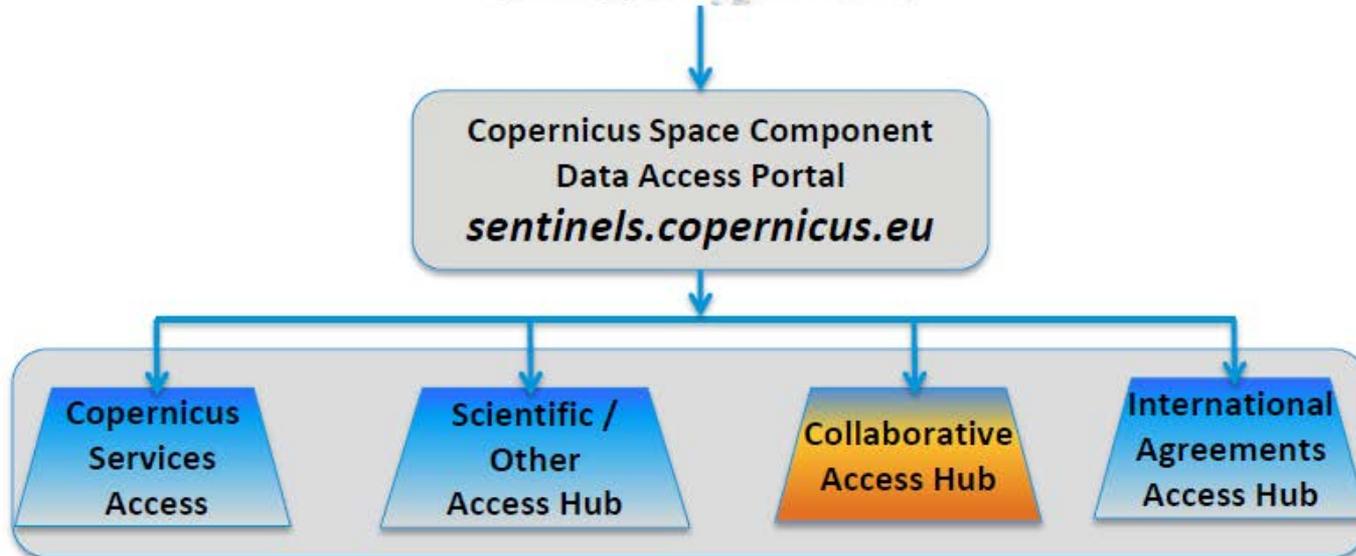
FIRST LAUNCH
3.04.2014

FIRST LAUNCH
23.06.2015

Sentinel-2 main characteristics

- 13 VIS/NIR/SWIR spectral bands with 3 new bands in the red edge tailored to vegetation monitoring
- Spatial resolution: 10m / 20m
- Swath: 290 km with 2 spacecraft on same orbit, 180° apart -> 5 days revisit at equator
- Systematic coverage between 84° N and 56° S
- Aiming at global systematic long term coverage

Sentinel Data Policy = **FREE and OPEN access**



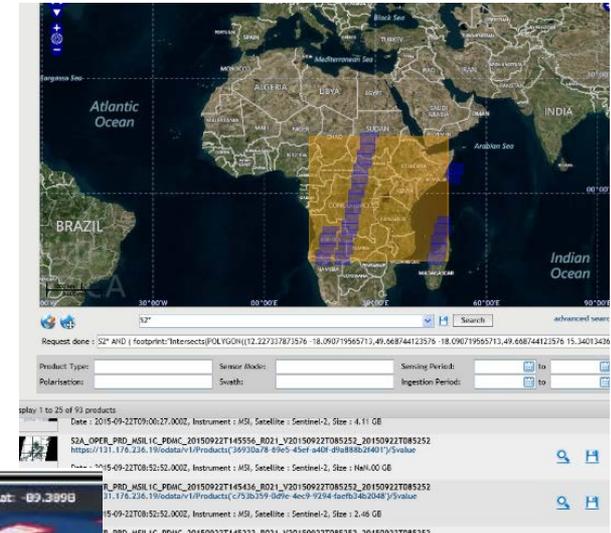
Sentinel-2a mission status

- Sentinel-2A has been launched 23 June 2015
- 11 August 2015: L1C sample products released
- 16 October 2015: hand-over of space segment responsibility from ESTEC to ESRIN
- ...to be followed by opening of data access to all users (via SciHub) target before end October 2015
- Continued ramp-up phase, with gradual increase of acquisition and processing capacity and further improvement of products quality
- Full operational readiness of S-2A is planned for ~ Jul 2016
- Sentinel-2B expected for launch in Q4 2016

Sentinel-2A data access

Online data access at:
sentinels.copernicus.eu

For the tropics still limited data
availability (*status 15 Oct*)



Sentinel-2 Observation scenario

Currently: observation of 40% of average observation time in full operations = ~ Europe + Africa systematic, plus selected cal/val sites

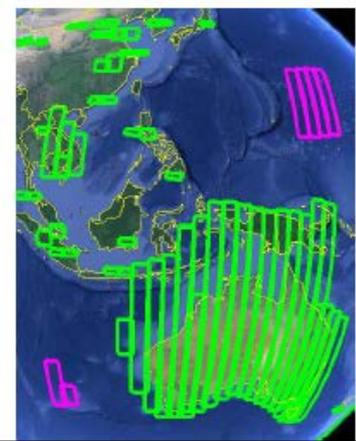
After IOCR, the initial scenario foresees to

- Systematically acquire Europe & Africa
- Acquire the rest of the world within a certain time interval to be progressively reduced to reach 10 d

The observation plan will fulfil:

- the needs of Copernicus users
- the objective to compile a Global reference image

e.g. cycle 18-29 Oct





Highlights from an initial experts assessment

Data interface:

- Well structured user interface
- Many data easily retrievable
- Fast search & high download speed

Spectral Quality: Very good radiometry

- Spectral signatures matching those of Landsat perfectly in shape, more signal than in Spot5
- Red-edge makes all the difference

Geometry: matching ground truth (apart steep terrain)
... Can Landsat convert to S2 geometry?

Features of <10m size clearly distinguishable



The sentinel-2 mission: specific assets for tropical forests

Humid Tropics:

A major drawback for mapping forests in the humid domain has been the lack of frequent high resolution data:

Frequent: to compensate for cloud cover and to pick up the dynamics of logging signs which disappear quickly

High resolution: canopy gaps in disturbed (logged) forests are often smaller than 20-30m resolution

Dry Tropics:

High resolution ($\leq 30\text{m}$) data with low revisit restricts available images to dry season (no cloud) making the detection of seasonal forests and discrimination between different forest canopy covers (e.g. pristine and degraded forests) difficult (no leaves!)

Preliminary results for humid tropical forests

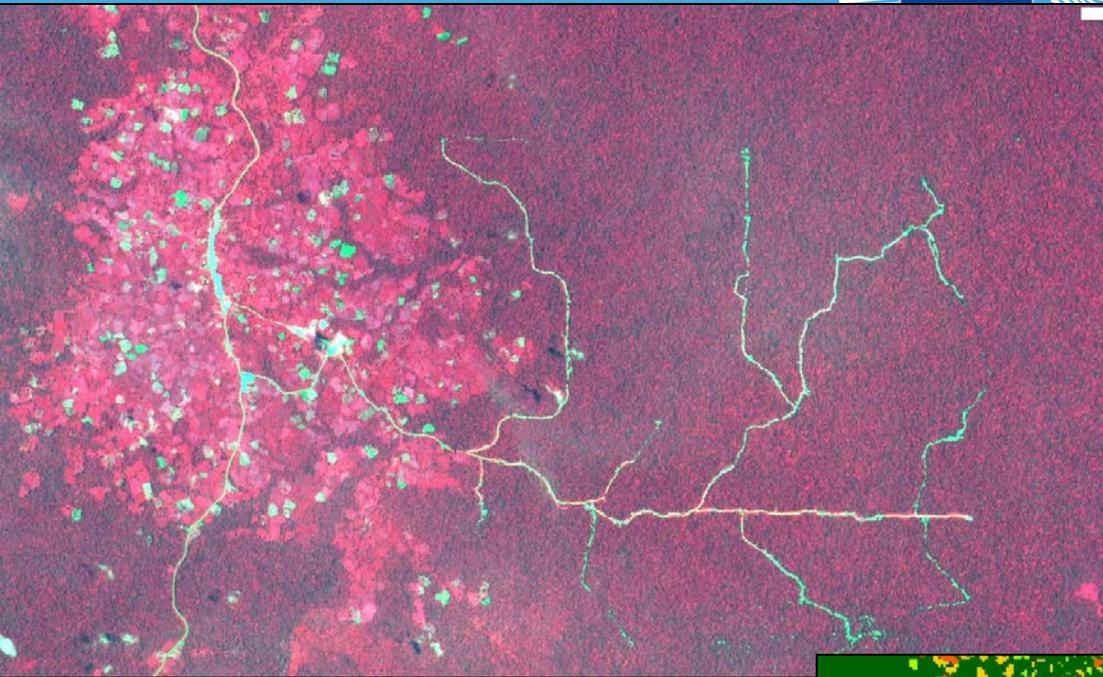
Improves the potential to monitor logging activities – due to spatial and temporal resolution – includes controlling whether management plans are being respected – i.e. cutting is taking place in the correct sector and width of roads.



Para state Brazil
18 sept 2015

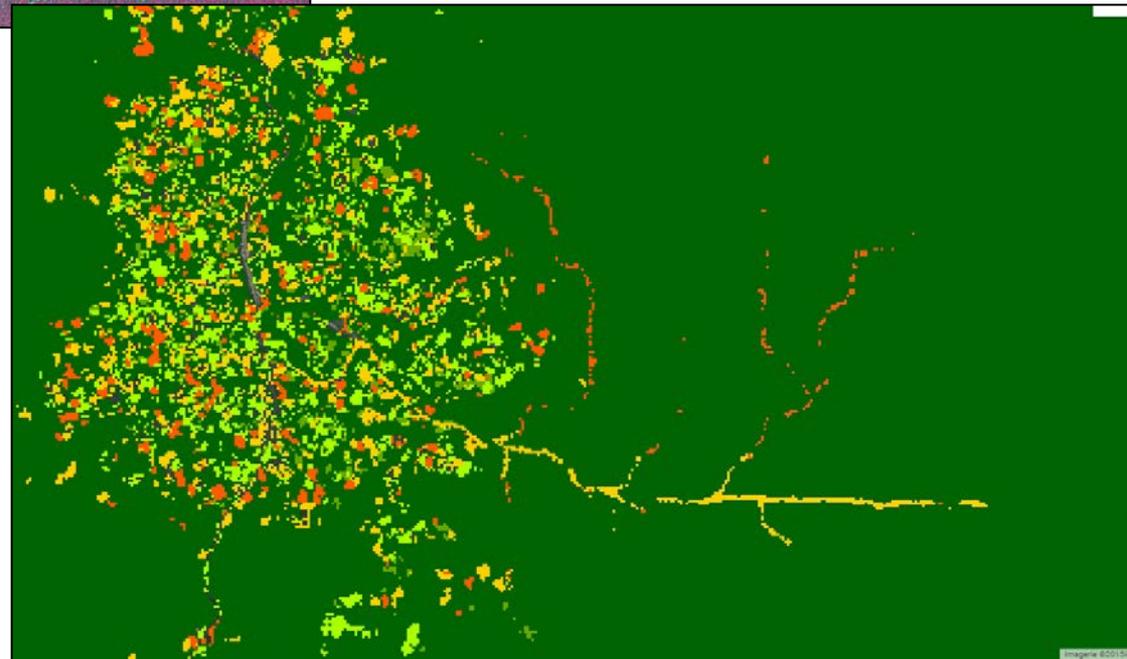


Badjamba DRC
22 sept 2015

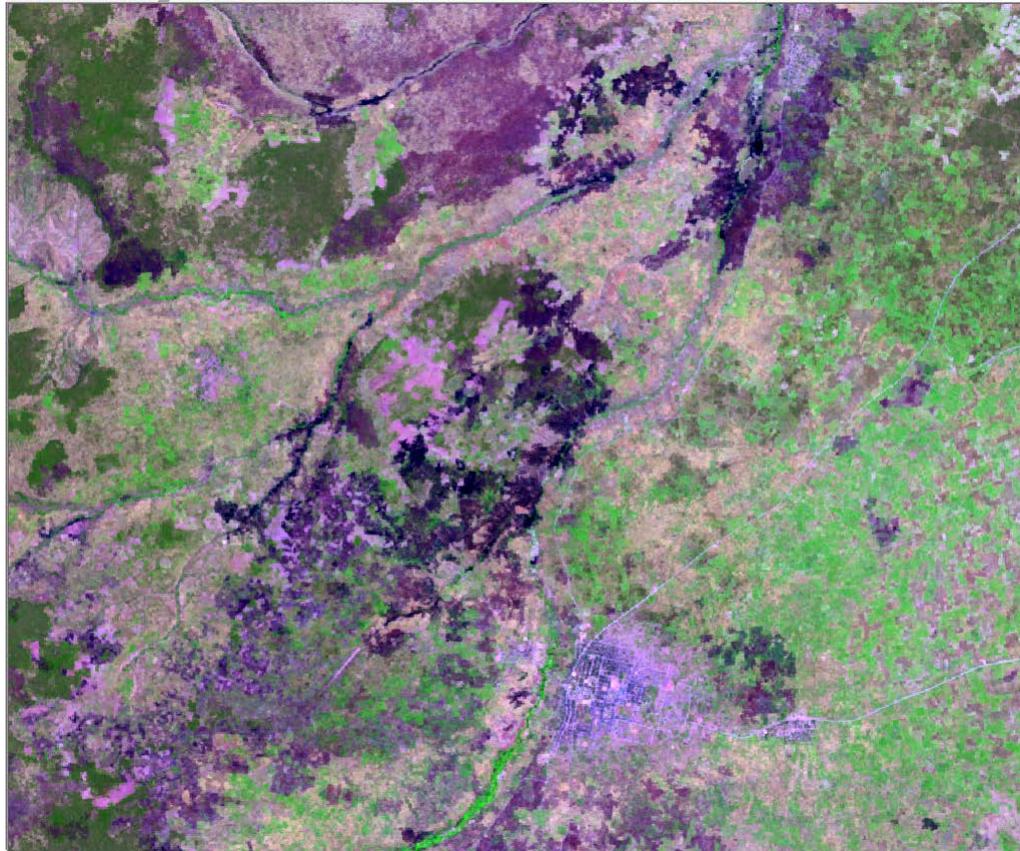


Sentinel-2 image
22 sept 2015

Land Cover map
from Landsat
near Kisangani, DRC



Dry Forests and savannah fires in Tanzania



*Towards a
Global burnt
area product?*

S-2 15th September / L-8 20th September

Specific highlights from initial assessment

Data and Access

- Need for tools for 'simple users' for acquisition of data
- Need for high level products such as monthly mosaics

Application to tropical forest monitoring

The high revisit frequency, choice of bands (SWIR) and resolution (10m) means that if rapid access to Sentinel 2 data is assured it will be a major tool in monitoring, mapping tropical forests and support countries in enforcing forest law.

Generally

Potential for new sets of products at regional scales: wet / dry season mosaics; burnt area; irrigated agriculture etc.

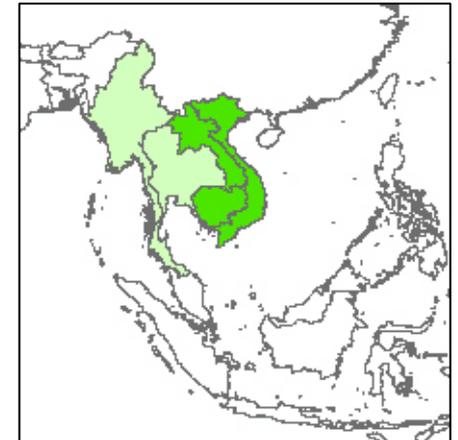
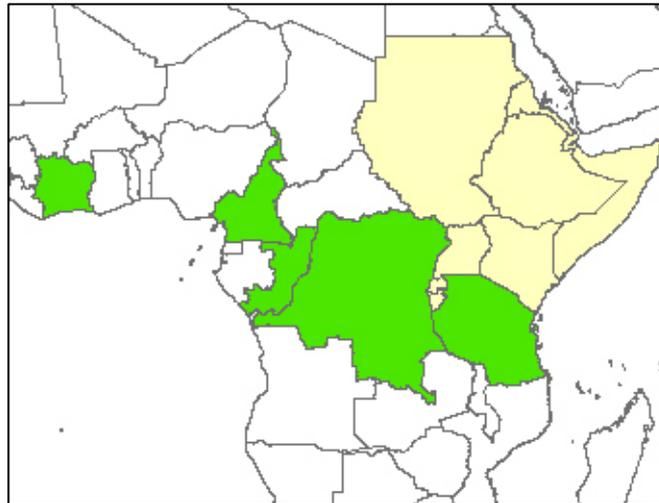
Sentinel-2 : perspectives for REDD+

One set of reference data with globally consistent approach with different levels of pre-processing:

- Level 1 data already available
- Level 2 data processed by the users with a toolbox
- Levels 2&3 data in the making: due in 2016 to fit the service to Copernicus user needs
- Level 4 (mapping and emissions): for 2017?

Should build upon available methodologies to estimate deforestation and forest degradation,

Partner countries In the ReCaREDD project



Thanks + a few recent refs



- **Increase in fire driven forest degradation in Mato Grosso, Brazilian Amazon, from 2000 to 2010**
Miettinen, J., Shimabukuro, YE et al (in press) *International Journal of Wildland Fire*
- **Monitoring deforestation and forest degradation in the context of REDD+; Lessons from Tanzania.**
Hojas-Gascón L et al. (2015) CIFOR InfoBrief No. 124, May 2015
- **First assessment on the potential of Sentinel-2 data for land area monitoring in Southeast Asian conditions.**
Miettinen, J et al. (2015) *Asian Journal of Geoinformatics* 15: (1) 23-30
- **Assessment of forest degradation in Brazilian Amazon due to selective logging and fires using time series of fraction images derived from Landsat**
Shimabukuro Y et al (2014) *Remote Sensing Letters*, 5:773-782
- **Remote sensing of forest degradation in Southeast Asia - aiming for a regional view through 5-30 m satellite data**
Miettinen J, Stibig H-J., Achard F (2014) *Global Ecology and Conservation* 2: 24–36
- **Can recent pan-tropical biomass maps be used to derive alternative Tier 1 values for reporting REDD+ activities?**
Langner A, Achard F, Grassi G (2014) *Environ. Res. Lett.* 9:124008