Big Earth Observation Analytics:

Rapid detection of illegal tropical deforestation and recovery

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E-Science ASDI RETURN & STW Big-EO-Analytics projects

UNIVERSITY OF COPENHAGEN

netherlands eScience center

UNIVERSIDADE FEDERAL DE SANTA CATARINA

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SATELLIGENCE

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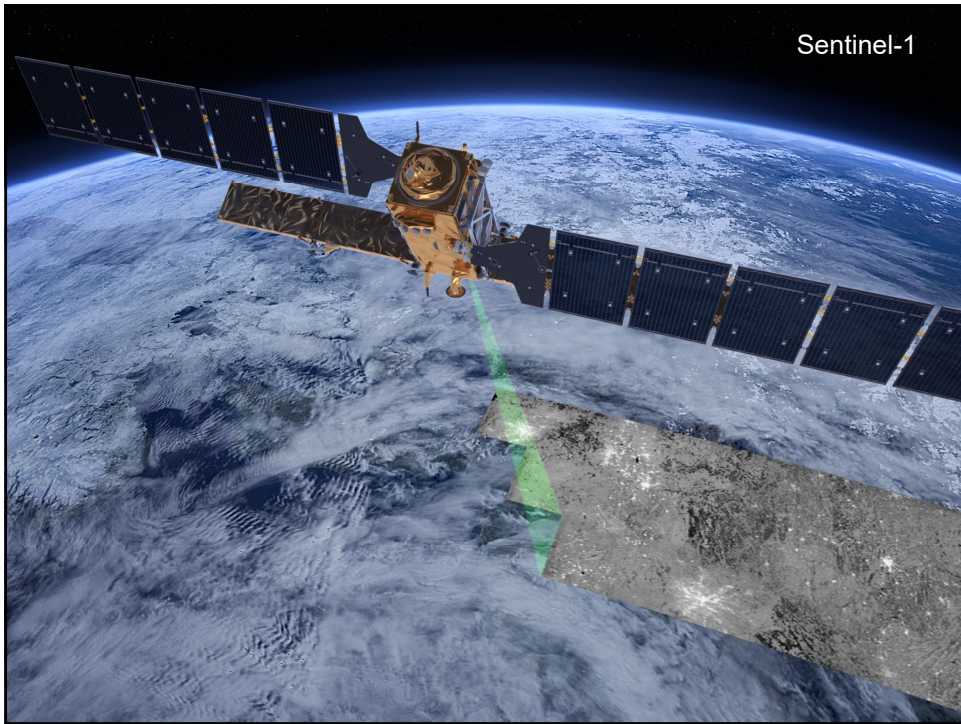UNIVERSITY & RESEARCH

New Sentinel-1 radar overcomes biggest monitoring limitation: clouds.
Global coverage since 2014

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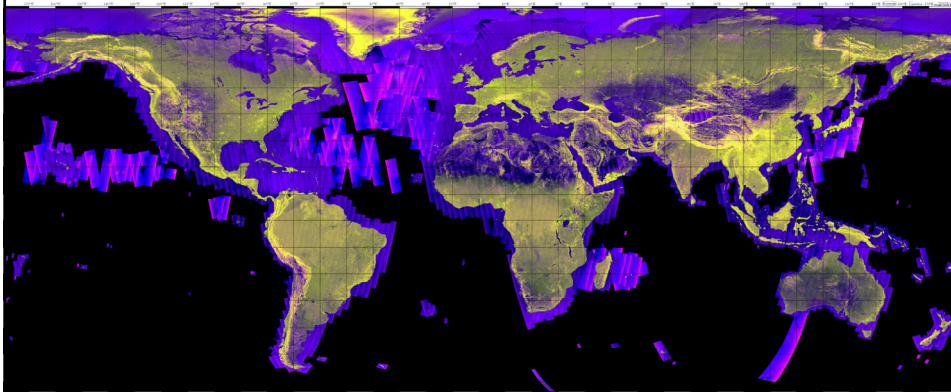
Sentinel-1

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Sentinel-1A and B radar

- Regular and consistent observations **every 6-12 days**

- **Reliable**: cloud-free information
  -> No information gaps

- High spatial **detail (10m)**, higher detail is not needed

- **Data continuity**: 10+ years data guaranteed

- Data **free** of charge

Example: 237 observations
Siak, Riau, Indonesia 2014 - 2018

Contains modified Copernicus Sentinel data 2014-2018. Processed by WUR and Satelligence.

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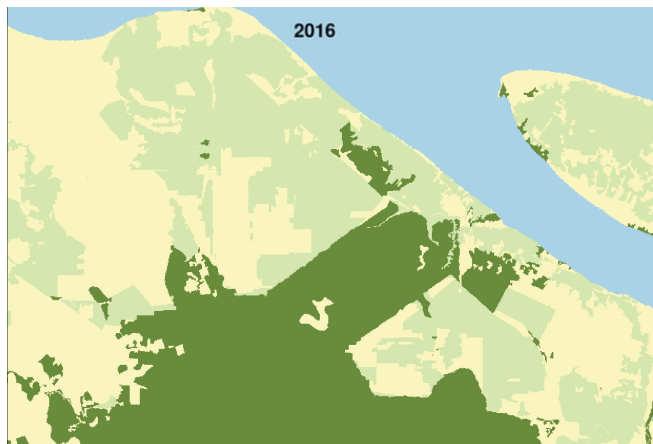SATELLIGENCE

WAGENINGEN
UNIVERSITY & RESEARCH
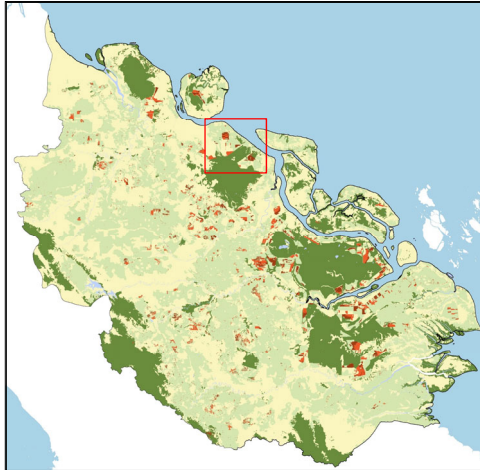
Radar alerts 2016-17, Riau, Indonesia

- Machine learning method based on Reiche et al. (2015, 2018; RSE)

○ Natural forest
○ Plantations
○ Old clearing
New clearing

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SATELLIGENCE

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2016

Radar alerts

- Machine learning method based on Reiche et al. (2015, 2018; RSE)

○ Natural forest
○ Plantations
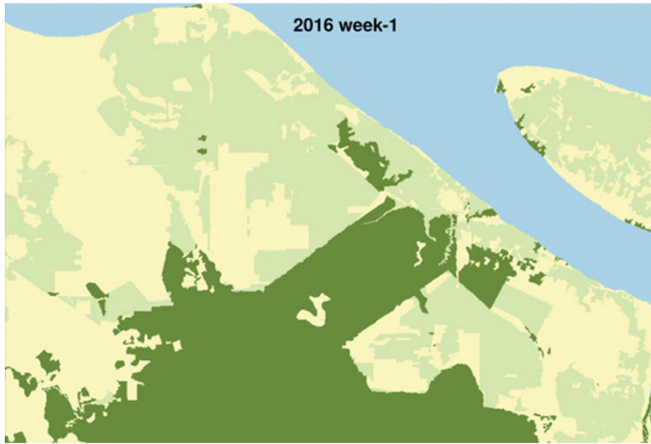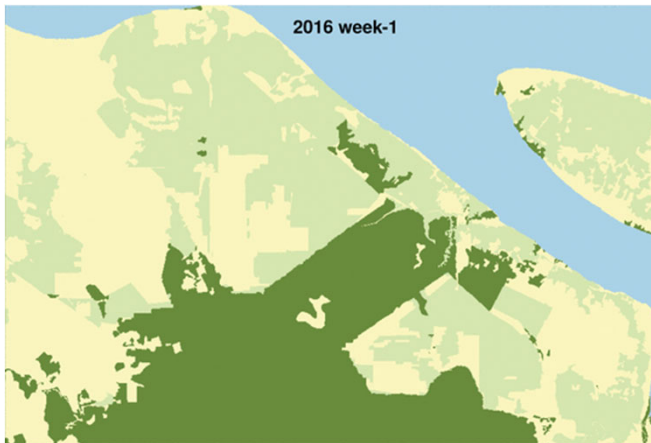○ Old clearing
New clearing

Example: Siak, Riau, Indonesia   Contains modified Copernicus Sentinel data 2014-2018. Processed by WUR and Satelligence.

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7

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New recovery measures?

RRI = recovery magnitude / impact

BFAST

Planting and regrowth in 2001
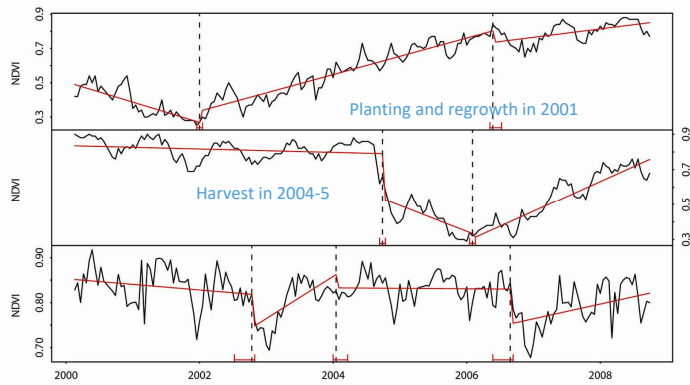
Harvest in 2004-5

Drought stress in 2003 and tree Mortality in 2007
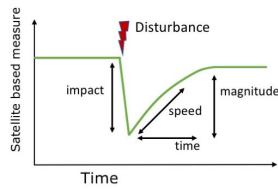
BFAST, Verbesselt, J., et al. (2010). Detecting trend and seasonal changes in satellite image time series. RSE.
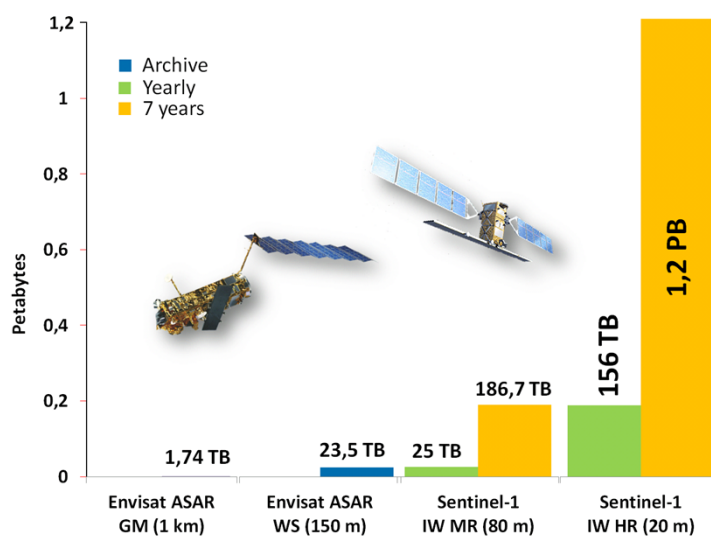
https://github.com/bfast2
BFAST GPU // Python

Big Earth observation data amounts

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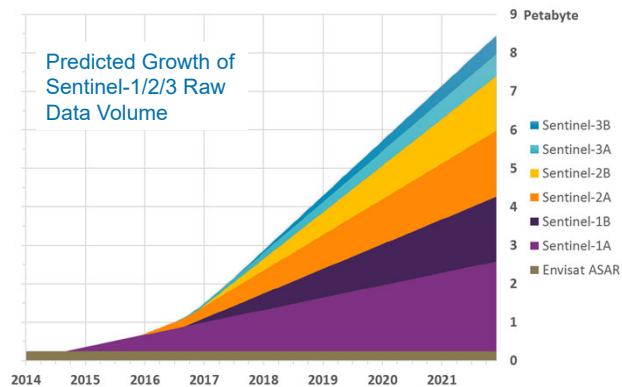## From ENVISAT ASAR to Sentinel-1

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Towards a New Era in Earth Observation

- Volume and diversity of EO data is growing fast
- **Bringing the users and their software to the data**
    rather than vice versa becomes inevitable

Predicted Growth of Sentinel-1/2/3 Raw Data Volume

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The Formation of a Network of EO Cloud Platforms

- Reaching a critical mass is essential for survival
- How to scale up?
    - Venture capital → Google, Amazon, …
    - Public investments → Copernicus DIAS, ESA Open Data Cube
    - Cooperatives → EODC, Science Centres
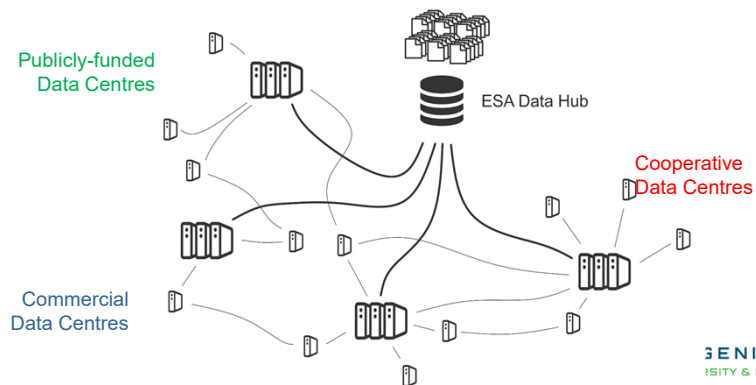
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ASDI RETURN - Scaling recovery capacity

- Scaling algorithms: need for distributed computing frameworks and tools

Analysis ready Sentinel-1 data from GEE

Download

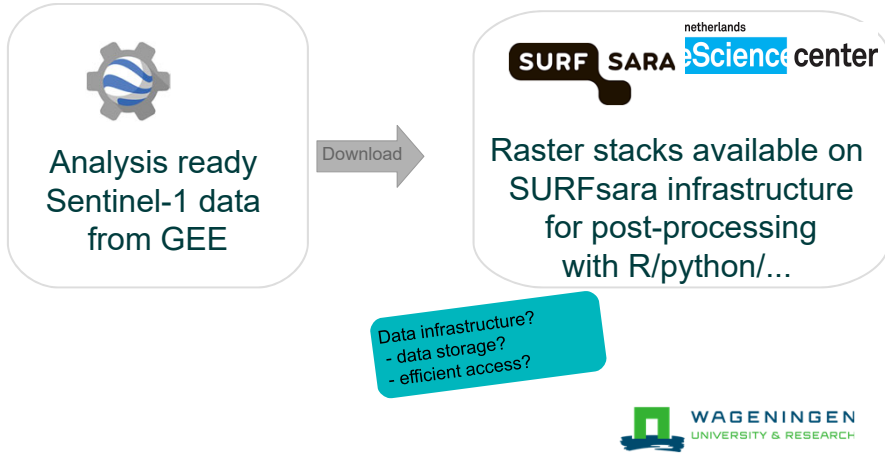Raster stacks available on SURFsara infrastructure for post-processing with R/python/...

Data infrastructure?
- data storage?
- efficient access?

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Vision: ARD ready S1 data for the pan-tropics

AGB (Mg/ha)
0
0 - 10
10 - 25
25 - 50
50 - 75
75 - 100
100 - 150
150 - 200
200 - 300
300 - 400
400 - 500
500 - 620

16
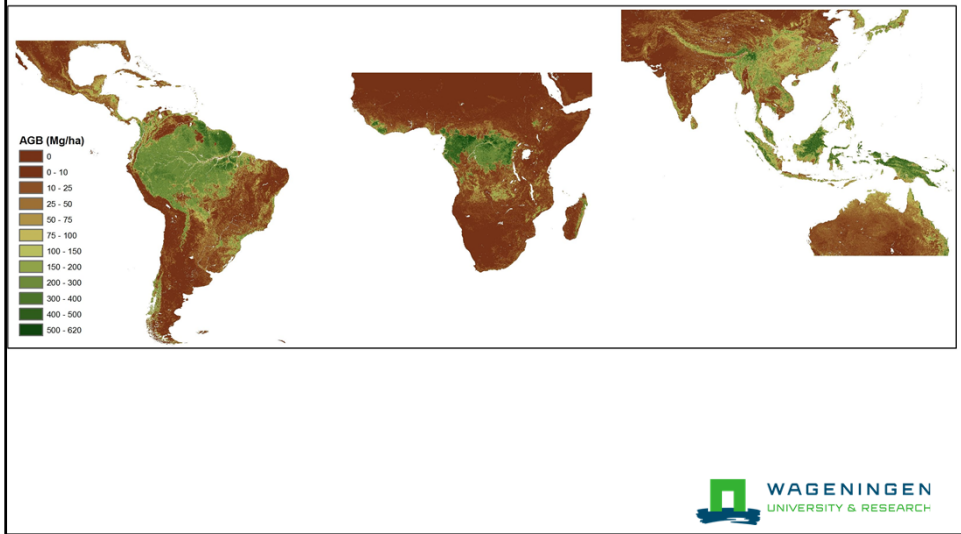
Slide 15

VJ3 @wanda: kan deze slide eventueel wat uitgebreid worden.
Verbesselt, Jan, 02/10/2019

Slide 16

VJ3 @wanda: kan deze slide eventueel wat uitgebreid worden.
Verbesselt, Jan, 02/10/2019

Discussion & thanks

What is the best way to gain access to ARD ready Sentinel data?

Ongoing projects:

- ASDI RETURN project (2019-2021)
  https://www.esciencecenter.nl/project/monitoring-tropical-forest-recovery-capacity-using-radar-sentinel-satellite
- NWO STW Big-EO-Analytics project 15839 (2019-20
    - https://big-eo-analytics.gitlab.io/
- H2020 Open-EO project (2018-2021)
    - http://openeo.org/about/
    - European solution for opening up access to EO data
    - H2020: EO-2017 Number 776242 "openEO"
    - openEO develops an open API to connect R, python, javascript and other clients to big Earth observation cloud back-ends in a simple and unified way

Thanks
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https://github.com/bfast2

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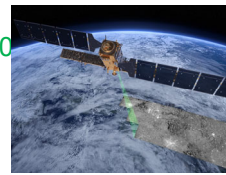
KEEPING AN EYE ON THE WORLD
FROM THE HEART OF EUROPE
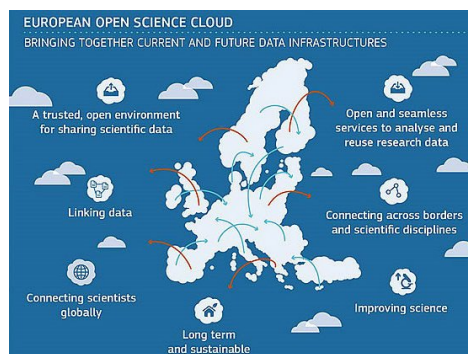
11 - 16 July 2021
in Brussels

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EO cloud platforms?

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How to Organise Collaboration? - HPC versus Data

- HPC, metadata and some selected data sets can be organised nationally
  - Same/similar requirements for a wide range of applications

- Science does not stop at borders → scientific data centres must transgress national boundaries

EUROPEAN OPEN SCIENCE CLOUD
BRINGING TOGETHER CURRENT AND FUTURE DATA INFRASTRUCTURES

A trusted, open environment for sharing scientific data

Open and seamless services to analyse and reuse research data

Linking data

Connecting across borders and scientific disciplines

Connecting scientists globally

Improving science

Long term and sustainable

- Earth observation is by its nature a global undertaking
  - Organisation along thematic topics
    - Sensors
    - Geoscientific disciplines

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