

Study on Copernicus Sentinels' Products Economic Value

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Workshop: *Exploiting the value in EO data*
Geospatial World Forum
26 May 2016, Rotterdam

- **Copernicus Sentinels**
 - Short introduction and current status

- **The study on the economic value of Copernicus Sentinels data**
 - Rationale, approach, strengths and further developments

Sentinel missions



SENTINEL-6
Altimetry Mission



SENTINEL-5
LEO Atmospheric
Chemistry Mission



SENTINEL-5P LEO Atmospheric
Chemistry Mission



SENTINEL-4 GEO Atmospheric
Chemistry Mission



SENTINEL-3 MR Optical and
Altimetry Mission



SENTINEL-2 HR Optical Mission



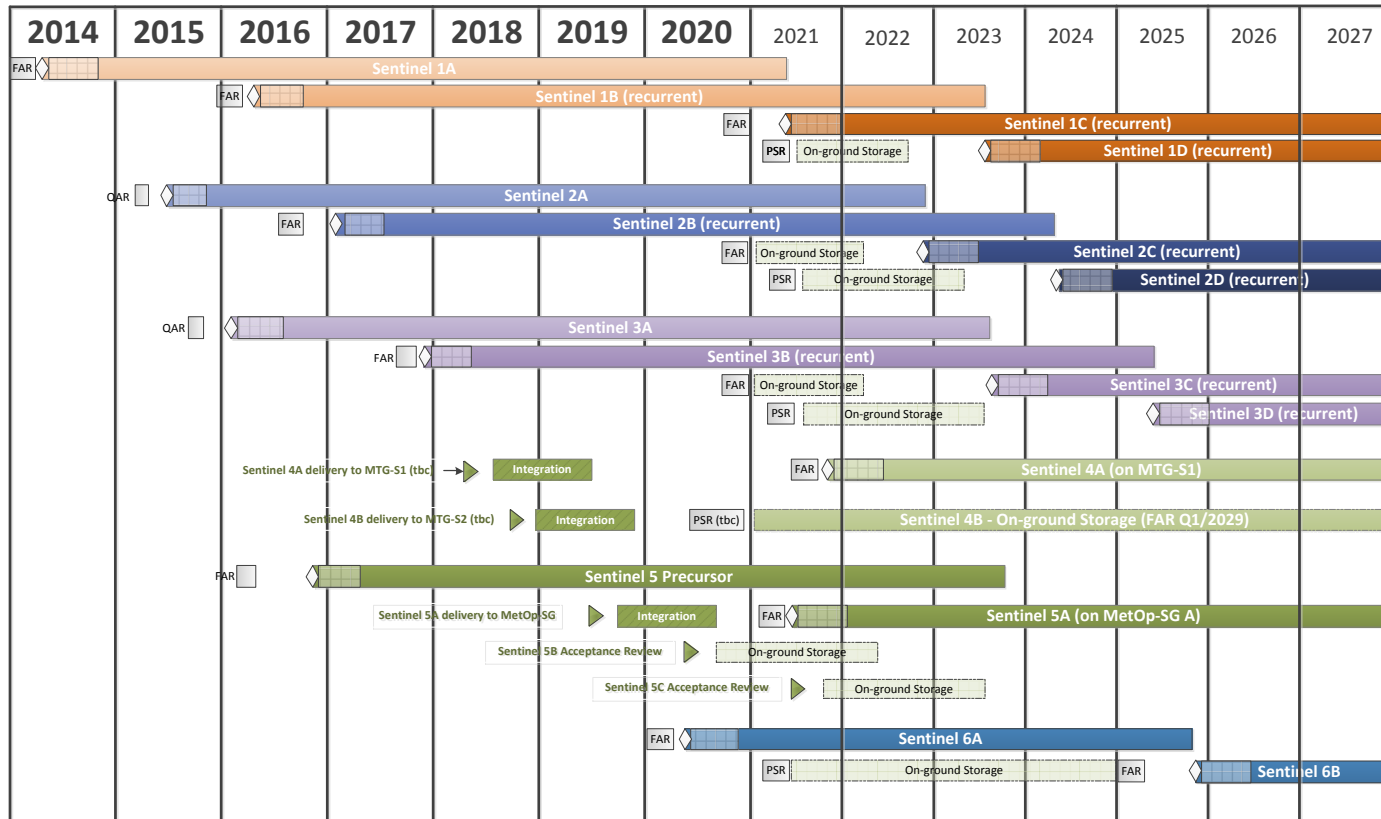
SENTINEL-1 Radar Mission



Sentinels tentative deployment schedule



Copernicus Constellation Deployment Schedule



Legend:
 ■ Qualification Acceptance Review (QAR)
 ■ Flight Acceptance Review (FAR) or PreStorage Review (PSR)
 ■ On-ground Storage
 ◇ Tentative launch date
 ■ In-orbit Commissioning

Status: 22 March 2016

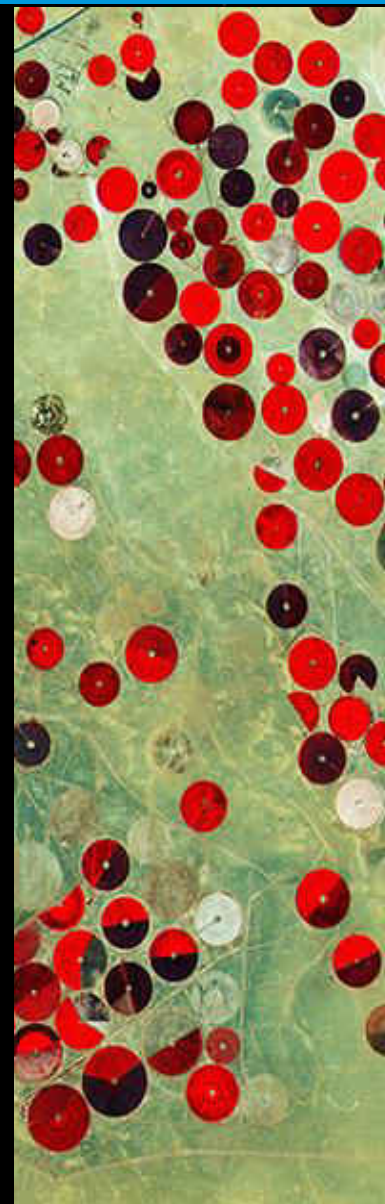
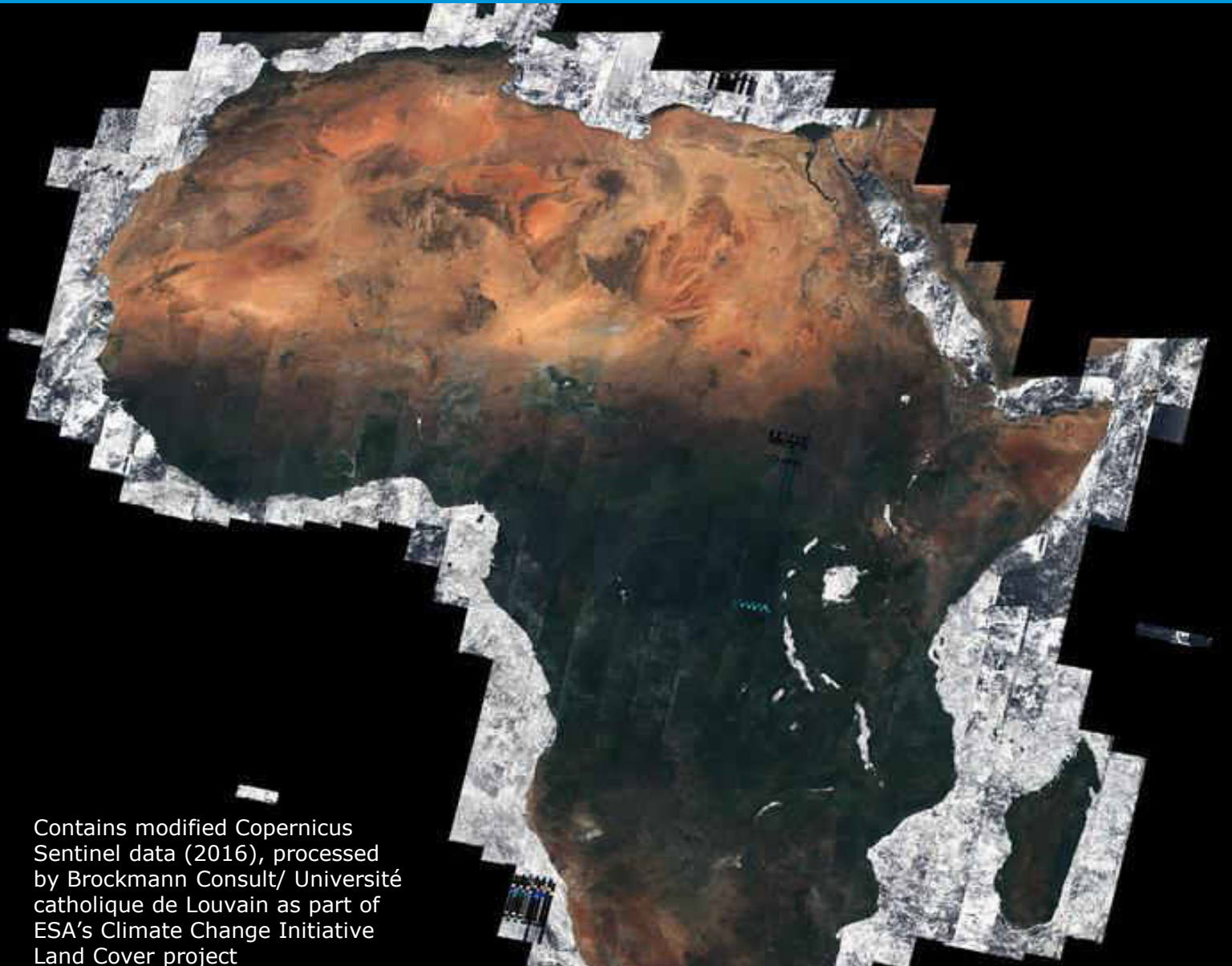
European Space Agency



Sentinel-1 Mission

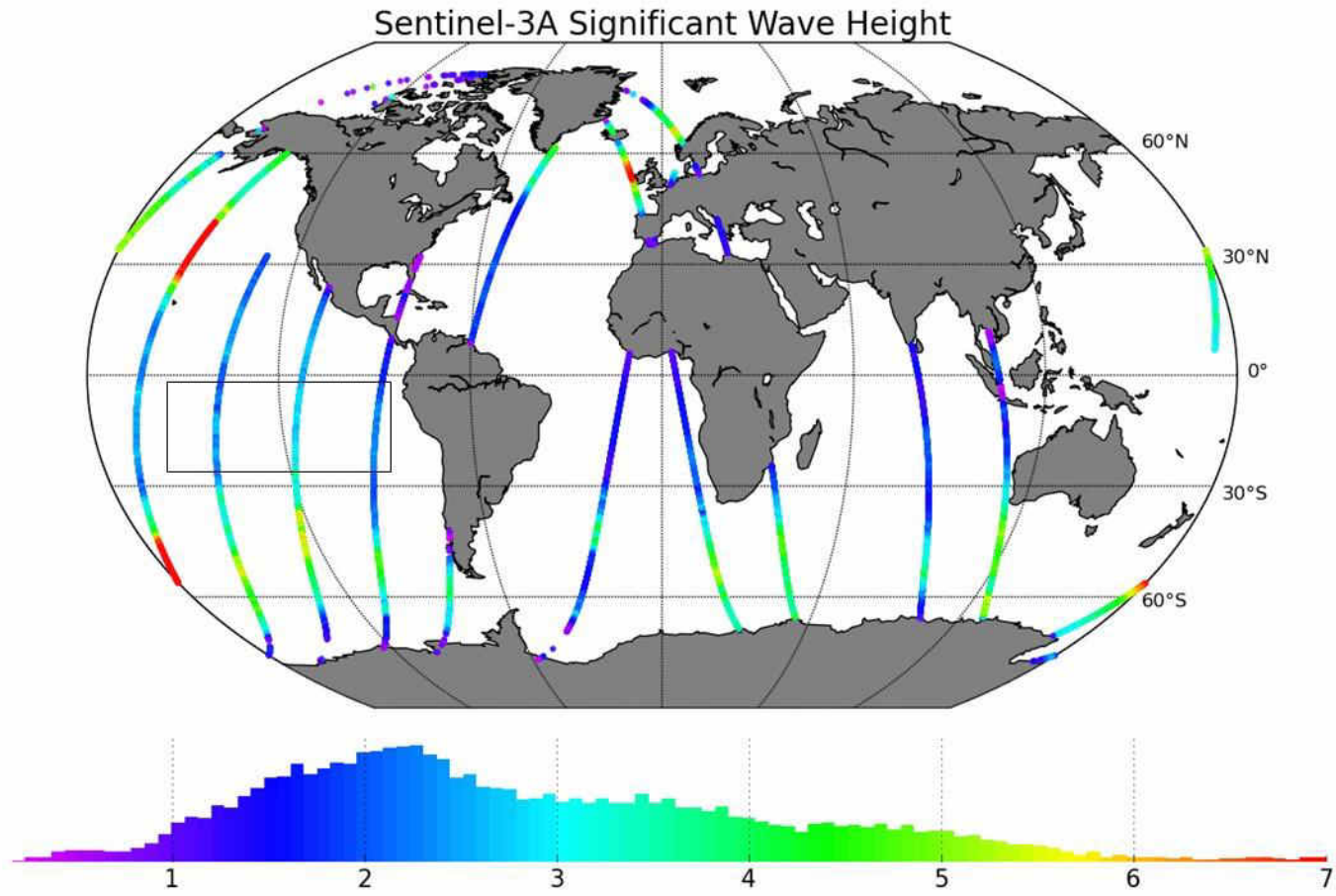


Sentinel-2 Mission



Contains modified Copernicus Sentinel data (2016), processed by Brockmann Consult/ Université catholique de Louvain as part of ESA's Climate Change Initiative Land Cover project

Sentinel-3 Mission



Copernicus Sentinel data (2016)

Sentinel-5P Mission



- Low Earth orbiting satellite, embarking a UV-VIS-NIR-SWIR spectrometer payload derived through tailoring of Sentinel-5 specifications
- Systematic acquisition with systematic processing and publication according to pre-defined product types
- Applications include monitoring of atmospheric chemistry, with advanced capabilities to study tropospheric variability
- UVN module of TROPOMI provided as a national contribution by the Netherlands

[Link to Sentinel-3 Web Pages](#)

Sentinel data are available:

- Over a very long term
- Systematically, in an operational fashion
- Open and free

ESA implements on line access to Sentinel products via dedicated data hubs

Open access data hub <https://scihub.copernicus.eu>



- On-line self-registration
- Free access to ALL products (>560000 today)
- Powerful API interface
- Open source SW (incl. toolbox)

Additional data access hubs deployed to provide tailored services to specific users, e.g. EU/ESA Member States, International Partners



Sentinel data access tools @ ESA



Display 1 to 125 of 498807 products.

S2A MSI S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V...
Download URL: <https://scihub.copernicus.eu/athus/data/v1/Products/>
Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-04-05T22:1

S2A MSI S2A_OPER_PRD_MSILC_PDMC_20160407T115324_R114_V...
Download URL: <https://scihub.copernicus.eu/athus/data/v1/Products/>
Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-04-05T20:3

S2A MSI S2A_OPER_PRD_MSILC_PDMC_20160407T115330_R114_V...
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Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-04-05T16:5

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Download URL: <https://scihub.copernicus.eu/athus/data/v1/Products/>
Mission: Sentinel-1; Instrument: SAR-C; Sensing Date: 2016-04-07T0

S1A SAR-C S1A_IW_GRDH_1SDV_20160407T091144_20160407T09120...
Download URL: <https://scihub.copernicus.eu/athus/data/v1/Products/>
Mission: Sentinel-1; Instrument: SAR-C; Sensing Date: 2016-04-07T0

Products per page: 125 << page: 1 of 3991 >> CLOSE

Data Hub web graphic Interface
<https://scihub.copernicus.eu>

Open Data Protocol (OData)

The Open Data Protocol (OData) enables the creation of REST-based data services, which allow resources, identified using Uniform Resource Identifiers (URIs) and defined in a data model, to be published and consumed by Web clients using simple HTTP messages.

The OData protocol provides easy access to the Data Hub and can be used for building URI for performing search queries and product downloads offering to the users the capability to remotely run scripts in batch mode.

URI Components

A URI used by an OData service has up to three significant parts: the service root URI, resource path and query string syntax:

```
<Scheme>://<Host>/<ServiceRoot>/<ResourcePath>?<QueryOptions>[&query=<query>]&[options]
```

where:

- <Scheme>: Identifies the protocol used to access the service.
- <Host>: Identifies the host name of the service.
- <ServiceRoot>: Identifies the root of the OData service.
- <ResourcePath>: Identifies the resource to be accessed.
- <QueryOptions>: Identifies the query options used to filter the data.

OData Query String Syntax

OData Query String Syntax is defined by the OData protocol. The query string syntax is defined by the OData protocol.

Examples of OData URIs for the Sentinel Data Hub:

- `https://scihub.copernicus.eu/athus/data/v1/Products/S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V...` - Get the product S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V...
- `https://scihub.copernicus.eu/athus/data/v1/Products/S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V...?&query=*&orderby=SensorFootprintArea` - Get the product S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V... sorted by SensorFootprintArea.
- `https://scihub.copernicus.eu/athus/data/v1/Products/S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V...?&query=*&orderby=SensorFootprintArea&select=SensorFootprintArea` - Get the product S2A_OPER_PRD_MSILC_PDMC_20160407T123928_R115_V... sorted by SensorFootprintArea and only the SensorFootprintArea property is returned.

Data Hub APIs interface

SNAP Sentinel toolbox

SNAP | Sentinels Application Platform

SENTINEL TOOLBOX

SNAP | Sentinels Application Platform

Data Hub Server available as open source software
<https://github.com/SentinelDataHub/DataHubSystem>.

Sentinel Toolbox available as open source software
<https://github.com/senbox-org>



Data access stats from the open and free data hub



> 500,000
products
available

> 30,000
Registered
users

➤ 4 Million
products
downloaded

> 4,7 PByte
Data volume
downloaded

Archive
Exploitation
Ratio
>5

SciHub statistics at April 7, 2015

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1. Copernicus shall contribute to the following general objectives:
 - (a) monitoring the Earth to support the protection of the environment and the efforts of civil protection and civil security;
 - (b) maximising socio-economic benefits, thereby supporting the Europe 2020 strategy and its objectives of smart, sustainable and inclusive growth by promoting the use of Earth observation in applications and services;

[Copernicus Regulation, Art.4.1]

Various ex-ante studies foresee important benefits brought from the Copernicus Programme

Benefits are expected from Sentinels: their demonstration is vital to support further user uptake and to sustain investments

- Wide acceptance of space-based solutions as a supporting tool for (non-space) end users remains the main weakness of EO services development
- EO market structure relatively poorly consolidated with a limited number of identified “mature”, self-sustained operational uses
- Copernicus, with its operational, long-term sustained data provision and its open and free data policy is expected to boost EO applications
- Copernicus may change the traditional EO operational paradigms (e.g. time to business, entry barriers): benefits estimation requires new approaches to be developed and maintained in the long term

Rationale for the approach

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Global comprehensive figures, Linkable to consolidated registries

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Very broad assumptions

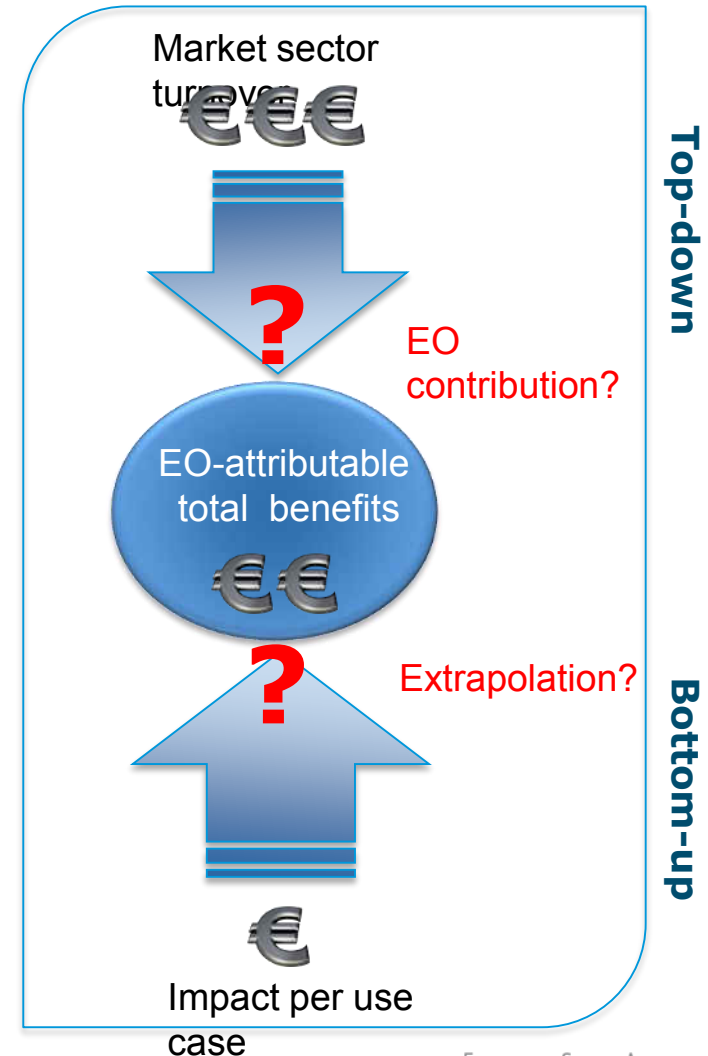
Complementary approaches, potentially supporting mutual modelling improvements and asymptotically converging in the very long term.

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Limited to analysed use cases

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Strong link with EO technology; Reduced uncertainty (for the selected cases)



- Bottom up approaches, taking into account the specificities of the users and data use, can provide important indications for technological developments and valuable examples of successful exploitation, potentially stimulating further user uptake.
- EO-derived benefits should be systematically monitored, via both top-down and bottom-up approaches

ESA contract started with EARSC on Jan 2015: *“Assessing the detailed economic benefits derived from Copernicus Earth Observation data within selected value chains: a bottom-up study survey”*

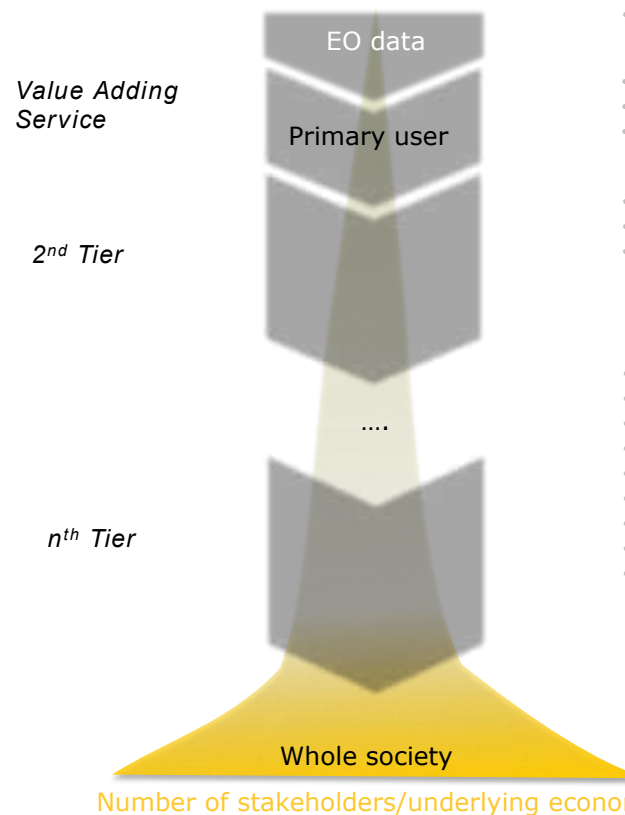
Study winning tips

- Value chain approach
- Based on concrete experience of people working in the field
- Explicit assumptions, models and uncertainties



"From satellites to citizens"

- It is at least as important to understand the mechanisms through which EO data affect economy and society as the precise estimates themselves.
- The value chain approach developed for the study seems effective in showing these mechanisms.



The contribution of stakeholders is key to obtain reliable figures and showcase benefits in a most convincing way

Acknowledgments:

We should like to thank the following people for their assistance in preparing this report:

- Patrick Eriksson, [Eero Rinne](#), [Marja-Liisa Tuomola](#); Finnish Meteorological Institute
- Jarkko Toivola, [Esa Pasanen](#), [Antti Arkima](#); Finnish Traffic Agency
- Ulf Gullne, [Johny Lindvall](#); Swedish Maritime Administration
- Markus [Karjalainen](#); [Arctia](#) Shipping
- Robin Berglund; VTT
- [Pentti Kujala](#); Aalto University
- [Jukka Kallio](#); Port of Helsinki
- [Mikaela Dahlman-Tamm](#); [Sveriges Forskningsforbund](#)
- Erik [Willen](#); The Forest Research Institute of Sweden, [Skogforsk](#)
- [Anders Persson](#), [Patrick André](#); Swedish Forest Agency (SFA)
- [Ola Inghe](#), [Ninni Boren](#); Swedish Environment Protection Agency
- [Sandra Wennberg](#), [Peter Svedberg](#), [Erik Sjoberg](#); [Metria](#)
- [Johan Viklund](#); SCA Skog (timber company)
- [Stellan Torshage](#); Holmen (timber company)
- [Johanna Ehlin](#); County Administration Board, [Lansstyrelsen Gavleborg](#)
- [Ivor Visser](#); [Stedin](#) part of the [Eneco](#) Group.
- [Jurien den Besten](#); [Oasen](#) N.V.
- [Jos Maccabani](#); [SkyGEO](#) Netherlands B.V.

  EARSC Economic Value Study @ ESA Living Planet; 12th May 2016 

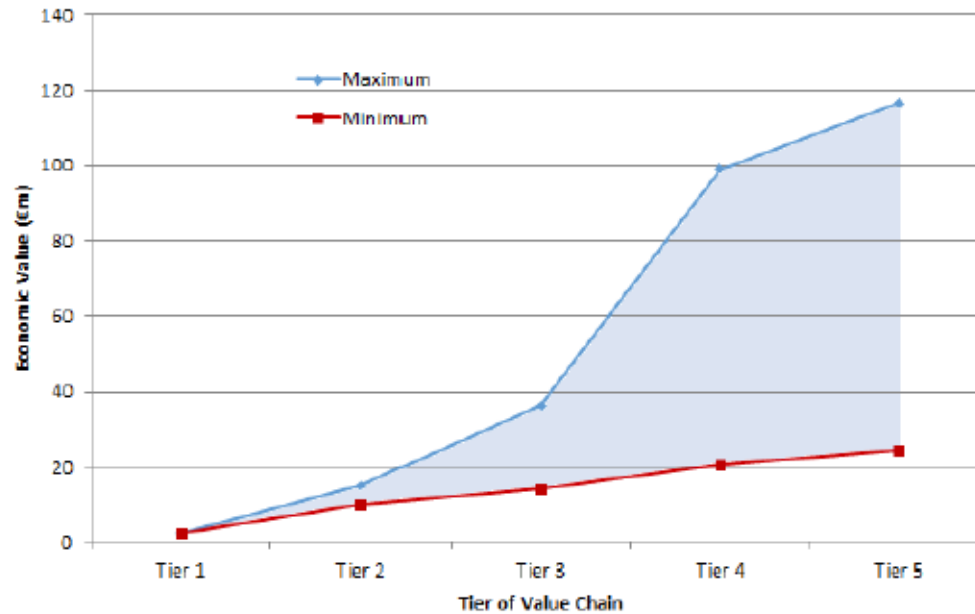


Figure 9-2: Cumulative economic value at each tier of the value chain per annum

[from EARSC Report, 2015]

Direct revenues from primary users is just the tip of the iceberg

What's next?



- The study is mostly based on results from pre-Sentinels era: operational paradigm changes might be difficult to anticipate
→ time validity of the collected figures might be limited
- Copernicus satellite infrastructure is being progressively deployed
→ meaningful assessments for Copernicus can only be planned in the long run
- In the long run, the accumulation of a sufficiently rich set of case studies (across different applications, scales of assessment and geographic areas) might allow a comprehensive overview
- New contract framework envisaged extending over four years, to set the basis for future systematic assessments (IITT published on EMITS and TED)

Conclusions



- Beyond the hard figures, the study convincingly shows that there is a traceable impact linking satellite imagery to the local economy and society (“from satellites to supermarkets”)
- The methodology looks promising and worth to be enlarged to showcase additional value chains and benefits types
- The demonstration of Sentinels-derived benefits is vital to support further user uptake and to sustain investments
- This requires new approaches and cooperation with core stakeholders and beneficiaries

**Thank you
for your kind attention**

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