



Value in EO Workshop

Round Table V: Measuring impacts on
advancements in understanding (in science and
technology)

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Focusing on scientific and technological impacts

RT V: Science and Technology

	ECONOMIC	ENVIRONMENTAL	REGULATORY	INNOVATION & ENTREPRENEURSHIP	SCIENCE & TECHNOLOGY
Farming in Denmark	☆☆☆	☆☆☆	☆☆☆	☆☆☆☆☆	☆
Flood management in Ireland	☆☆☆	☆	☆	☆	☆
Ice navigation off Greenland	☆☆☆☆	☆☆	☆	☆	☆☆☆
Farming in Poland	☆☆☆	☆☆☆	☆☆☆	☆☆☆☆☆	☆
Winter navigation in the Baltic	☆☆☆☆☆	☆	☆	☆	☆
Forestry management in Sweden	☆☆☆	☆	☆☆☆☆☆	☆☆	☆☆
Infrastructure management in the Netherlands	☆☆☆☆	☆	☆	☆☆☆	☆
Growing potatoes in Belgium	☆☆☆	☆☆☆	☆☆	☆☆☆	☆☆☆



Advancing the understanding and measurement of the societal benefits of Earth Observations, Rome, July 2019



Impacts on science and technology

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How can we identify the impacts of EO on science and technology?

- Potential signals include:
 - Academic output
 - Utilisation in R&D projects
 - Human capital (e.g. researchers and students)
 - Applied science leading to operational services

Challenges:

- Isolating specific programmes and removing false positives
- Attribution / causality
- Impact via data applications

Measurements of science and technology

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Category	What it can mean	Examples of possible indicators/markers	Measurement approaches
Human capital	EO data subject of high-level education	Number of researchers Number of EO/RS courses Number of students on courses	University databases/desk research
Research and development	EO data used in R&D projects	Number of R&D projects using Sentinels data (outside from space Calls)	Open data on projects + semi-automated classification

Measurements of science and technology

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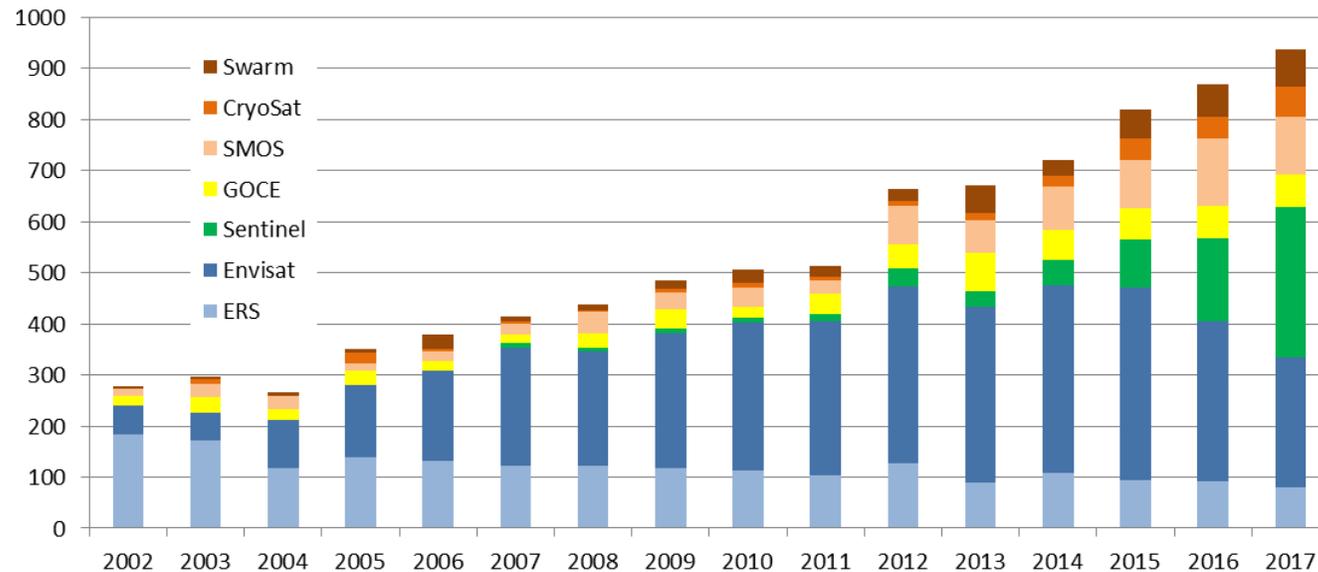
Category	What it can mean	Examples of possible indicators/markers	Measurement approaches
Applied science to operational services	Sentinels data used within research centres to develop operational services	Research institutes contribution in the SEBS use cases	Interviews with stakeholders



Measurements of science and technology

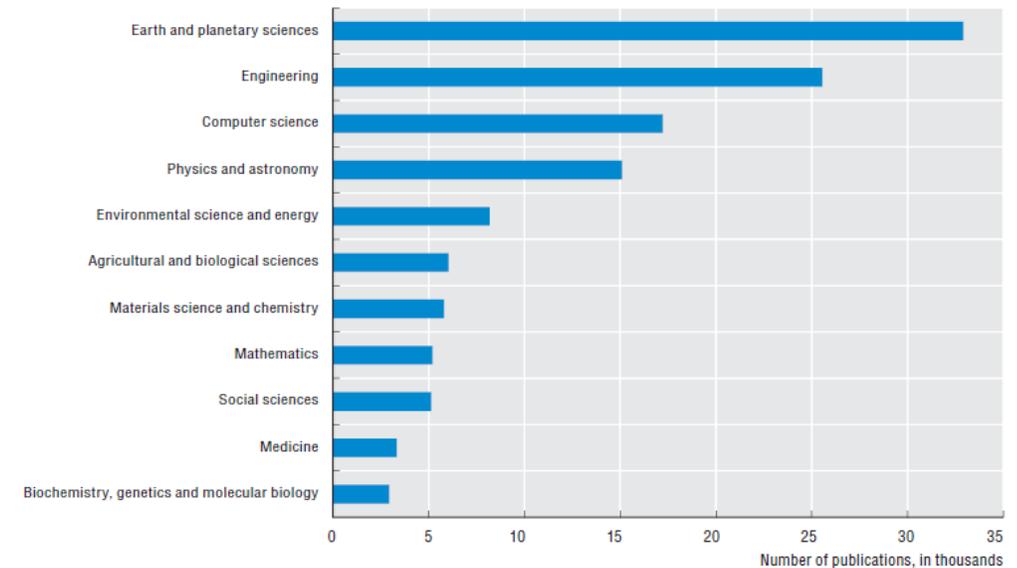
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Category	What it can mean	Examples of possible indicators/markers	Measurement approaches
Academic output	EO data used to perform scientific research	Number of scientific publications Number of theses (PhD, Master's)	Bibliometrics



16.2. Scientific production in satellite technologies by subject area

Number of publications, 2008-13



ESA/Albani (2018) ESA User Metrics, Presentation at 3rd GEOSS Data Providers Workshop

OECD (2014), The Space Economy at a Glance



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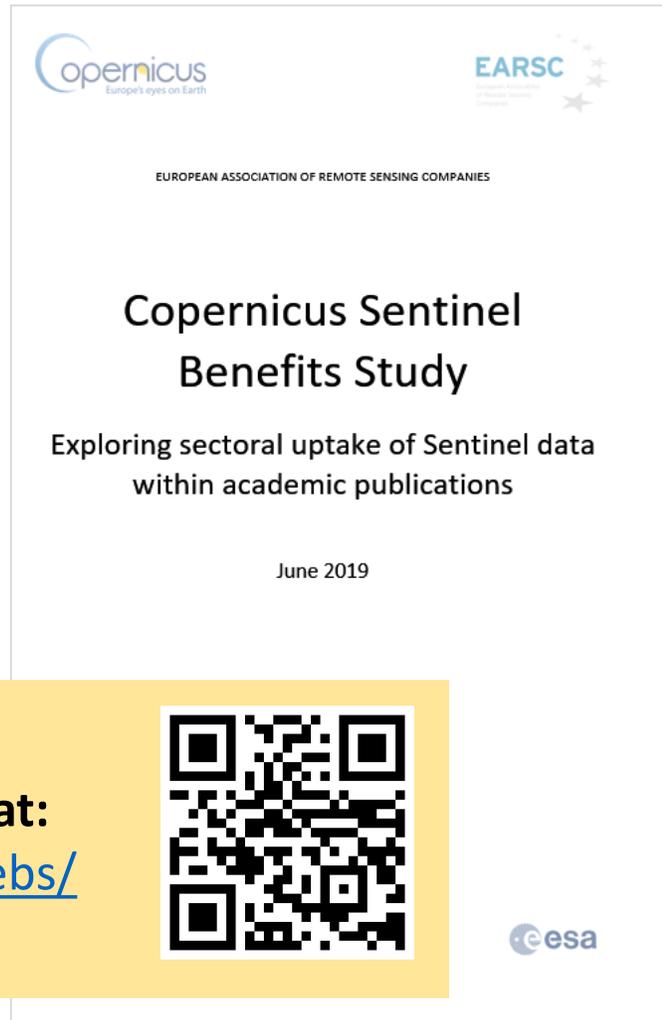


What have we done? Study overview

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Exploring sectoral uptake of Sentinel data within academic publications

- Approach: Bibliometric indicators on academic output related to Sentinels (1998-2018+2019 Q1)
- Aims: Develop an understanding of how Copernicus Sentinel data is being exploited within academic, scientific and research contexts
- Key dimensions: **Thematic/EO-related**, volume/rate of publications, mode of use, **nature of link to Sentinels**, authorship and geography.



>70M
Records searched

~2500
Publications analysed

Report available at:
<http://earscl.org/Sebs/>



esa

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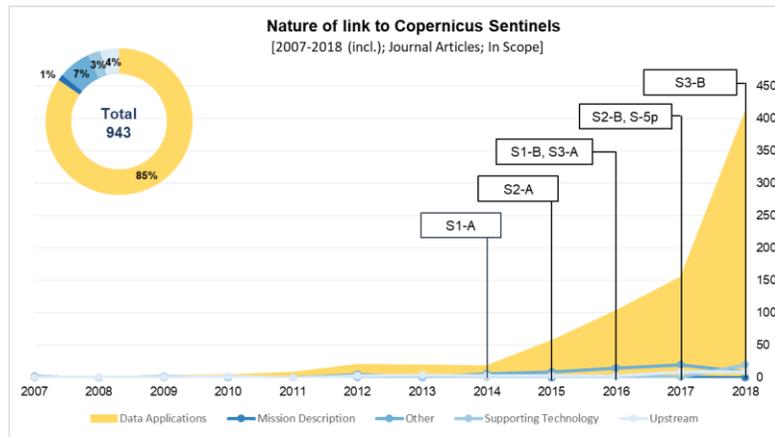
What have we done? Methodology

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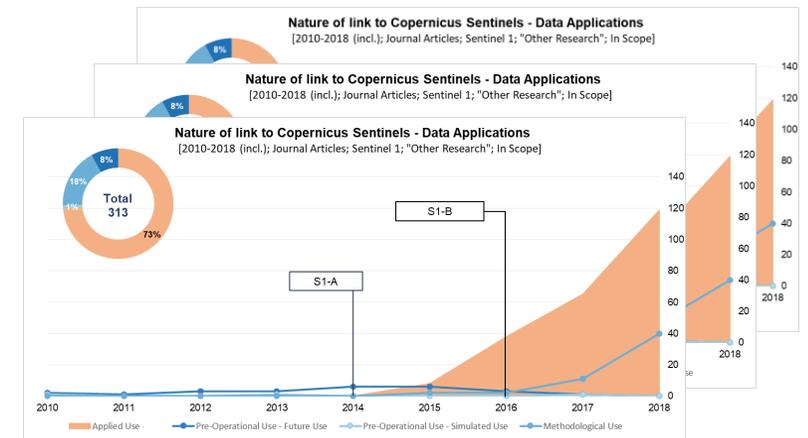
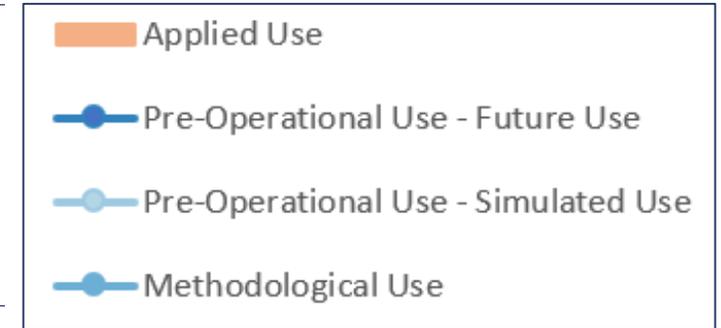
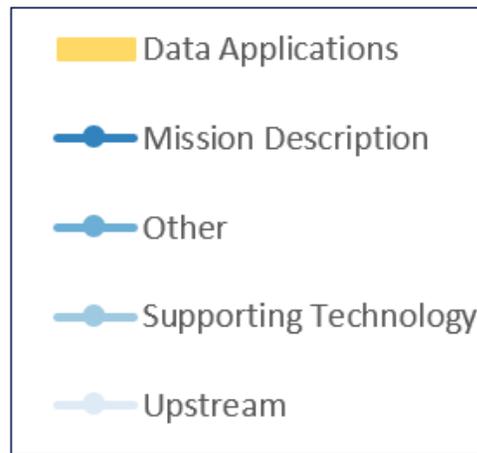
- 1. Data acquisition:** Dataset of published materials from Scopus (keywords: “Copernicus” “Sentinel”, “satellite”)
- 2. Filtering and exclusions:** Removing duplicate/irrelevant entries, validation and quality control
- 3. Source characterisation:** Characterising publication sources based on quality, subject areas and thematic nature
- 4. Classification of records:** Range of dimensions, including nature of their link with the Copernicus Sentinels, publication context, and application area.
- 5. Analysis and interpretation:** Examining relationships between categories, querying and extracting insights and conclusions: conferences and journal papers separately.

What have we done? Methodology

Nature of link to Sentinel data



Journals vs Conferences

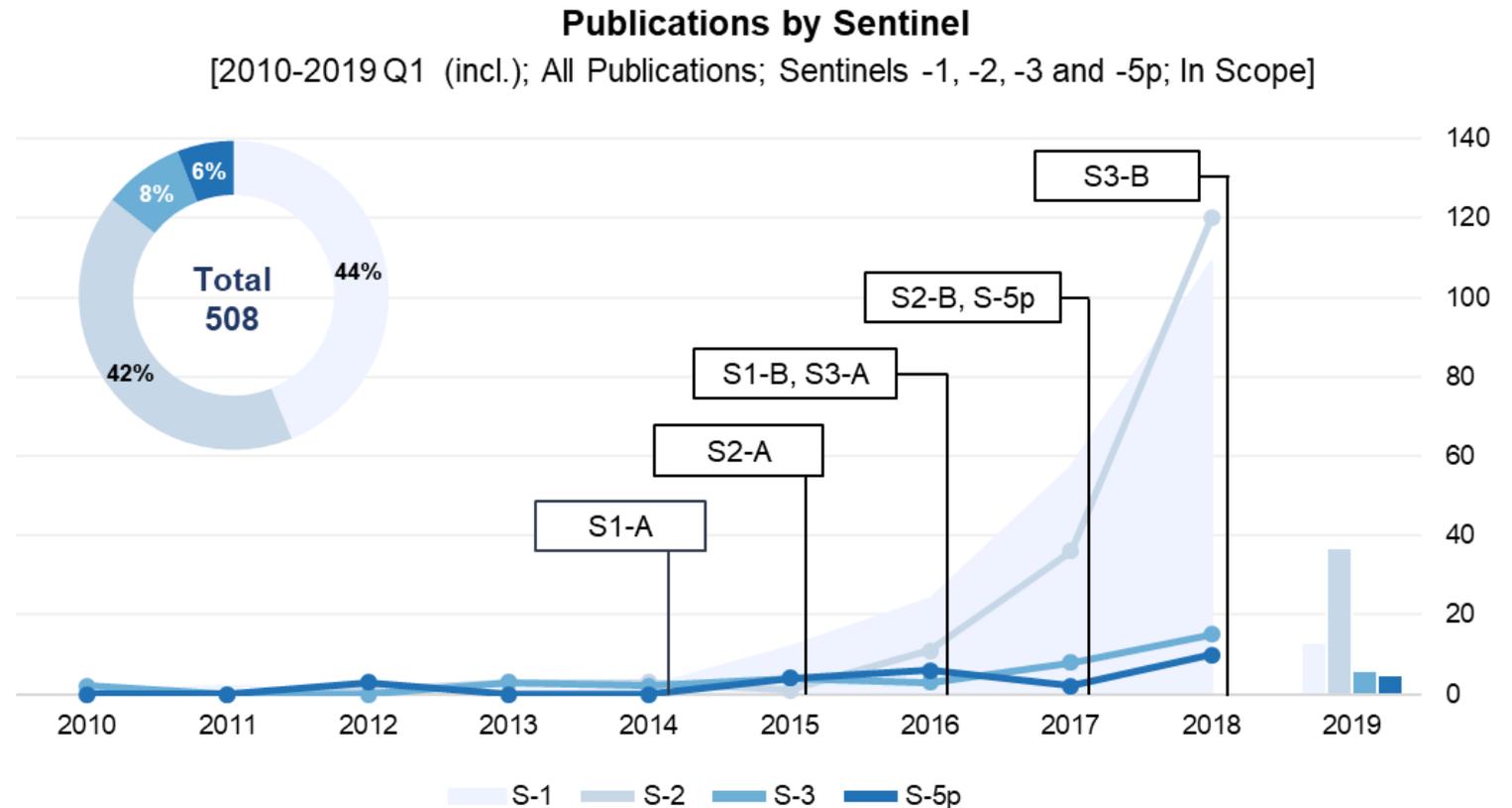


By Sentinel

What have we learned?

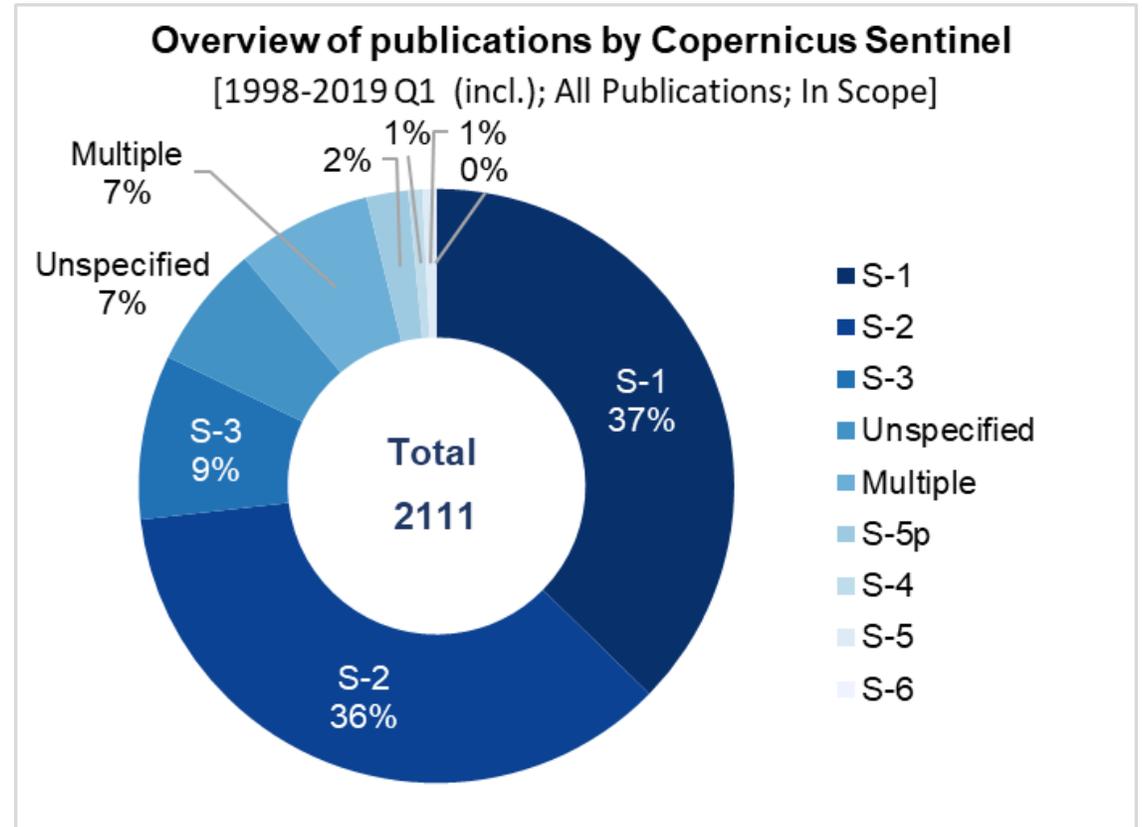
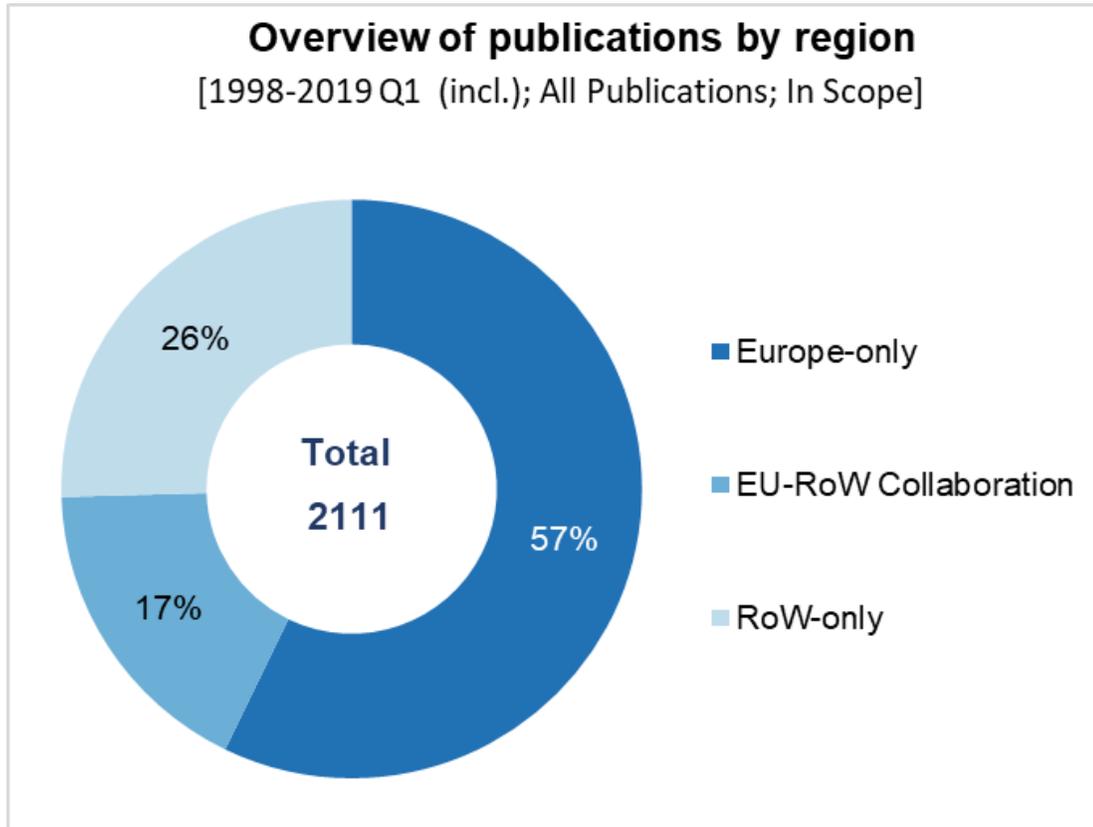
Publications by Sentinel

- The total volume of publications in 2018, at 770 publications of both types, more than doubled the 2017 watermark
- Publications on Sentinel-2 overtook Sentinel-1 for the first time in 2018



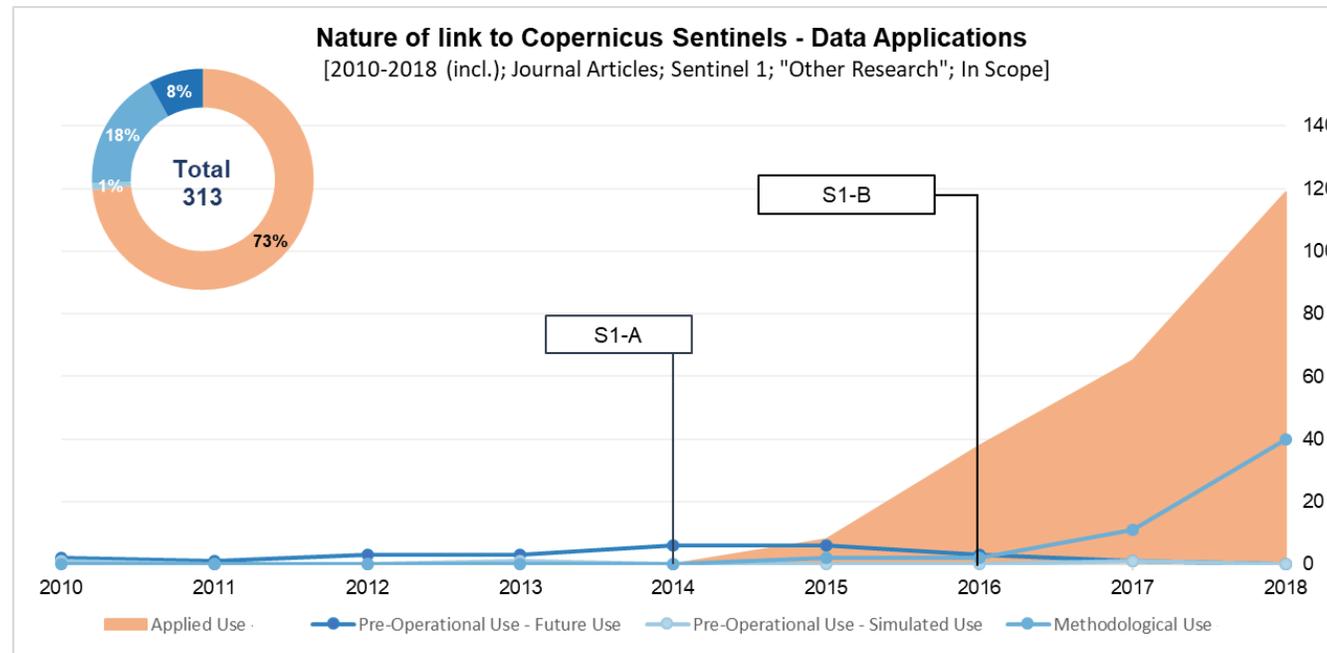
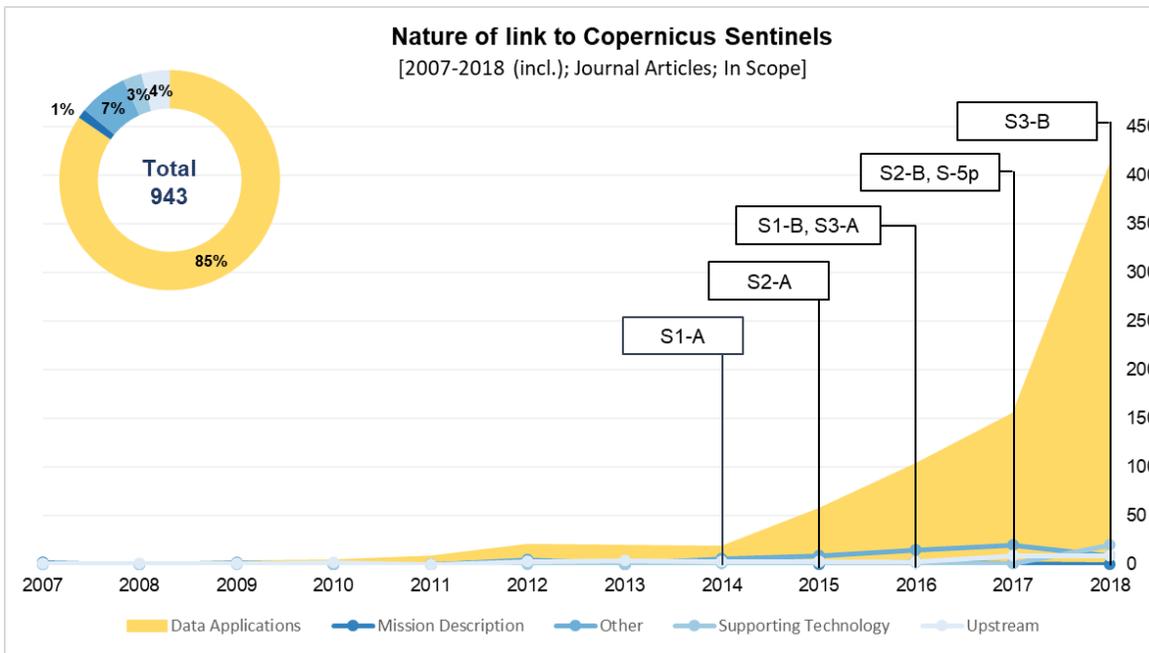
What have we learned?

Publications by region and Sentinel



What have we learned?

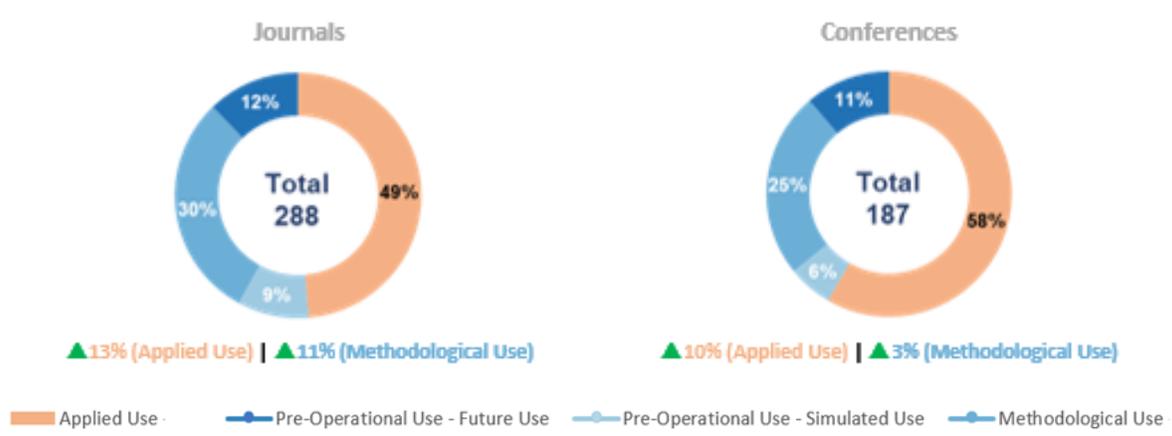
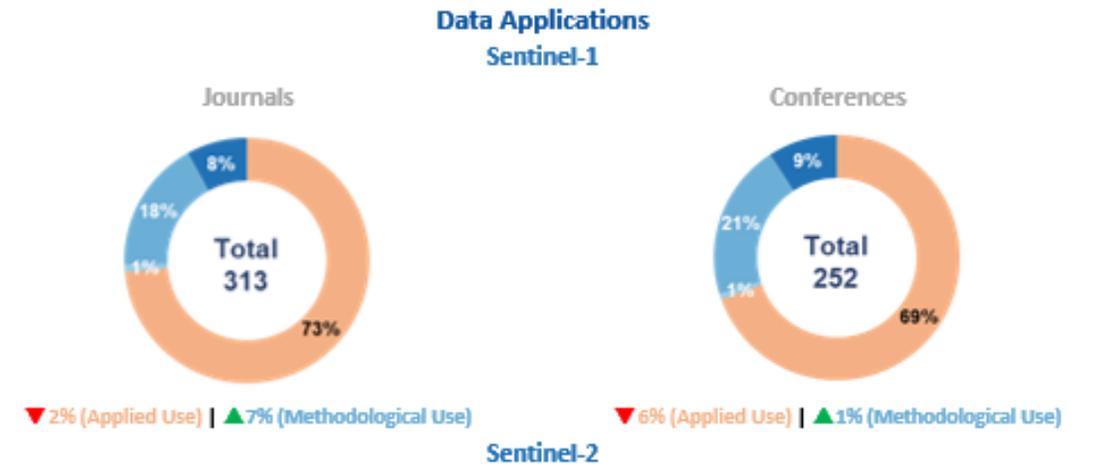
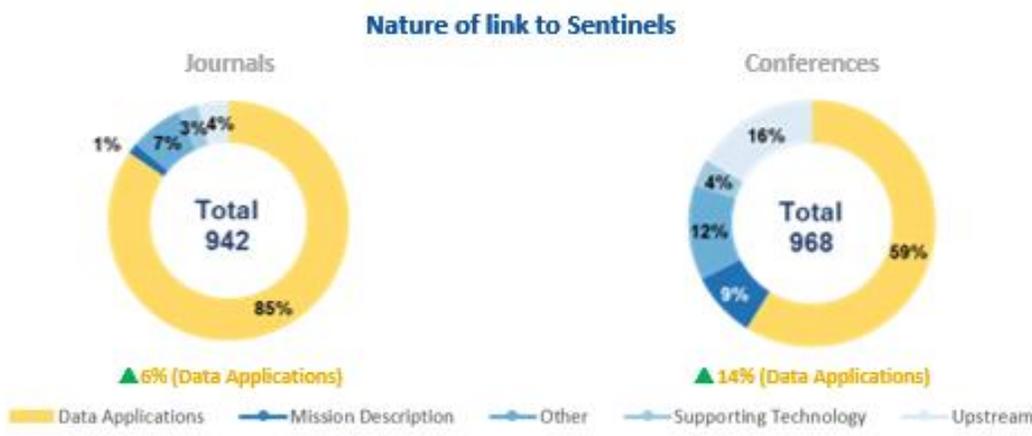
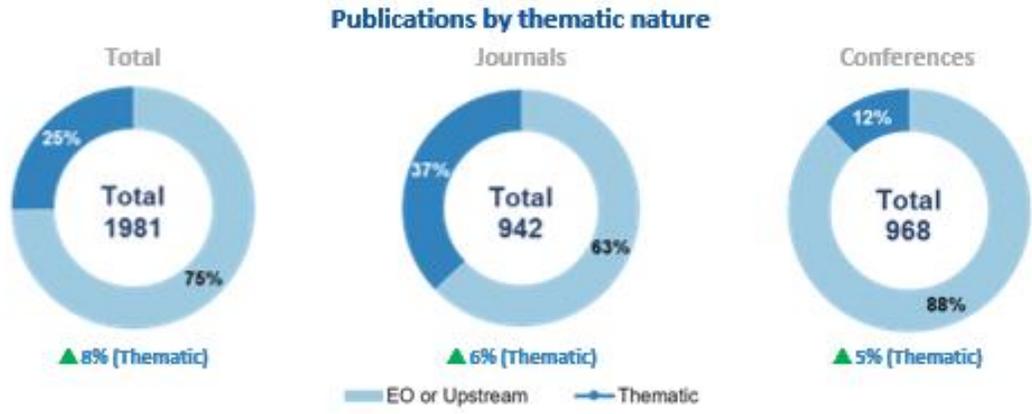
Nature of link to Copernicus Sentinels



Data applications remain the dominant category for both Sentinel -1 and Sentinel-2

What have we learned?

Indicators of Sentinel-based publications



Limitations and areas for improvement

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- **Representativeness and scope:** e.g. limited to English-language publications
- **Source query** is limited by keyword reference in title, abstract or key word fields only
- **Manual classification** of “nature of link” can be biased by individual judgement – although several measures were taken to avoid/minimise this effect
- The study on publications is repeated annually to observe changes in the indicators presented – **comments on refinements to approach or analysis?**

Proposals for further research

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- Deep-dive into specific emerging sectors of interest
- Deeper classification of methodologies/techniques (“innovation monitor”)
- Use of data within national research agencies/councils
 - Forestry/agriculture
 - Environment
 - Urban management

Thank you!

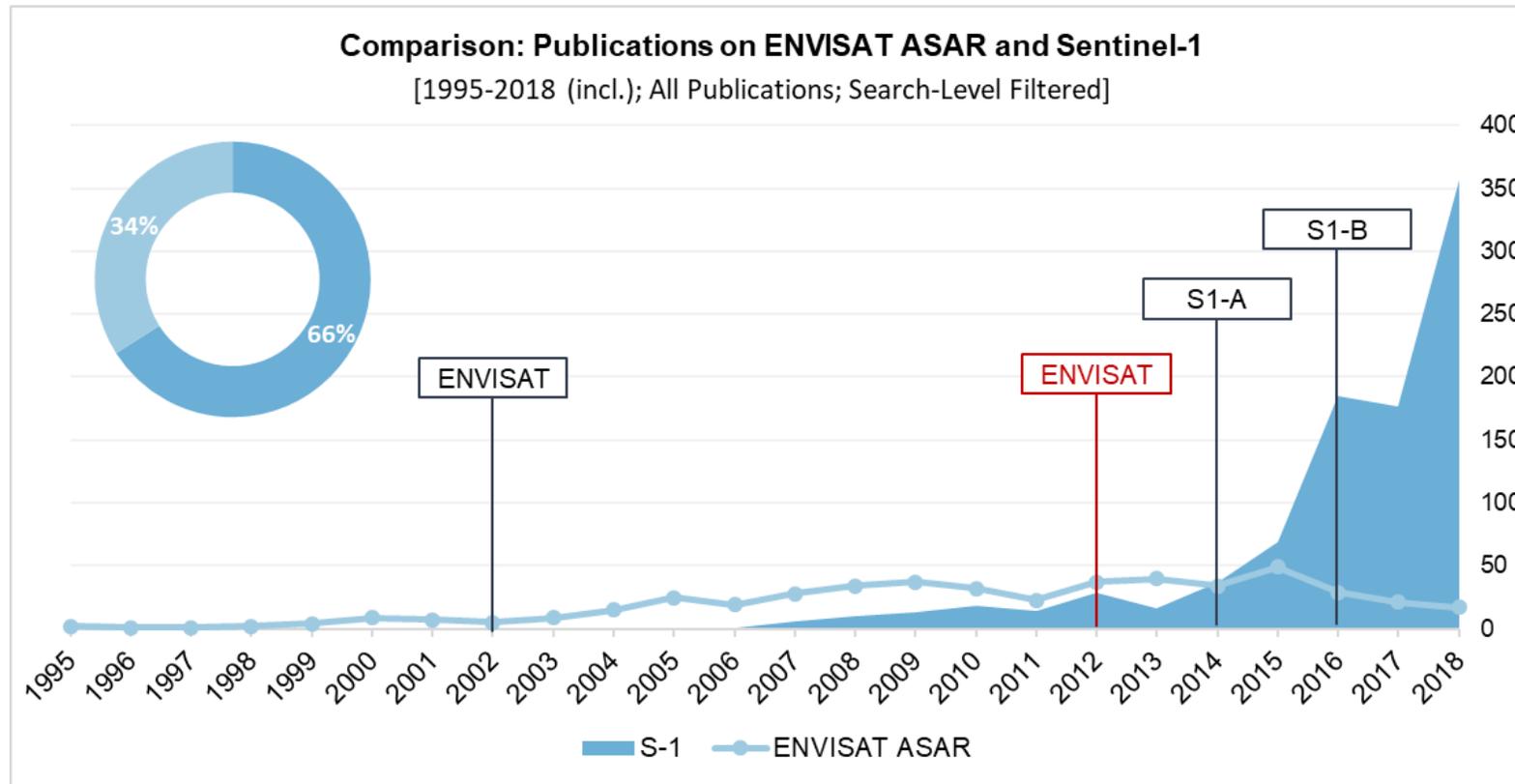
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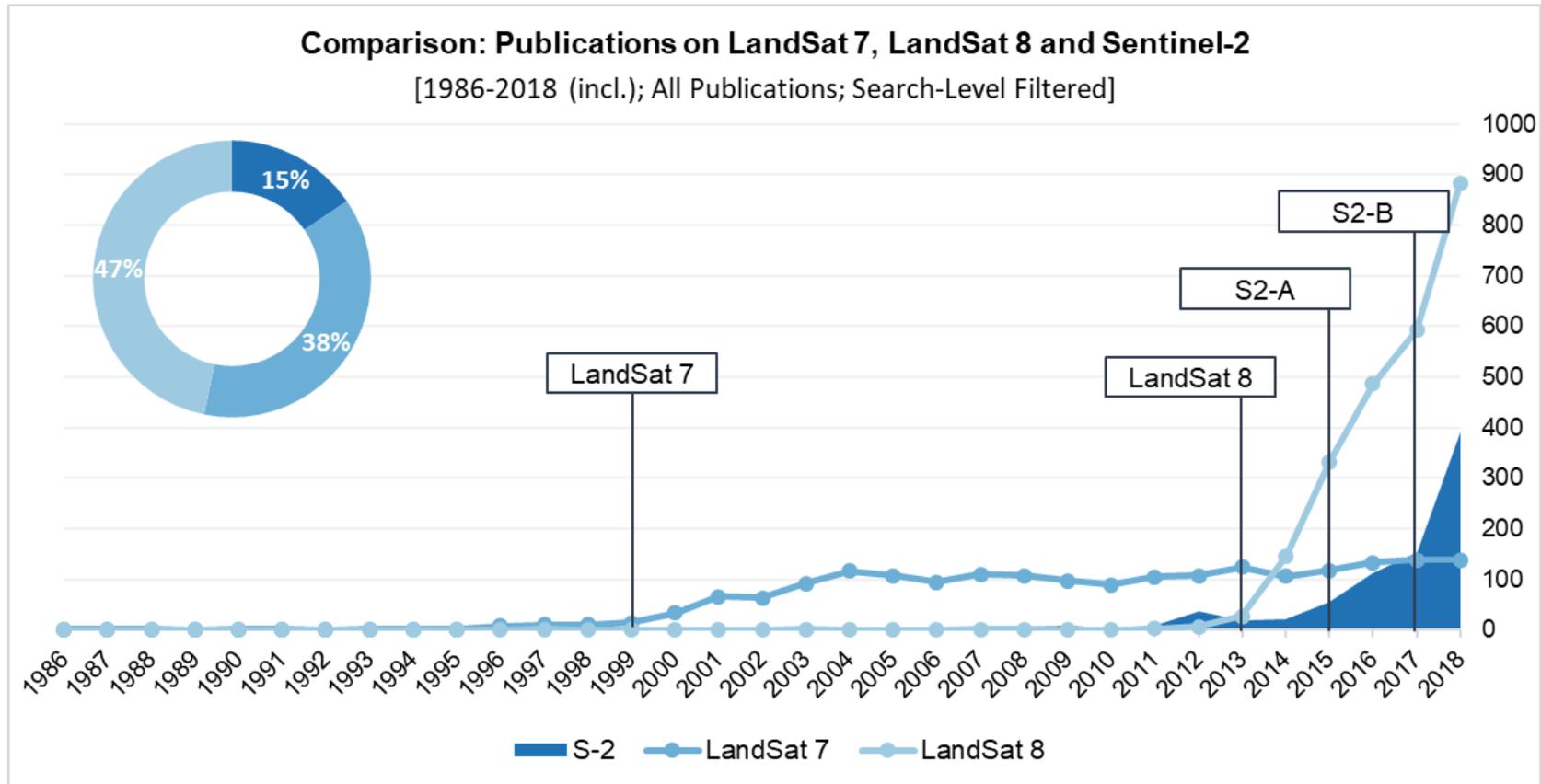
What have we learned?

Comparison: Sentinel-1 with ENVISAT



What have we learned?

Comparison: Sentinel-2 with Landsat



What have we learned?

Comparison: Sentinel-3 with ENVISAT (MERIS/AASTR/RA2)

