

Copernicus Sentinel-2 imagery: How much data are available to perform territorial monitoring?



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Introduction

Copernicus, the programme launched by the European Commission, produces accurate, timely and simply accessible information to support multi-domains applications (e.g.: environment, climate change, civil security).

The **Sentinel satellites** fleet deployed by Copernicus produces, with open access policy, a wealth of data (10 Terabytes per day ca.) that can be used for territorial monitoring.

However, the open up of new potentiality for scientific analysis of terrestrial phenomena is accompanied with the difficulties to store, process and distribute large volume of data.

Objective

Using the global archived data of Sentinel-2 to extract spatio-temporal metadata to compute metrics for assessing terrestrial monitoring capabilities.

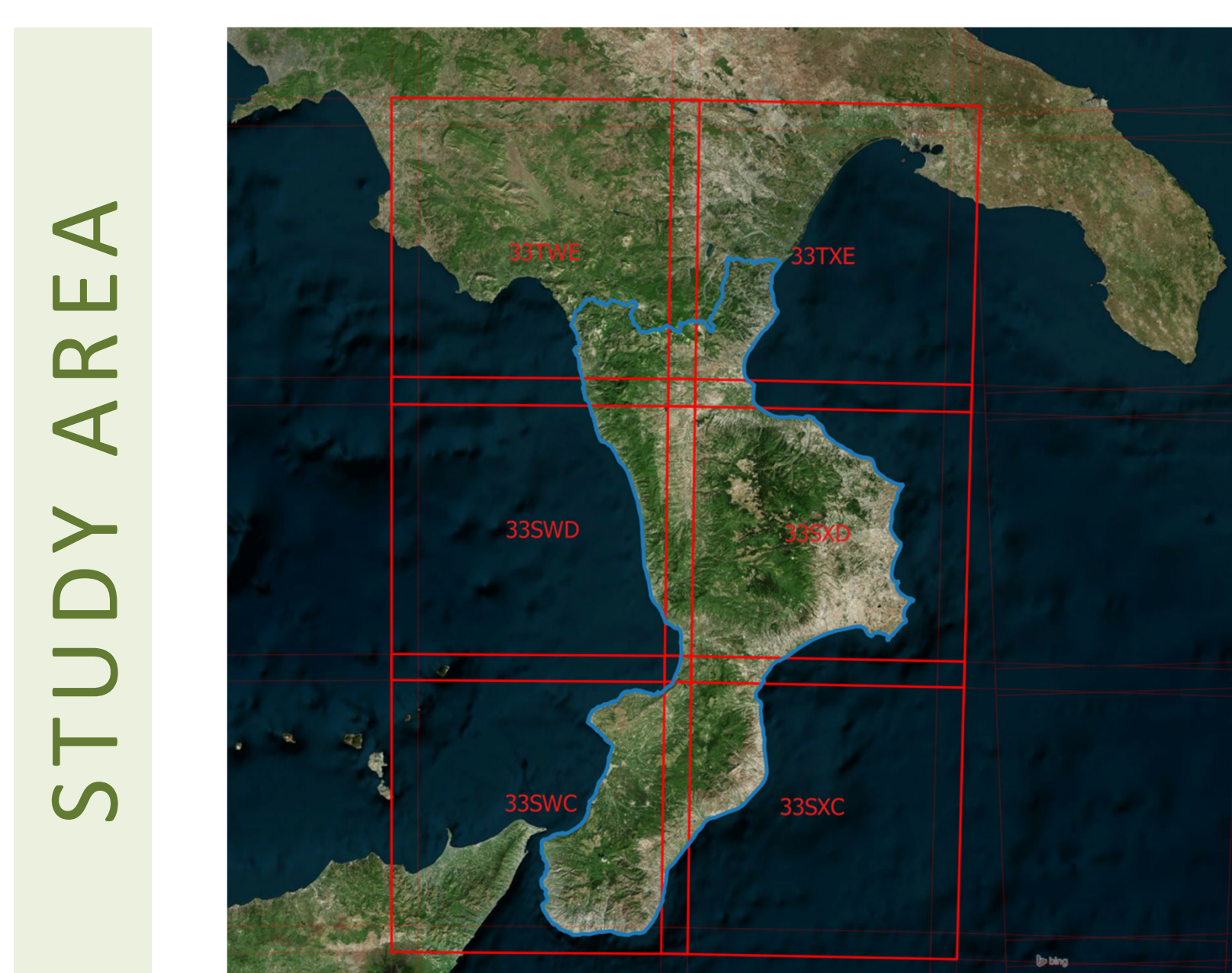
Materials and methods

Copernicus Sentinel-2 missions

Sentinel-2 is a multi-spectral imaging mission with a wide swath (290 km), global coverage and high spatial and temporal resolution. The mission is made up of twin satellites (2A, launched on 23 June 2015 and 2B on 7 March 2017) flying in the same orbit but phased at 180° with a revisit time of 5 days at the Equator (2-3 days at mid-latitudes). Sentinel-2 has 13 spectral bands: four bands at 10 m, six bands at 20 m and three bands at 60 m spatial resolution.

Data discovery and database creation

We built a database with the metadata of the images acquired by S2A and S2B from **1 July 2017 to 30 April 2018** (10 months). We considered only products processed at Level-1C composed of 100x100 km² tiles (ortho-images in UTM/WGS84 projection).



Calabria region with the overlaps of the six Sentinel-2 tiles boundaries.

Tiles structure and coding derive from the Military Grid Reference System (MGRS).

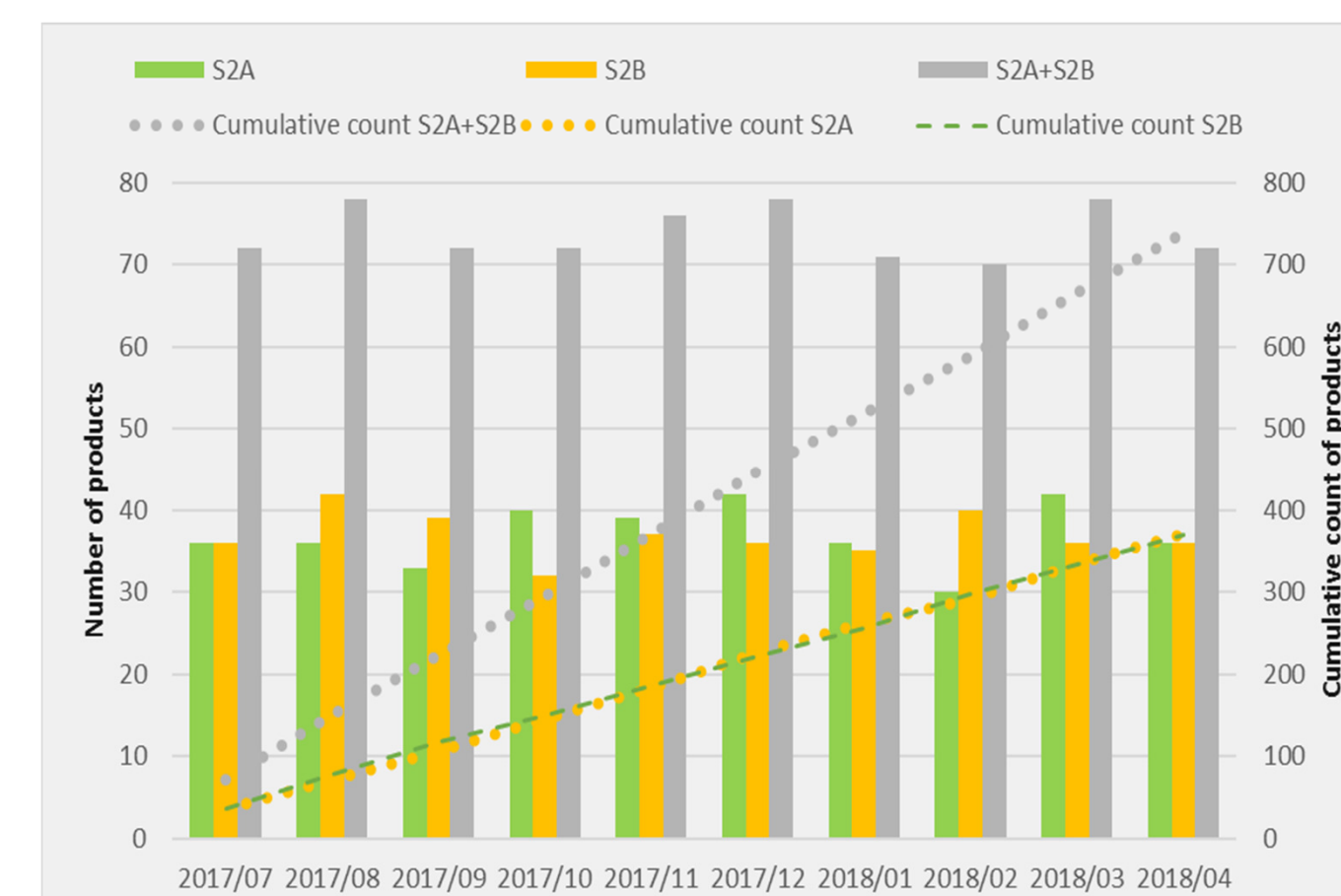
Tile boundaries are derived from the KML file distribute by European Space Agency (ESA).

The database was populated with the catalogue of Sentinel-2 imagery acquired worldwide and published by ESA within the **Copernicus Open Access Hub** repository. The catalog, available in text format with one file for each day and for each satellite, was downloaded to extract the products metadata (e.g.: date, size, tile, etc.). A batch script was used to extract **779 files** later joined into a single file with the **R language**.

A total of **2,443,488** products were indexed in the database with a worldwide coverage for the 10 months time range. A subset of **739** products was extracted with the tiles covering Calabria region.

Results

NUMBER



Monthly number of products available from the single Sentinel-2 missions and their combination (S2A+S2B) with the cumulative number for the time range 1 July 2017-30 April 2018.

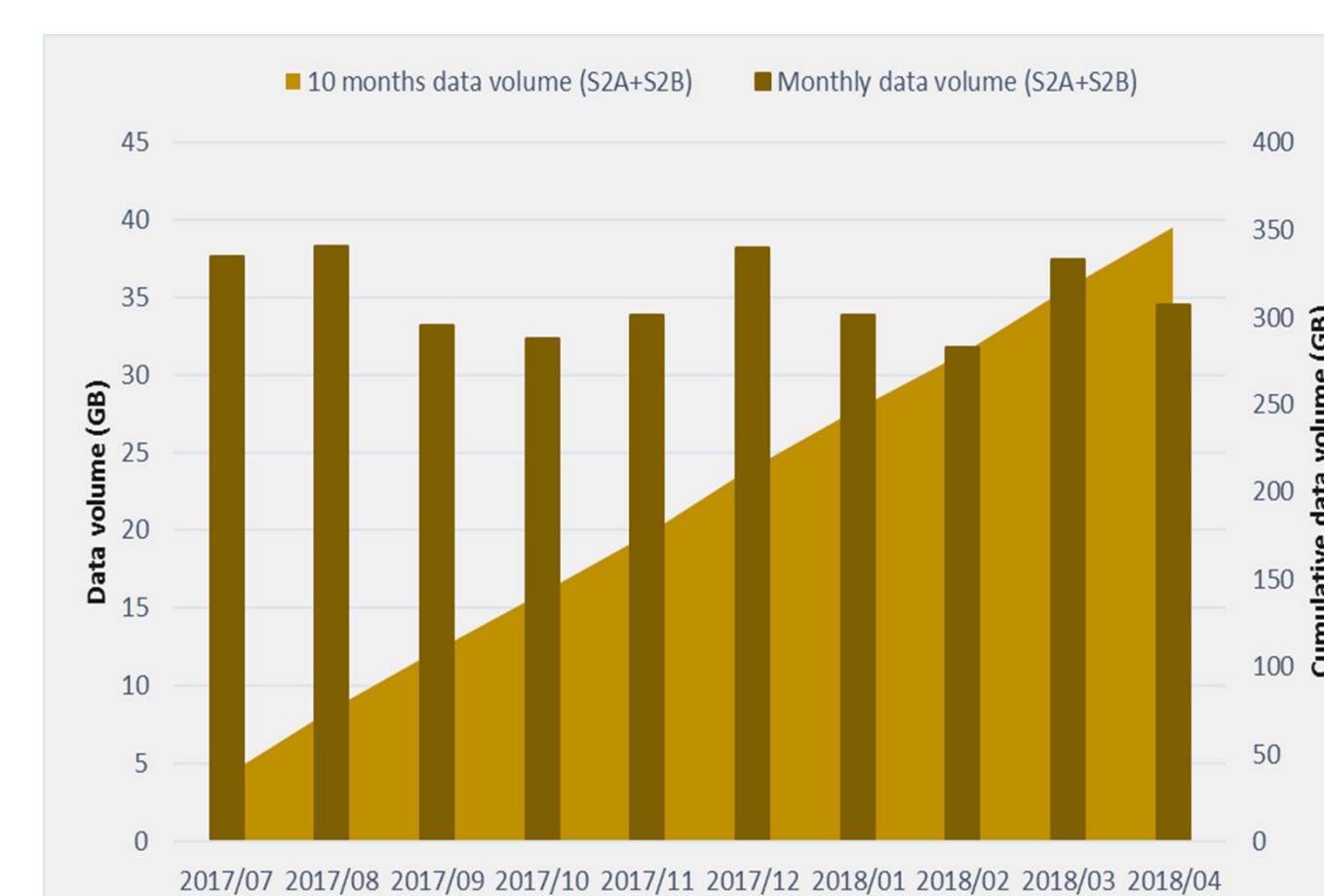
The number of acquisitions is comparable between S2A and S2B having similar orbit configuration.

TIME

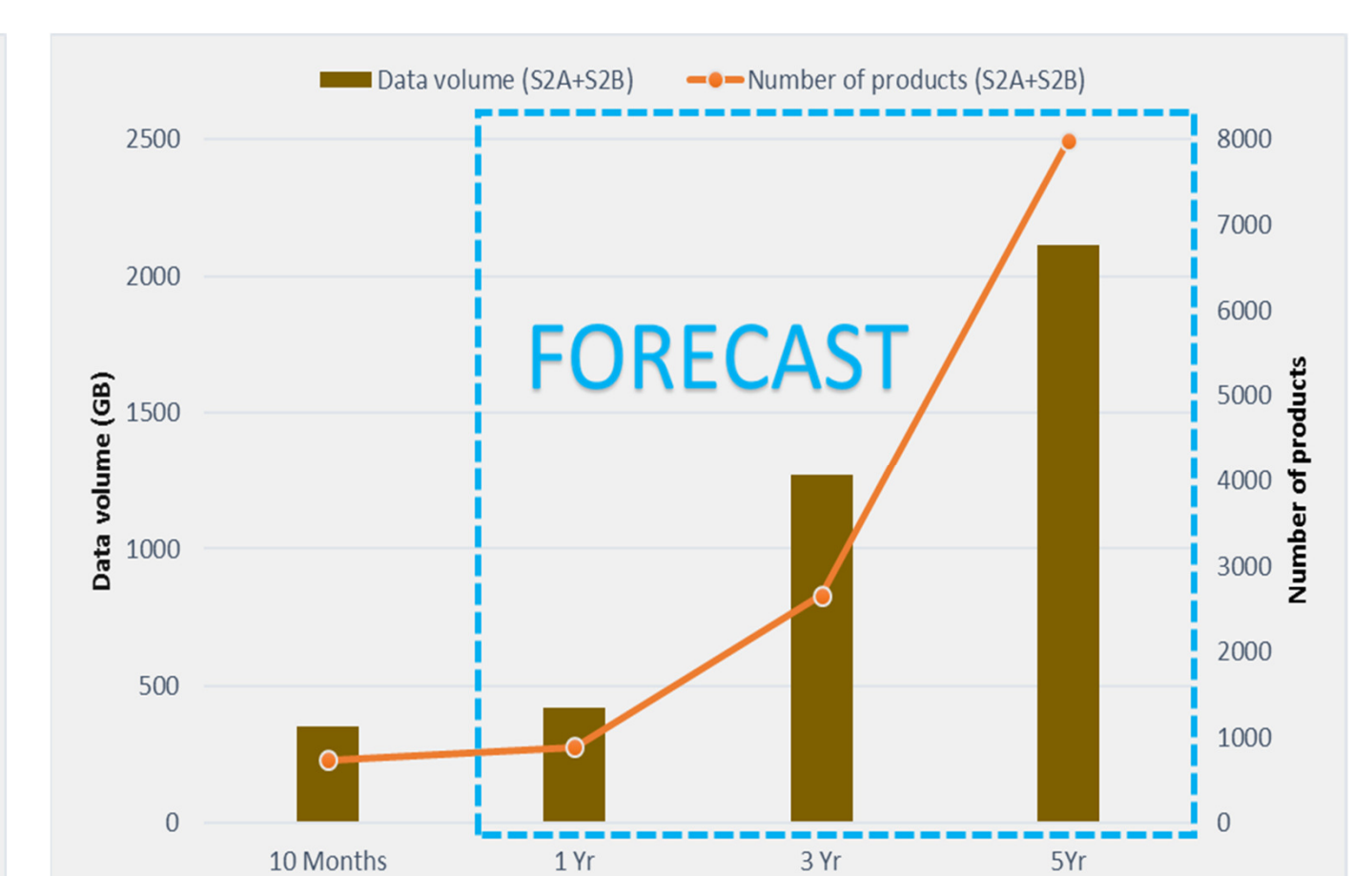
Tile	Number of products			Mean revisit time (days)		
	S2A	S2B	S2A+S2B	S2A	S2B	S2A+S2B
33SWC	61	62	123	4.9	4.8	2.4
33SWD	63	61	124	4.8	4.9	2.4
33SXC	61	61	122	4.9	4.9	2.5
33SXD	63	62	125	4.8	4.8	2.4
33TWE	61	61	122	4.9	4.9	2.5
33TXE	61	62	123	4.9	4.8	2.4

Average revisit time for the time range of analysis for the single Sentinel-2 missions and for the combination S2A+S2B computed for each tile of the study area.

VOLUME



Monthly size (Gigabytes) of the products and cumulated size over the 10 months period of the constellation (S2A+S2B) within the study area.



Number of products and size (Gigabytes) of the constellation (S2A+S2B) within the study area estimated for the 10 months period and for three time range projections: 1, 2 and 5 years.

Conclusions and Next steps

Here, the data acquired by the Sentinel-2 for an Italian region during a 10 months period were computed along with some metrics. The revisit time shows the availability of several images per week achieving monitoring capabilities for rapidly changing phenomena. At the same time, large volume of data needs to be managed by devising proper algorithms and tools. Improvements of the methodology could be reached by:

1. assessing the cloud coverage for each product.
2. extracting more products metadata to evaluate the actual territorial coverage of each scene and its quality.
3. computing the data volume for all the different level of preprocessing of the products (i.e. Level-1C and Level-2A).

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