

## Copernicus/Sentinel Data Uptake and Application

### Summary of SIT-32 User Survey

One of the themes of the ESA SIT Chairmanship is to ensure full access to, and exploitation of Copernicus Sentinel data. Ahead of the CEOS SIT-32 meeting, a user survey was issued to gather the latest user feedback from relevant CEOS (VCs, WGs, AHTs, etc.) and GEO initiatives. The feedback gathered from the community on their experiences with Copernicus Sentinel data (regarding uptake, suggestions, improvements, and other ideas) is presented here with the goal of raising awareness of issues, improving user experience, and ensuring maximum uptake of Copernicus data.

The following distillation of some key/common messages from the survey responses:

- The Sentinel Hub data access is throttled by two simultaneous downloads which limits some user's applications; more data mirrors are desired. Some comments suggesting improvements to SciHub data discovery and access were provided (e.g. filter functionality, data selection process, information display).
- The CEOS SEO strongly supports mirror hubs globally. They use the Alaska Science Facility (ASF) for Sentinel-1 downloads, and intend to use USGS for Sentinel-2. In addition, there are users who get their data (or perform analyses) using Google Cloud and Amazon holdings, and these important community resources (standard product transmission amplifiers) which should not be ignored. Amazon has Sentinel-2 TOA (Level-1). Google Cloud has Sentinel-2 TOA (Level-1), and Google Earth Engine has Sentinel-1 GRD (Level-1) and processed (Level-2) GRD in dB format.
- Capacity building support via online workshops/seminars would be very useful, particularly around how to use Sentinel products.
- Sentinel Hub is very useful and the Thematic Areas section is helpful.
- NOAA is pleased by the response to their request(s) for Sentinel-1 acquisitions during events (e.g., flooding in Alaska last year). They are also pleased to see routine coverage of the Gulf of Mexico in recent weeks/months. NOAA would like to see more complete coverage over Western Arctic and U.S. waters with Sentinel-1.
- NOAA has developed algorithms for wind speed, ice, and snow detection that could be combined with ESA efforts to form joint or blended algorithms in production. A partnership with ESA on passive microwave and scatterometry missions was identified as something that would be extremely useful.
- NOAA continues to seek free-and-open access to Level-0 data (e.g., OLCI S3 Level 0).
- SANSAs noted would like to address weekly observation requirements for high temporal resolution applications such as their Crop Watch System, which would require increased acquisitions.
- Cross-calibrated, fused data products for Sentinel-2 and Landsat-8 OLI would make a significant improvement in applications that require high temporal resolution.
- SANSAs suggested that it would be useful if data processing tools were customizable, allowing users to optimize algorithms with calibration datasets, e.g., the Sentinel-2 tools for computing LAI, FCOVER and FAPAR in SNAP.
- The CEOS SEO believes the highest priority should be the definition of Analysis Ready Data (ARD) for Sentinel-1 and Sentinel-2. The desire is to come to an agreement on the ARD properties and determine a path for users to get this ARD. Having a defined set of steps that will allow the *majority* of users to produce a valid product for the *majority* of applications will be very beneficial. Getting to ARD could be done with SNAP or through Python scripts (preferred).

Once ARD is defined, the next step is moving toward routine production and hosting of ARD, similar to USGS Landsat SR products. Users have expressed a desire to download ARD to minimize time and technical knowledge in data processing. This goal would benefit a LARGE number of users, but not everyone. There will still be many science users that prefer Level-1 data and have the resources and knowledge to do their own processing and build their own ARD.

- In the case of Sentinel-1, there is a desire for more routine coverage and consistent data formats (GRD). This is the only way to build adequate time series.
- It was suggested that ESA could perhaps release a long-term planning report that shows expected coverage of regions for the coming year.
- USGS would like to see systematic 10-day acquisitions for the globe (or at least North America) as soon as possible, rather than the 20-day cycle for the U.S. growing season.
- USGS noted that the process for retrieving data from the International Hub is currently sufficient, since they are not limited in the number of concurrent threads. However, they do not have sufficient capability to retrieve everything needed from the Science Hub, as they are limited to 2 concurrent threads. The data that has ‘aged off’ of the International Hub and is only available on the Science Hub is a bottleneck that hinders their ability to obtain all the Sentinel-2 data.
- USGS noted that when the change was made to tiles, it was not expected that bundles of tiles would still be created and placed on the Hubs. USGS are now attempting to accommodate either. They asked whether there is an explanation of why bundles are still being produced after the change to a single tile product was made.
- The JPEG2000 image format often needs to be converted to other formats (e.g., GeoTIFF) for ease of use in desktop applications.
- USGS noted that although the Sentinel Toolkit has useful desktop applications, they would like to have the ability to extract some of these capabilities (source code) to integrate into larger computing clusters for large-scale processing. Open source software would be ideal for cloud computing and collaboration. In some cases, agencies (at least NASA) cannot sign restrictive licensing agreements, so cannot benefit from limited distributions.