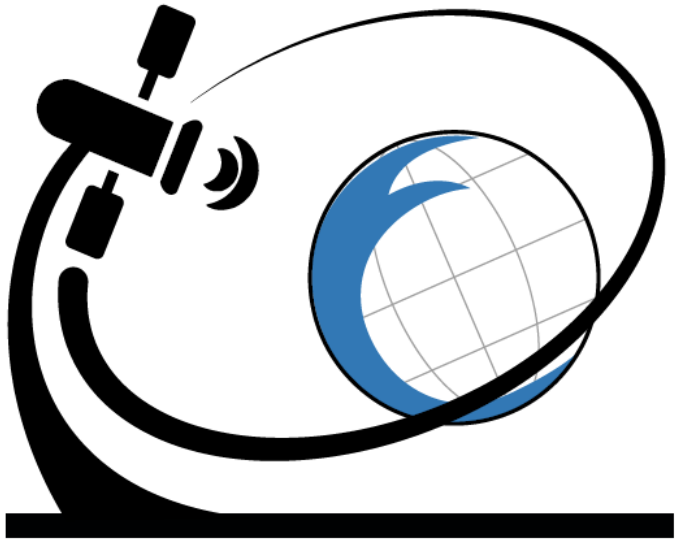


# Ocean Virtual Lab

Developed by

OceanDataLab

Funded by

esa

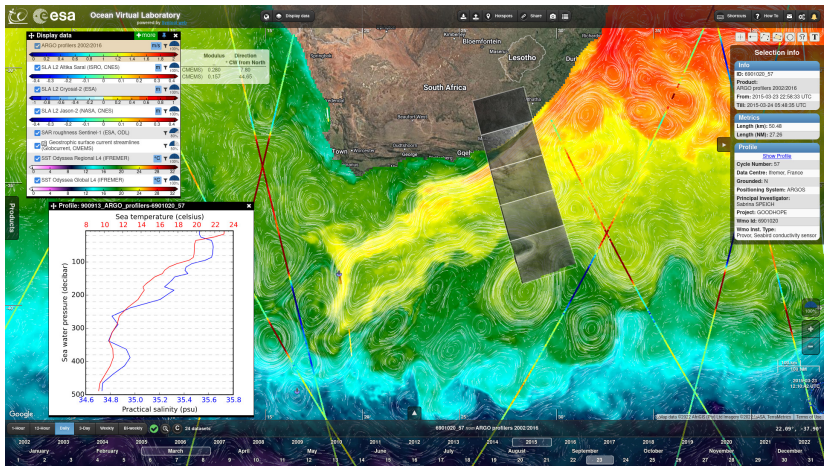
Sponsored by

NoR

# Objectives

Earth Observation missions generate a large amount and variety of satellite data, treasure troves waiting to be fully exploited but currently underused because their data format, volume and complex geometry constitute a barrier for many users.

To help remove this barrier and foster data synergy exploitation, open tools such as the Ocean Virtual Laboratory (`https://ovl.oceandatalab.com`) were developed with ESA support, making data discovery, access and analysis a rather easy task for science users.




Ocean Virtual Laboratory `https://odl.bzh/fn-IFecI`

The main objectives of the OVL-NG project are:

- to prolong the ESA/Copernicus data visualisation and promotion activities started in OVL and S3VIEW for 24 months
- to improve tools and services based on user feedback
- to explore ways for improving the sustainability of these services in the long term

# Achievements - resources optimizations

To ensure the sustainability of the service both in terms of computing resources consumption and maintenance effort, the software component which manages data processing chains has been improved in several ways:

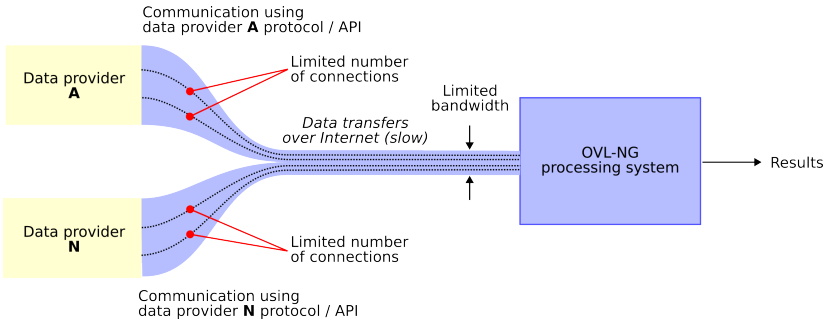
- OVL previously used three different processing systems, which made it difficult to operate and maintain. These systems have been harmonized and merged into a single solution.
- all the processing chains that generate images for the OVL have been adapted to the new system, making them easier to migrate between hosting platforms.
- a new scheduling mechanism has been written to make better use of available computing resources, avoiding slowdowns caused by submitting too many tasks to processing units when they are already busy
- images generated by the processing chains are now published as soon as they are ready, whereas the old processing system published them only at fixed times

These optimizations allowed the service to not only reduce the publication latency in OVL, but also to process more products while using the same amount of computing resources.

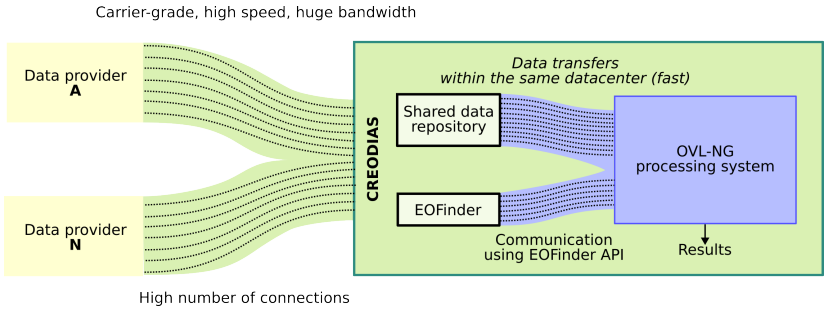
The new processing system also collects more metrics when executing a task, providing relevant numbers to estimate resources consumption and allowing further optimizations in the future.

OceanDataLab has been offering online visualisation of Sentinel-1 SAR roughness and wind speed data for several years, but the spatial coverage was limited to a few areas of interest because network bandwidth and download concurrency restrictions made it impossible to fetch and process all the files in near real time.

Data transfers and the related bottlenecks can be removed by using an ESA DIAS both as source for input data, as infrastructure for processing and as hosting platform for results: with a fast, direct way to read L1 and L2 products, combined with the ability to process these data in parallel and to store a large amount of resulting images, offering visualisation for the global coverage of Sentinel-1 data is not an issue anymore.




Before migration

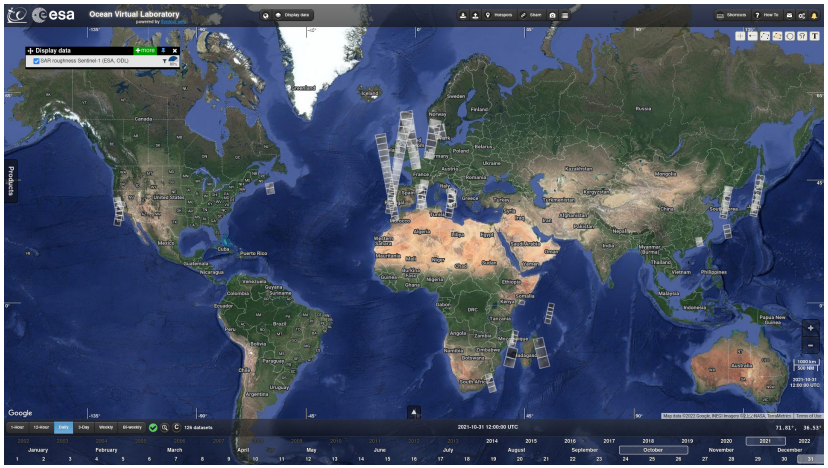



After migration

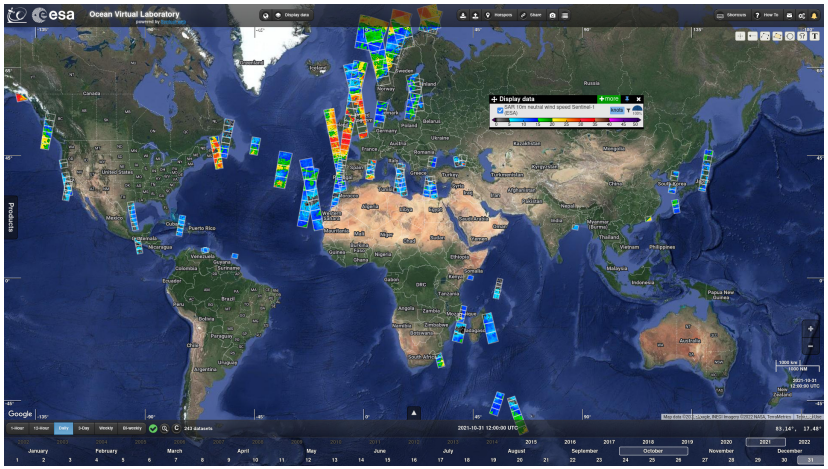
During the OVL-NG project, the OVL processing chains for Sentinel-1 products have been adapted to leverage the capabilities of the Creodias infrastructure and services, and global coverage is available in the OVL portal for Sentinel-1 data since 1st November 2021.

# Achievements · Sentinel-1: spatial coverage extension

## Before migrating to Creodias

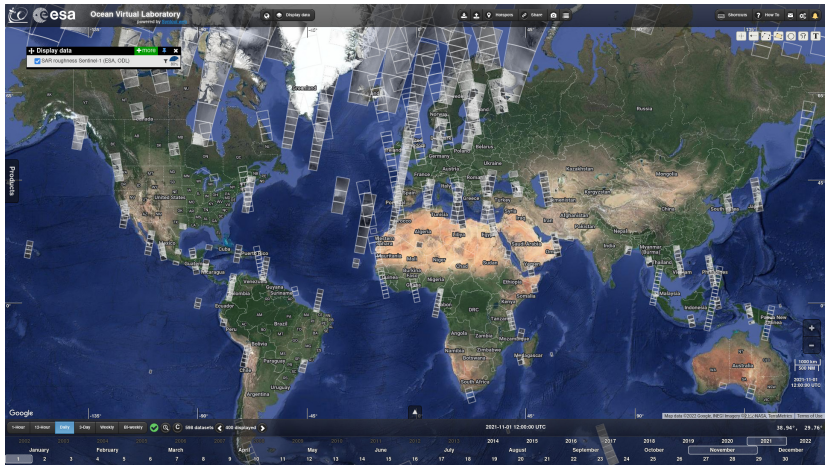



Sentinel-1A/B SAR roughness
`https://odl.bzh/VFLRiNmy`

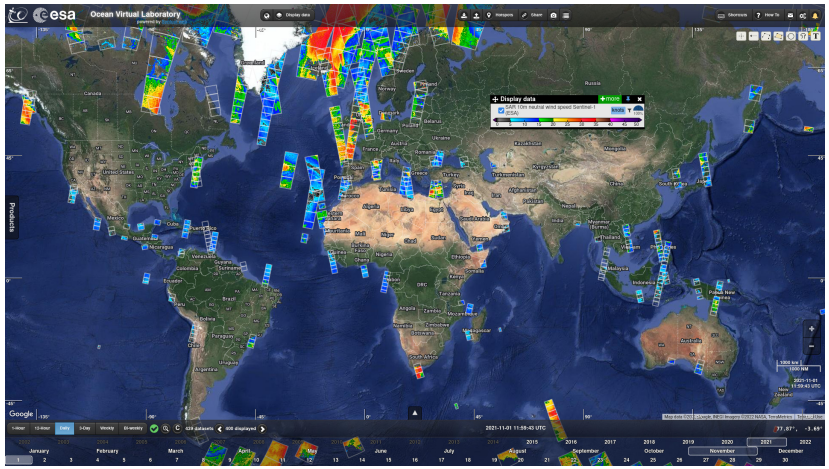



Sentinel-1A/B wind speed
`https://odl.bzh/P2YDDwva`

## After migrating to Creodias




Sentinel-1A/B SAR roughness
`https://odl.bzh/e4_8hkSU`

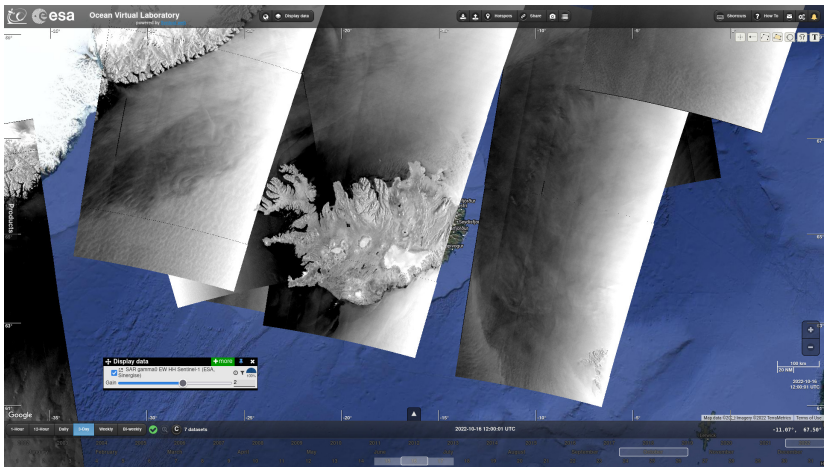



Sentinel-1A/B wind speed
`https://odl.bzh/iXsFsKvL`

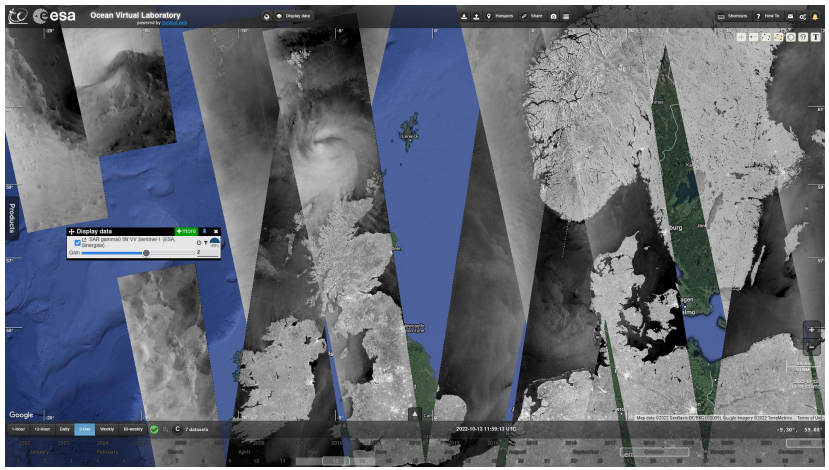
Extending the spatial coverage for Sentinel-1 SAR roughness revealed that the processing settings previously used in areas of interest were not giving good results everywhere, notably at high latitudes where acquisitions with HH polarization are much more common.

Starting 7th February 2022, a different Geophysical Model Function (CMODH) and values range have been used in the processing chain for Sentinel-1 SAR roughness to produce better images from acquisitions in HH polarization.

Providing visualisation of Sentinel-1 global data prior to the migration to Creodias was not in the scope of the project, yet it was still a requested feature. In order to give users a way to achieve this, the OVL portal has been modified to integrate Sentinel-1 gamma0 WMS layers from Sentinel Hub.




Sentinel-1A gamma0 EW HH (Sinergise)
`https://odl.bzh/MgDG9RKm`

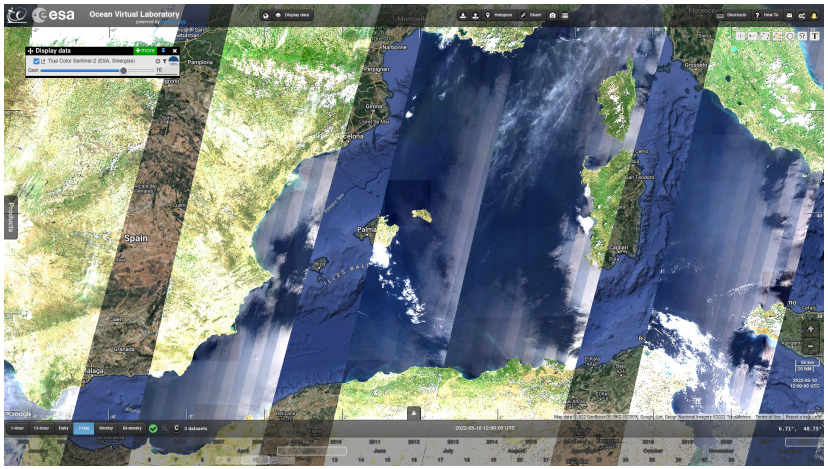



Sentinel-1A gamma0 IW VV (Sinergise)
`https://odl.bzh/s06vDL-F`

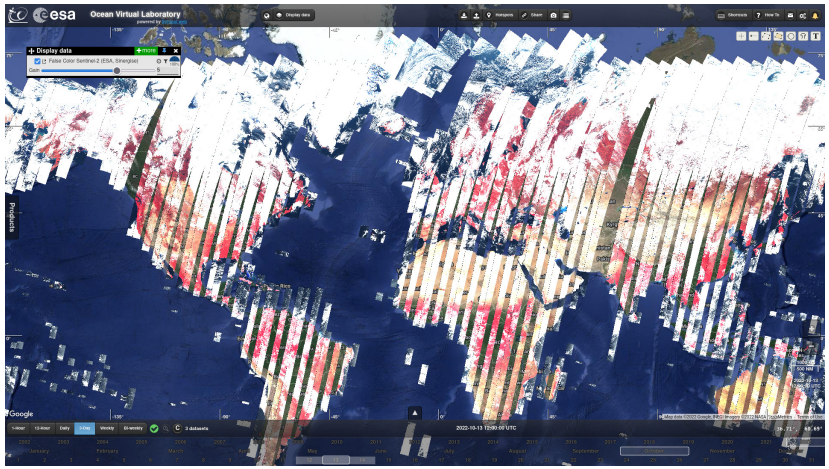
The processing of Sentinel-2 products was not part of the OVL-NG project, but it was important to have these products in the OVL portal because the optical sensors onboard Sentinel-2 have a high resolution which can reveal details on the sea surface that can be difficult to detect using measurements from the other Sentinel satellites.

Thanks to a subscription to Sentinel Hub services sponsored by the NoR, it has been possible to include Sentinel-2 products in the OVL portal as WMS layers, allowing users to leverage the synergy between the high resolution optical acquisitions and the wide variety of data available in OVL.

These layers have been further integrated by adding embedded controls to configure the gain and toggle the display of the acquisition date over the images.




Sentinel-2A/B true color (Sinergise)
`https://odl.bzh/izN6Gdbo`




Sentinel-2A/B false color (Sinergise)
`https://odl.bzh/ljt9wOwl`

The Sentinel-3 NRT data visualisation service was initially developed during the OVL project extension named "S3VIEW" to produce images from the OLCI, SLSTR and SRAL instruments onboard the Sentinel-3A and Sentinel-3B satellites and to publish these images in the OVL portal within a few hours after the acquisition.

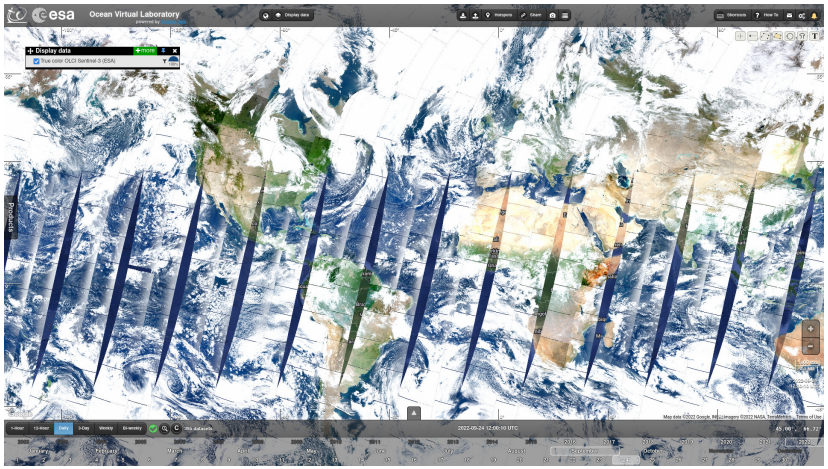
The latency constraint would have been a real challenge if the input data had to be downloaded using consumer grade connections, as well as managing the storage for the ever growing amount of images generated by the service.

Developing S3VIEW on the infrastructure now known as Creodias trivialized these issues:

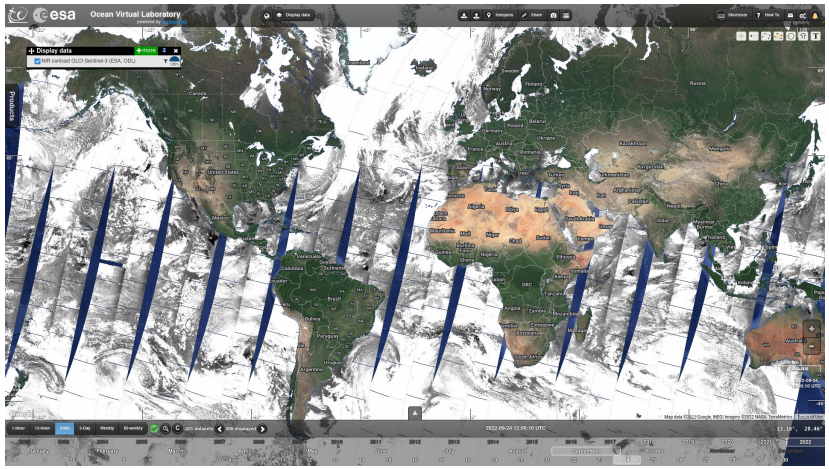
- the platform has a very fast high-bandwidth connection to the data sources and automatically feeds a shared data repository with copies of new acquisitions, so fresh input files are available shortly after they have been published by the original data provider
- using virtual volumes for storage means that their capacity can be extended with almost no effort

NoR sponsoring for storage resources required by images produced during S3VIEW and by images generated during OVL-NG allowed the service to provide users with Sentinel-3 NRT imagery for two more years.

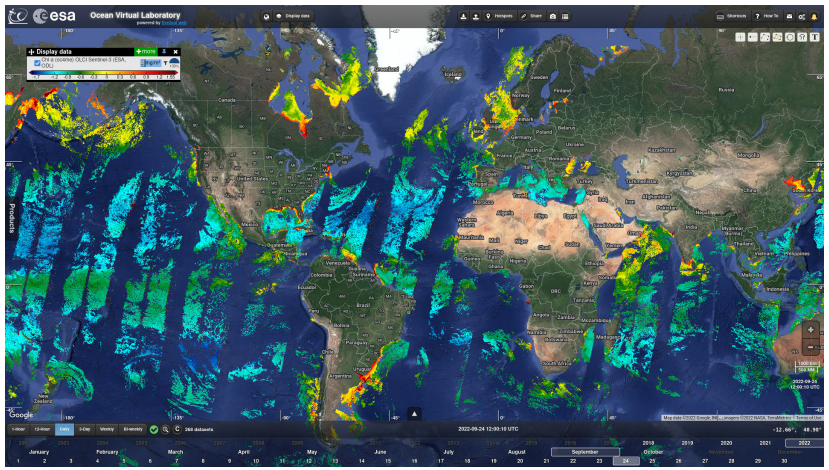
# Achievements · Sentinel-3: temporal coverage extension




Sentinel-3A/B OLCI true color
`https://odl.bzh/Zq3kEfFy`

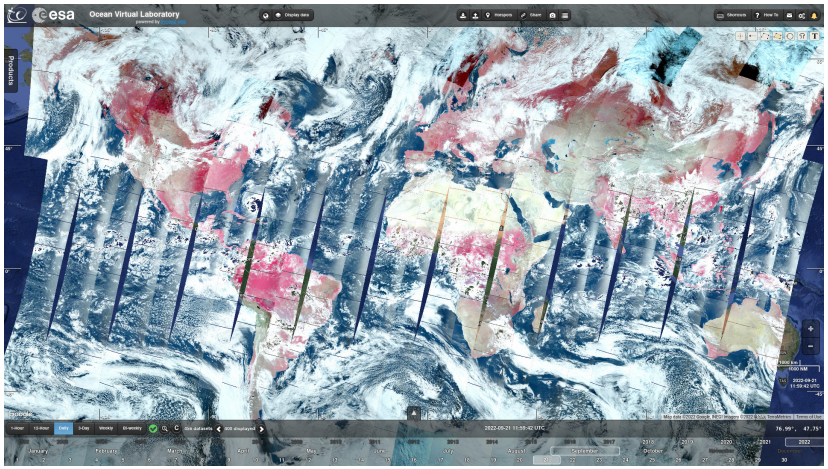



Sentinel-3A/B OLCI NIR brightness contrast
`https://odl.bzh/n2b6dYiT`

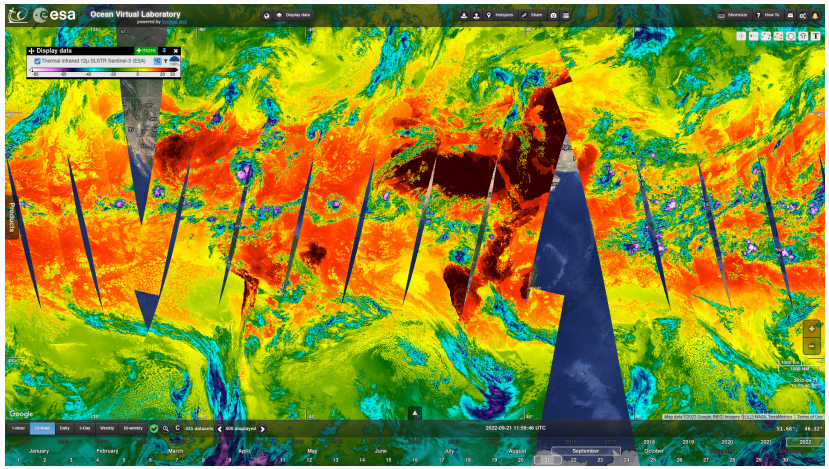



Sentinel-3A/B OLCI chlorophyll-a
`https://odl.bzh/RaokT06A`

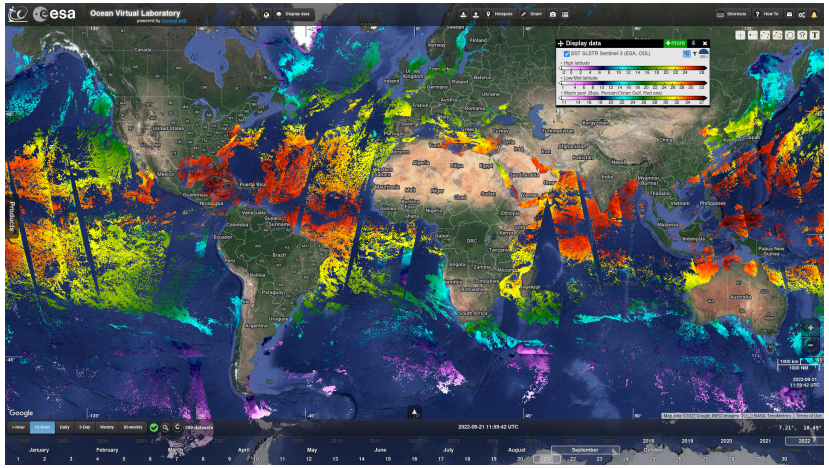
# Achievements · Sentinel-3: temporal coverage extension




Sentinel-3A/B SLSTR false color
`https://odl.bzh/ciWnFyPJ`

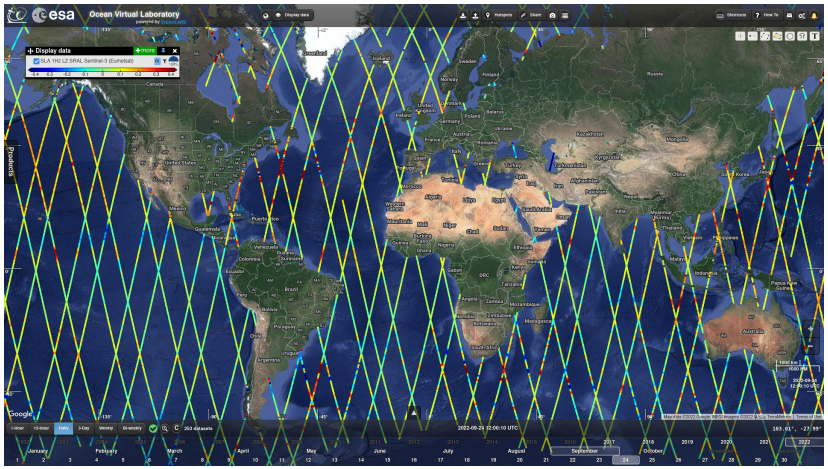



Sentinel-3A/B SLSTR 12µm brightness temperature
`https://odl.bzh/jZCNoTFo`

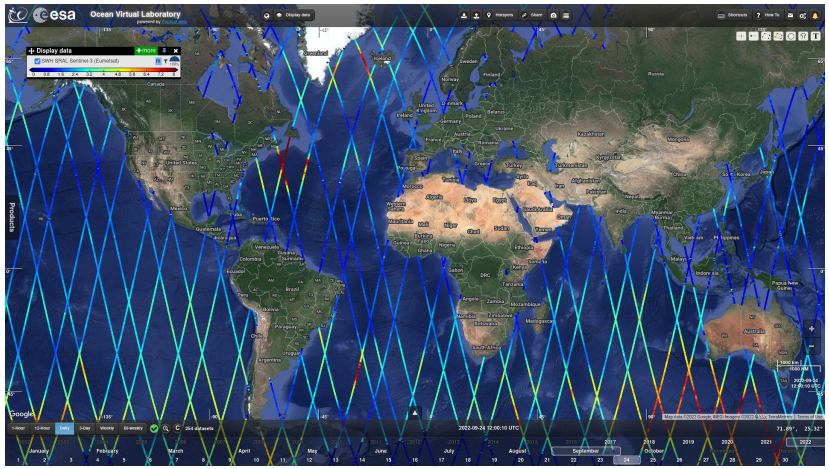



Sentinel-3A/B SLSTR sea surface temperature
`https://odl.bzh/XZE4OHck`

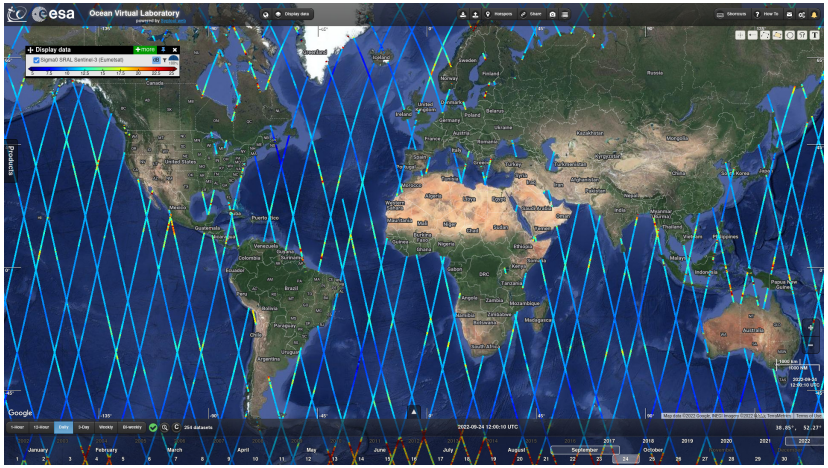
# Achievements · Sentinel-3: temporal coverage extension



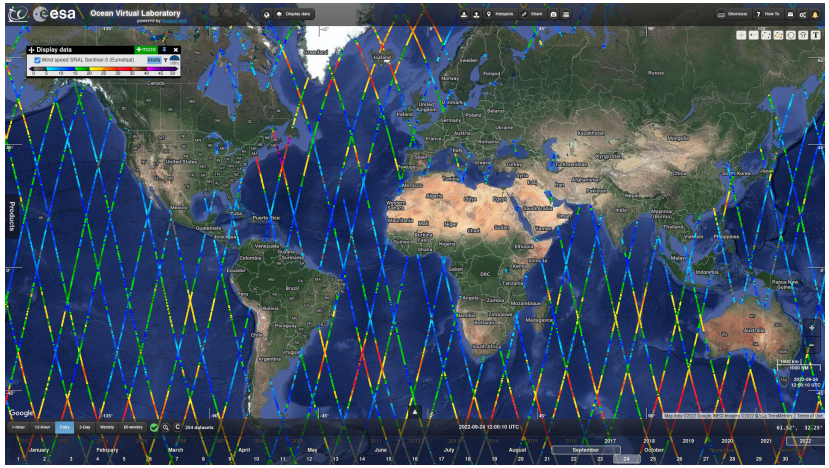

Sentinel-3A/B SRAL 1Hz sea level anomaly
`https://odl.bzh/Q25itcEc`




Sentinel-3A/B SRAL 1Hz significant wave height
`https://odl.bzh/RPxFbSL4`




Sentinel-3A/B SRAL 1Hz sigma0
`https://odl.bzh/4t4WmE06`

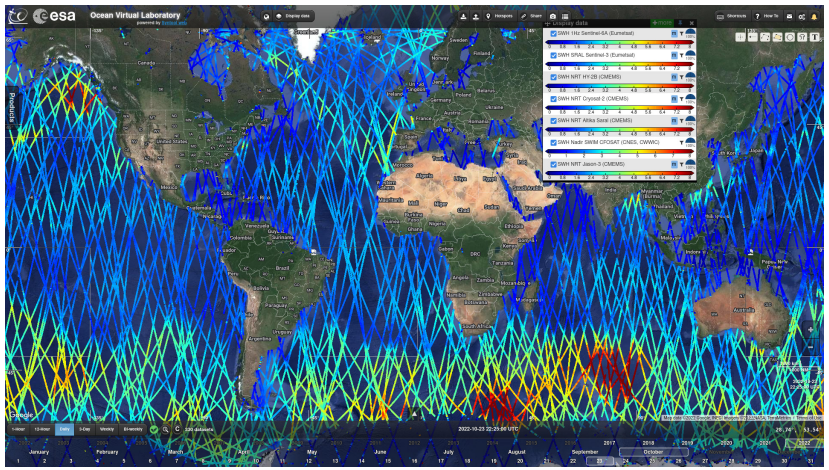



Sentinel-3A/B SRAL 1Hz wind speed
`https://odl.bzh/4NUvkSZT`

Creodias provides a service named EOFinder to search the content of the shared data repository using a well documented API. Search queries for this API all have the same structure, aside from a few sensor-specific filters, so adapting client software to support new satellites or sensors is quite easy.

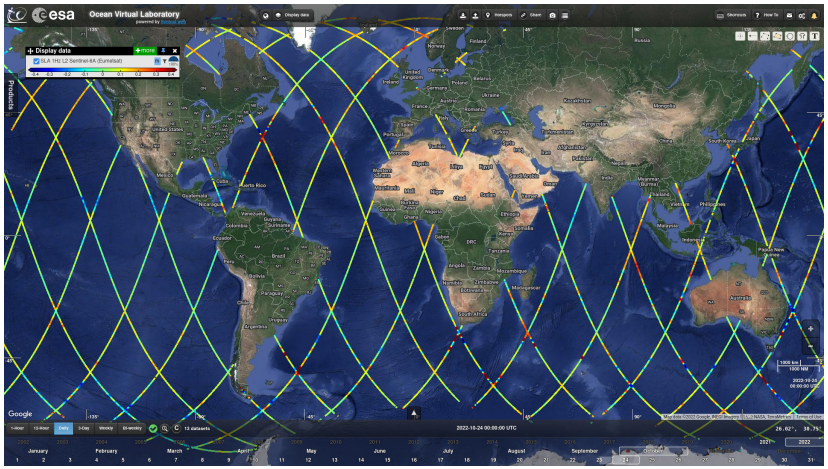
Due to this harmonized API and to the client software already developed for Sentinel-3, as well as a study performed in anticipation on data samples distributed by Eumetsat, it only took a few days after Creodias announced the availability of Sentinel-6 data on their platform before users could browse the NRT measurements in the OVL portal.

With the addition of Sentinel-6, OVL users now have access to NRT measurements from 8 altimeters and can display them concomitantly in the online portal to build a more complete picture of the variables retrieved from altimetry.

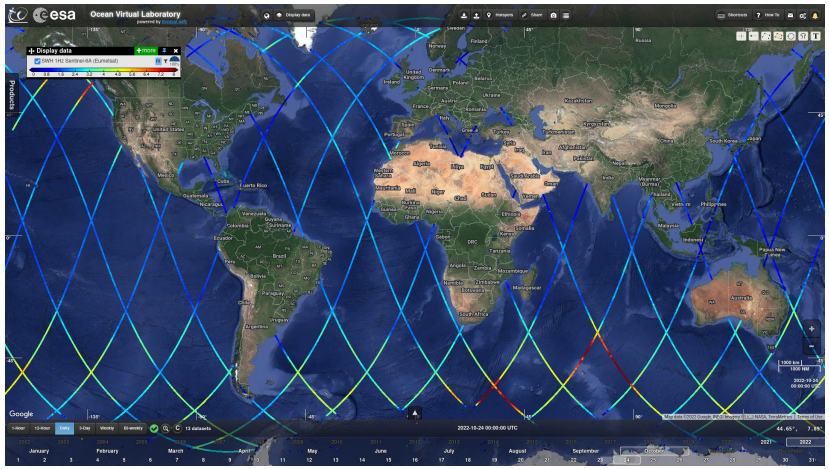



Significant wave height from Saral, Jason-3, Cryosat-2, HY-2B, CFOSAT, Sentinel-3A/B and Sentinel-6A
`https://odl.bzh/qNHJ7Rej`

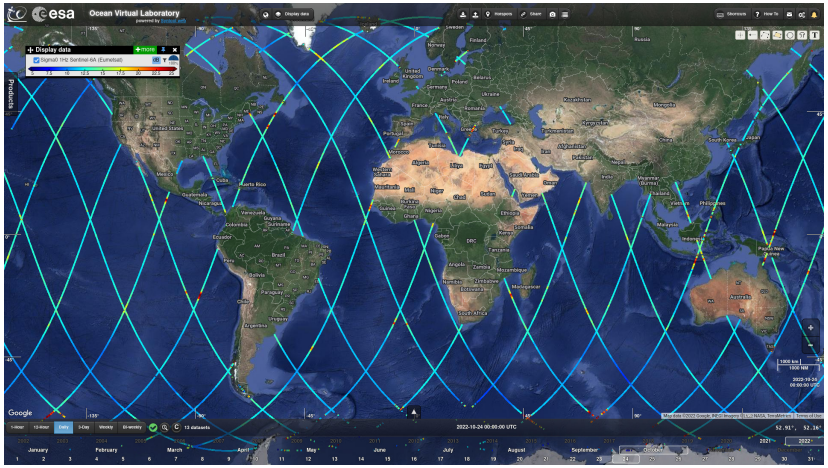
# Achievements · Sentinel-6: NRT visualisation



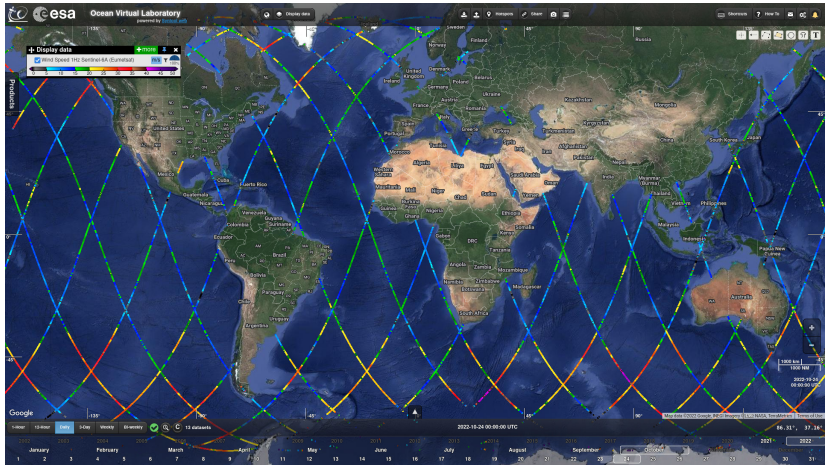

Sentinel-6A Poseidon-4 1Hz sea level anomaly
`https://odl.bzh/X9r3-Ylv`




Sentinel-6A Poseidon-4 1Hz significant wave height
`https://odl.bzh/SEqUPqez`



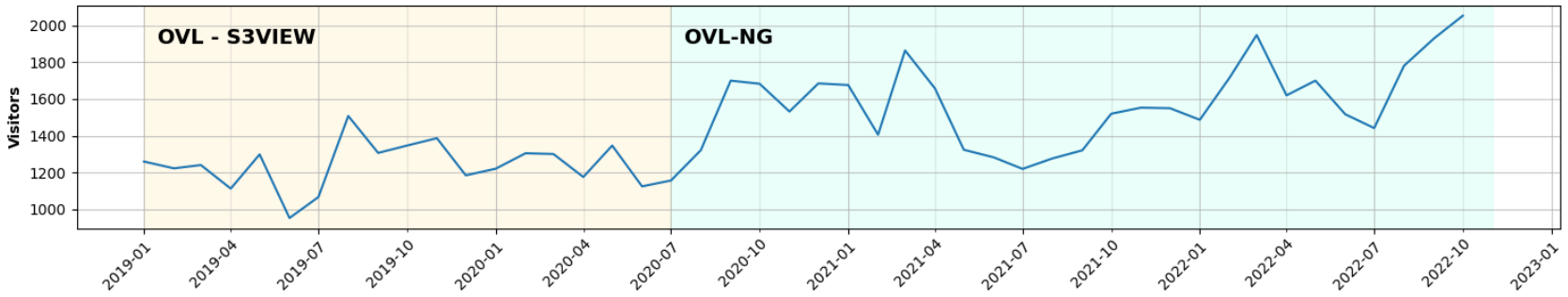

Sentinel-6A Poseidon-4 1Hz sigma0
`https://odl.bzh/aleMqtGc`




Sentinel-6A Poseidon-4 1Hz wind speed
`https://odl.bzh/ci83TsGA`

# Conclusion

Being able to offer online visualisation for a larger coverage of Sentinel data in time, space and variables has definitely contributed to attract more visitors to the OVL in the past two years.




This increase of the audience gave more visibility not only to Sentinel products but also to the myriad of satellite, in-situ and model products available in OVL and distributed by a wide variety of data providers such as CMEMS, CNES, Eumetsat, IFREMER, NASA, REMSS, etc...

The OVL has also been spotted on different occasions both on the Web and in the physical world, where it has been increasingly used for:

- illustrating case studies during conferences
- teaching oceanography during training courses and workshops
- making decisions based on satellite observations and simulation outputs during in-situ campaigns
- discussing outstanding and recent meteorological events in social media