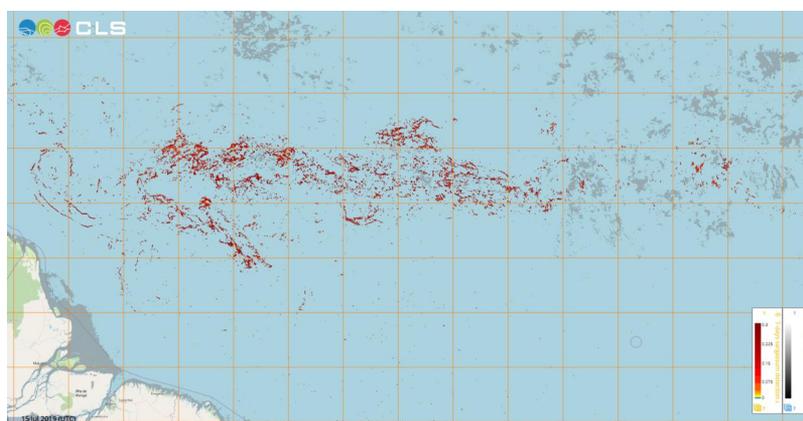




Floating Sargassum Algae detection using Sentinel-3 satellites

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1. Overview of this document

This document is the user manual for the **Floating Sargassum Algae Index using OLCI instruments onboard Sentinel-3A&B** product, processed by CLS In the frame of the European project e-shape <https://e-shape.eu/>.

1.1. Acknowledgments

When using the **Floating Sargassum Algae Index using OLCI instruments** product, please cite :
“The Floating sargassum algae detection product has been produced by CLS in the frame of the European project e-shape <https://e-shape.eu> , distributed by Aviso+ (DOI 10.24400/527896/a01-2022.007) with support from CNES.”

1.2. User’s feedback

This product is an **experimental** product.

Therefore, each and every question, comment, example of use, and suggestion will help us improve the product. You’re welcome to ask or send them to aviso@altimetry.fr.

2. Processing

Since 2011, unprecedented massive landings of sargassum seaweed (*Sargassum fluitans* and *Sargassum natans*) have been observed along the shorelines of a huge area encompassing the Gulf of Mexico, the Caribbean Sea and West Africa, having tremendous negative impacts over local communities.

Satellite imagery allows to detect the presence of floating sargassum and is a key tool to help scientists to understand the origin and the seasonality of the sargassum movements in the Atlantic, and to support local communities in the management of the next sargassum influxes. Pioneering work by Gower et al. (2006), and Hu (2009) has demonstrated the capacity of ocean colour satellites to detect sargassum rafts.

Sargassum presence is detected by the increase of the reflectance spectrum between the red and near infra-red wavelengths (see Fig. 1). Most well-known sargassum indices found in the literature, for example the Maximum Chlorophyll Index (MCI, by Gower et al., 2006), the Floating Algae Index (FAI, by Hu, 2009), the Alternative Floating Algae Index (AFAI, by Wang and Hu, 2016), follow the same mathematical statement : $\text{Index} = \rho_{\text{NIR}} - \rho'_{\text{NIR}}$

Where ρ_{NIR} denote a reflectance (or radiance) partially (or not) corrected for atmospheric effects in the near infra-red band, and ρ'_{NIR} is the equivalent NIR reflectance that would be measured at the same point in absence of sargassum. ρ'_{NIR} is approximated by a linear interpolation between the two reflectances measured at nearby wavelengths in the red and SWIR bands.

We use here a normalized version of the FAI, in which the normalization by the sum of reflectances is introduced to mitigate the variability of the FAI due to atmospheric conditions and observation geometry, as done for the NDVI over land surfaces : $\text{NFAl} = (\rho_{\text{NIR}} - \rho'_{\text{NIR}}) / (\rho_{\text{NIR}} + \rho'_{\text{NIR}})$

A cloud masking and editing procedure is also applied to the products to remove false alarms. It consists first in coarse cloud masking, followed by spectral shape tests leading to classify the pixel as cloud, or sargassum-free.

In the frame of the European project e-shape <https://e-shape.eu/>, CLS has produced a reanalysis of sargassum NFAl data using observations from OLCI sensor on-board Sentinel-3A and Sentinel-3B.

<https://e-shape.eu/index.php/showcases/pilot5-4-sargassum-detection-for-seasonal-planning>

The Weekly Composite of sargassum index provides the normalized floating algae index (NFAl) averaged over 7 days of data and on a 1-km. It is computed from the high resolution daily products computed at 300m resolution.

It is a composite product from OLCI Sentinel-3A and B data covering the whole Tropical Atlantic Basin and Gulf of Mexico.

Values of positive NFAl Indicate the presence of sargassum. Sargassum-free pixels are set to the value of -0.5.

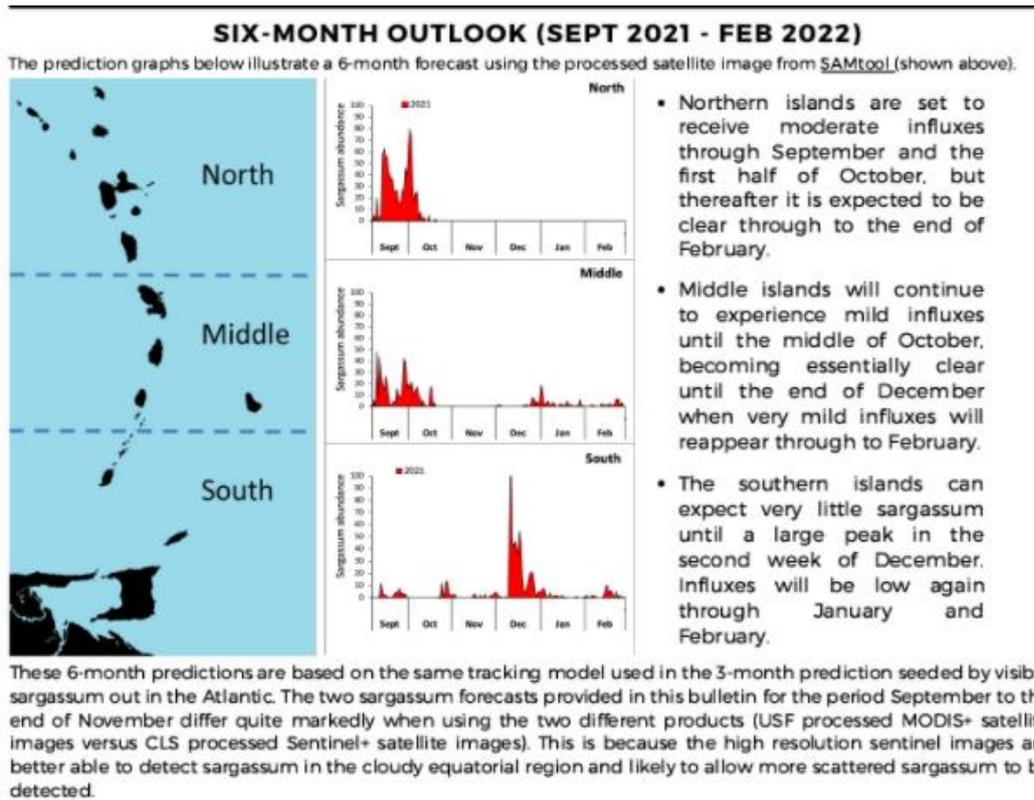


Figure 1: prediction graph for 6 month forecast using the processed images from SAMtool.

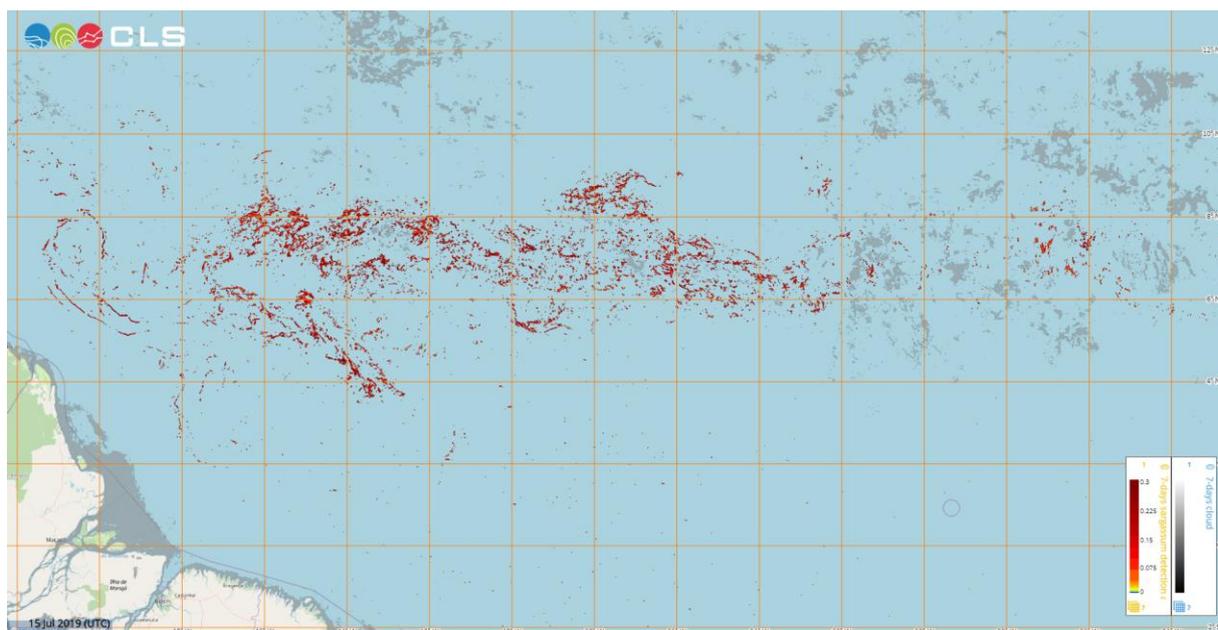


Figure 2: detection of sargassum on weekly maps of OLCI for July 15th 2019. Sargassum mats are shown in red, cloud is shown in grey

2.1. Examples of application

The weekly product serves a diversity of users, from scientists attempting to understand the seasonal cycle of sargassum circulation in the Atlantic basin, to coastal managers trying to anticipate the upcoming sargassum influxes to warn communities well ahead of arrival, to entrepreneurs who need to know how much raw product they will have to work with.

The Centre for Ressource Management and Environmental Studies (CERMES) of the University of the West Indies, based in Barbados, has the mission to contribute to sustainable development in the Caribbean region. CERMES provides graduate education, environmental guidance, consultancy and services to regional governments, NGOs and private sector in the Carribean.

Thanks to the pilot results, CERMES is enhancing its bi-monthly sub-regional Sargassum Outlook Bulletin by providing a 6-monthly forecast of sargassum influxes.

CERMES is relying on CLS high resolution (300m pixel) weekly product of sargassum detection from multiple satellites sensors to produce this 6-month outlook on the upcoming sargassum season. These data help CERMES to warn the tourism and fisheries industries in the Caribbean about the upcoming potential Impacts.

3. Description of the product

3.1. Product general content and specifications

Covered period	Spatial coverage	Delivery format	Grid resolution	Update
From 2018/12/26 to 2019/12/31	Tropical Atlantic from -5°S to 30°N, 100°W to 15°E	The Weekly Composite of sargassum index provides the normalized floating algae index (NFAI) averaged over 7 days of data. It is computed from the high resolution daily products computed at 300m resolution.	1 km	Every 7 days

Table 1: Characteristics of the Floating Sargassum Algae Index dataset.

3.2. Variables handling

The variable available in the product is:

nfa_i_mean = weekly mean of mean value of normalized floating algae index in bin_size degree cell

4. How to download a product

4.1. Registration

To access data, registration is required. During the registration process, the user shall accept using [license](#) for the use of AVISO+ products and services.

- if not registered on AVISO+, please, fill the form and select the product '**Sargassum detection product**' on <http://www.aviso.altimetry.fr/en/data/data-access/registration-form.html>
- if already registered on AVISO+, please request the addition of this '**Sargassum detection product**' on your personal account on <https://www.aviso.altimetry.fr/en/my-aviso-plus.html>

4.2. Access Services

Note that once your registration is processed (see above), AVISO+ will validate your registration by e-mail as soon as possible (within 5 working days during working hours, Central European Time).

Those data are delivered on the Thredds Data Server with authentication.

The access information will be available in your personal account on <https://www.aviso.altimetry.fr/en/my-aviso-plus.html>.

5. Bibliography

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Wang, M., and C. Hu, 2016: Mapping and quantifying sargassum distribution and coverage in the central west Atlantic using MODIS observations. Rem. Sensing of Environment 18