



## Aims

The AMT4SentinelFRM project focuses on providing high quality Fiducial Reference Measurements (FRM) to validate Copernicus Sentinel satellite data during the Atlantic Meridional Transect (AMT) research voyage between the UK and the South Atlantic.

These observations from space provide unique information which greatly aids understanding and management of our environment and are vitally important because they can observe vast areas of the Earth that are difficult to access and sample using traditional methods.

This will be achieved through the collection, processing, analysis, publication and reporting of *in situ* FRM field measurements coincident and near-contemporaneous with data from the Sentinel satellites collected as part of the AMT cruise. The project will utilise data from the Sentinel-1 SAR imager, Sentinel-2A Multi-Spectral Instrument (MSI) and the Sentinel-3A Ocean and Land Colour Instrument (OLCI) and the Sea and Land Surface Temperature Radiometer (SLSTR).

The project will take full opportunity to validate relevant Copernicus contributing missions. The European Commission's Copernicus programme is the largest global environmental monitoring initiative ever conceived. Data provided by the AMT cruise will confirm the quality and performance of Copernicus satellite data that are used by Copernicus services.

*Satellite images courtesy of ESA, RRS James Clark Ross images by C. Gilbert and P. Bucktrout, British Antarctic Survey.*

## What is a Fiducial Reference Measurement?

The Sentinel-3 Validation Team established the concept of Fiducial Reference Measurements as:

*"The suite of independent ground measurements that provide the maximum Return On Investment for a satellite mission by delivering, to users, the required confidence in data products, in the form of independent validation results and satellite measurement uncertainty estimation, over the entire end-to-end duration of a satellite mission."*

## Partners

The AMT4SentinelFRM consortium is led by Plymouth Marine Laboratory and includes two partners as subcontractors: the University of Southampton and the Institut Français de Recherche pour l'Exploitation de la Mer, Plouzane, France (IFREMER). The European Commission Joint Research Centre (JRC) is involved as an external party on Copernicus validation activities.

**PML** | Plymouth Marine Laboratory

UNIVERSITY OF **Southampton**

**Ifremer**

## Contact

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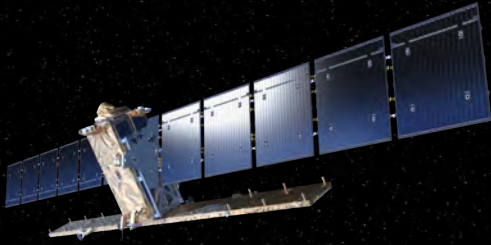


Validating Copernicus Sentinel data using Fiducial Reference Measurements





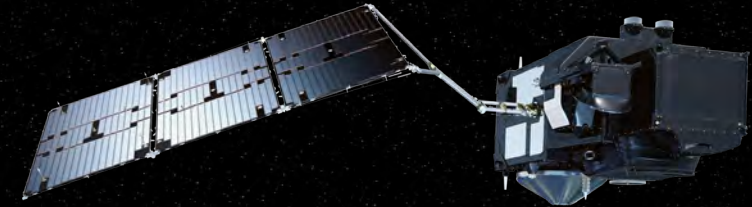
# Validating Copernicus Sentinel data products using Fiducial Reference Measurements



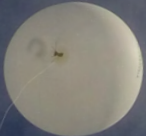
Sentinel-1: AMT26 is deploying a dedicated C-band radar and a WAVEX wave radar to validate Sentinel-1 Synthetic Aperture Radar (SAR) imager products.




Sentinel-2: AMT26 is collecting marine optics and biogeochemistry data to explore the application of Sentinel-2 Multi-Spectral Instrument for ocean colour applications.




Sentinel-3: AMT26 is collecting a suite of sea surface temperature, optics, biogeochemistry and radar data to assess the performance of ocean colour, temperature and radar instruments on the satellite.



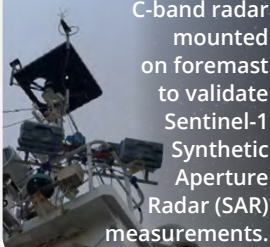
Radiosondes are launched daily attached to a helium balloon to provide profiles of lower atmosphere temperature, humidity, wind speed and direction.




Infrared Sea surface temperature Autonomous Radiometers (ISAR) continually measure the temperature of the surface of the ocean.




SATLANTIC radiometers (HyperSAS) measure reflected light from the sea surface which is used to validate satellite data and develop algorithms to estimate phytoplankton biomass.



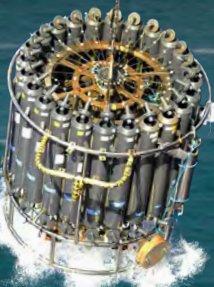
C-band radar mounted on foremast to validate Sentinel-1 Synthetic Aperture Radar (SAR) measurements.



The optics rig houses several instruments to quantify the optical properties of the sunlit ocean and beyond and is deployed at 10am each morning.



Bongo nets are deployed at 4m to capture zooplankton migrating upwards to feed on phytoplankton, providing a link from satellite phytoplankton biomass to higher life forms such as fish.



The ship stops several times a day to deploy a CTD, an instrument which measures profiles of Conductivity (salinity), Temperature and Depth. Water samples are taken from various depths, some to over 4km, and analysed for a vast array of parameters ranging from carbon fixation to genetic diversity. Additional data is gathered by instruments on top of the CTD, including a transmissometer measuring light levels, a Fast Repetition Rate Fluorometer measuring plankton photosynthesis and Acoustic Doppler Current Profilers for particle backscatter.



An absorption spectrometer and backscatter meter plumbed into the the ship's seawater supply continuously measure absorption and attenuation of particles in the water. This gives a measure of water clarity and backscattering of light, which the satellites also measure from above.