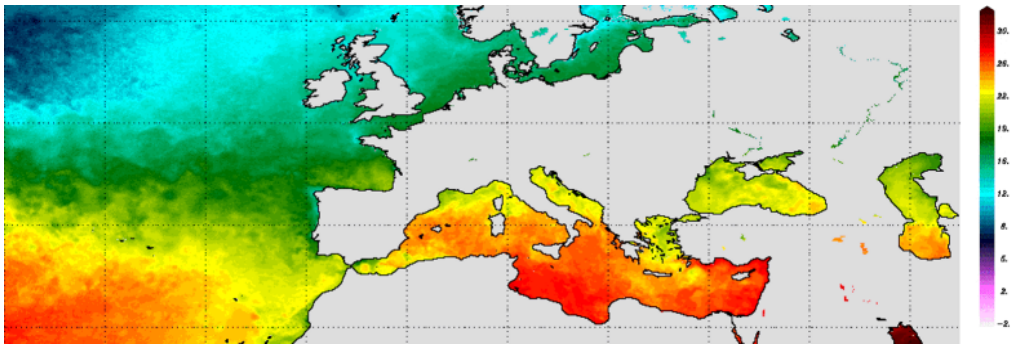
ESA CCI + Phase 1 Sea Surface Temperature (SST)



Product Validation and Inter-comparison Report D4.1 v1

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List of Acronyms

BT	brightness temperature
CCI	Climate Change Initiative
CDR	climate data record
DMI	Danish Meteorological Institute
ESA	European Space Agency
FIDUCEO	Fidelity and Uncertainty In Climate Data Records from Earth Observation
IR	infrared
MW(R)	microwave (radiometer)
PVIR	Product validation and intercomparison report
SST	sea surface temperature
WP	work package

1. SCOPE

This is a report in preparation for a comprehensive Product Validation and Intercomparison Report that will be completed to describe the Sea Surface Temperature Climate Change Initiative Version 3 Climate Data Record (SST CCI v3 CDR). The full PVIR will be document PVIR D4.1 v3.

The form of content of this interim PVIR report is notes arising from the algorithm development work to date within Contractual Phase 1 of SST CCI+ within WP20.

2. NOTES ON MW PRODUCT VALIDATION AND INTERCOMPARISON

2.1 Introduction

Validation of the ESA CCI SST retrievals are performed on a routine basis for the IR products. The validation consists of validation and verification of the IR SST retrievals and uncertainties using in situ observations such as: drifting buoys, Argo buoys, moored buoys and radiometer observations. The main part of the IR validation strategy should also be followed for the MW product with extensive validation against in situ observations. However, as the MW retrieval characteristics and error contributions differ from the IR retrievals special considerations have to be taken into account. This document presents a bullet point list of topics to be considered for the final validation of the MW products.

2.2 Effects of the RFI mitigation

The Radio Frequency Interference can potentially have a large effect on the MW retrievals. The RFI signal typically has a narrow frequency and will thus only contaminate a single frequency channel of the observations. Effective methods have been developed to mitigate the RFI effects (Nielsen-Englyst et al., 2018, Alerskans et al., 2020) and the PVIR should consider the effects of the RFI filtering on the retrieval. This can be done by specific retrieval assessments in regions typically affected by RFI, such as the coastal regions in Europe and United States.

2.3 Land and sea ice contamination on the retrieval

The impact from land and sea ice on the MW brightness temperatures are large compared to the open ocean, and residual side lobe effects can thus be seen several footprints away from the land and sea ice. These effects should be investigated in a validation of the MW SST products.

2.4 SST retrieval performance in cold water

The sensitivity of MW brightness temperature (BT) observations to SST in the 6 and 10 GHz channels is smaller in cold waters compared to warm waters and this can potentially have an impact on the performance of the MW retrieval (see e.g. Prigent et al., 2013). An assessment of the performance of the MW product in the cold waters is therefore essential.

2.5 Validate the uncertainties

The uncertainties within the ESA CCI projects have been developed to account for the different contributions in the IR retrieval. The time and space scales of the different uncertainty components in the MW retrievals are not guaranteed to be the similar to the IR retrievals. Retrieval estimates of the total uncertainty was demonstrated to be accurate in (Nielsen-Englyst et al., 2018, Alerskans et al., 2020) but special considerations should be made for the different uncertainty components and their spatial and temporal characteristics, when validating the MW products.

2.6 Sun glint effects

Sun glints contaminate the MW observations when the observation geometry is near the specular reflection angle. The regions where the observations might be contaminated are well known for each MW instrument. It should be verified that observations influenced by sun glint effects are masked out in the final products.

2.7 Assess the effect from surface roughness

The emissivity effects from the surface roughness are significant and complex (Kilic et al., 2018). These effects should be accounted for in the retrieval, but residual effects are often seen in the observations, especially for high wind speeds. It is thus necessary to validate the MW SST products with a wind speed dependent uncertainty assessment.

2.8 Sampling effects

The MW footprints are significantly larger than for IR observations and the spatial sampling effects can thus be a significant contribution to the differences in regions with large gradients, when the SST retrievals are compared against the in situ observations. This was also evident in Alerskans et al., 2020, where areas with high gradients and large variability showed elevated uncertainty. It is important to quantify the contribution from the

sampling effects and account for this when interpreting the satellite- in situ validation results.

2.9 Product Intercomparison

MW SST products have different observation and error characteristics compared to the IR. It is therefore important to perform an inter-comparison of the products against the IR products. These inter-comparisons should take into account the differences in the IR vs. MW observation characteristics, such as: footprint sizes, clear sky vs. nonprecipitating clouds and skin vs. subskin.

3. REFERENCES:

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