ESA SST CCI project - phase II
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Impact of Passive Microwave SST on level 4 analysis

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Introduction

The ESA Sea Surface Temperature (SST) Climate Change Initiative (CCI) phase II project has recently generated a new climate data record (CDR) of SSTs based on infrared (IR) satellite data.

SSTs derived from passive microwave (PMW) data have the potential to overcome the shortcomings of IR data (poor performance where there is cloud and aerosols).

This project aims to determine the impact of using PMW SST data from the AMSR-E (200206 – 201109) and AMSR2 (201207 – 201612) instruments in addition to the IR data used in the phase II CDR.

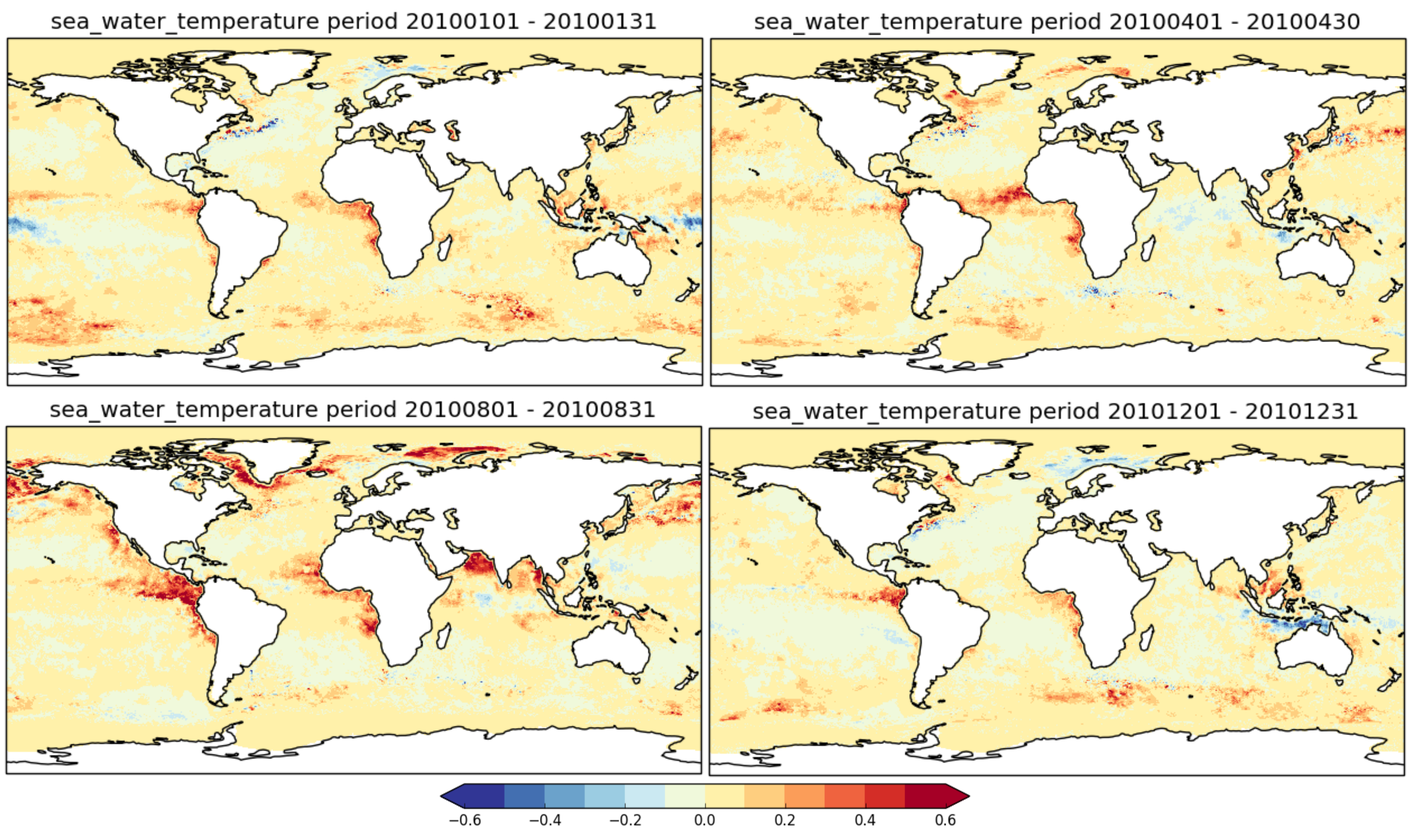

Fig 2: Monthly SST difference: IR+PMW minus IR-only control

Argo validation

Argo near-surface observations were compared to the two sets of analyses. Tables 1 and 2 show the results from the time periods that the AMSR-E and AMSR2 instruments were active.

Where the statistics are better by at least 0.02 between the types of analysis, the better of the two is highlighted in bold.

The results show that using PMW SST data improves the skill of the OSTIA analysis in all areas except the Mediterranean Sea.

Conclusion

Using PMW SST data results in:

- Increased number of observations globally, but most especially in areas poorly observed by IR data, such as tropical regions.
- Warmer sea surface temperatures distributed across the globe.
- Comparison to independent Argo data shows that PMW derived SSTs reduces the mean difference and standard deviation values.
- While the uncertainty was reduced, the spatial resolution remained the same.

The analysis shows that using PMW derived SSTs gives significant value to the analyses. It is therefore recommended that more PMW derived SST datasets are made available and utilised for future analyses.

The L4 analysis files are available for download. Please contact us at the email addresses below.

Comparison between level 4 analyses

The IR-only and IR+PMW data sets were processed using the Operational Sea Surface Temperature and Sea Ice Analysis (OSTIA) system to produce daily, global L4 analyses for the study period. The comparison shows that:

- The analysis relaxed to climatology less often in the tropics (more observations available).
- The global average timeseries shows that using PMW SST data results in a warmer sea (Fig. 1).
- Global monthly maps show that the warmer areas are distributed globally but are stronger in the tropics. Four months from 2010 are shown as an example (Fig. 2).
- Spectral analysis plots showed no significant differences between the two analyses. A plot from 2010 is given as an example (Fig. 3).

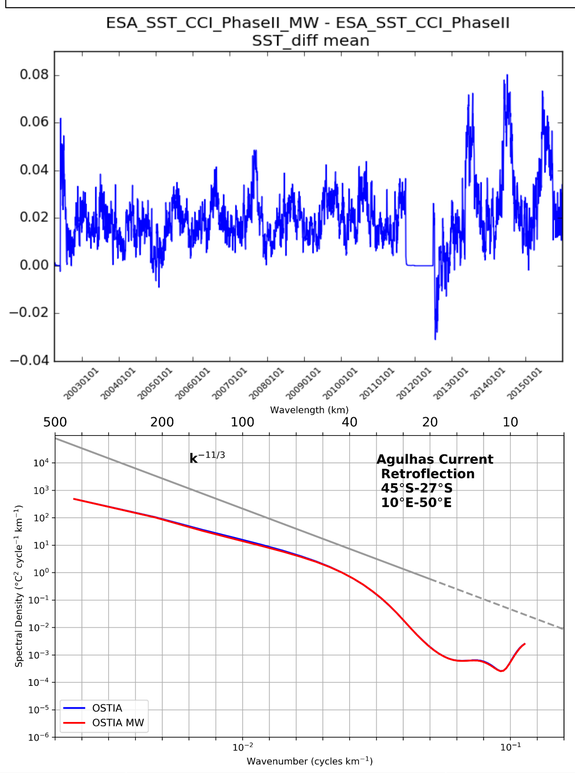

Fig 1: Time series global SST mean difference.

Fig 3: Spectral analysis - Agulhas current in 2010.

AMSR-E	IR – only analyses		IR and PMW analyses		
Region	Mean difference (K)	Standard deviation of differences (K)	Mean difference (K)	Standard deviation of differences (K)	Number of matchups
Globe	-0.065	0.445	**-0.040**	**0.415**	473987
Arctic	-0.188	0.532	**-0.149**	**0.488**	2754
Mediterranean Sea	0.093	0.762	0.101	0.761	2941
North Atlantic	-0.056	0.549	**-0.027**	**0.517**	63605
Tropical Atlantic	-0.110	0.359	**-0.053**	**0.324**	24402
South Atlantic	-0.056	0.432	**-0.038**	**0.406**	39860
North Pacific	-0.059	0.478	**-0.022**	**0.444**	166408
Tropical Pacific	-0.062	0.278	**-0.042**	0.260	102518
South Pacific	-0.064	0.342	-0.052	0.325	113292
Indian Ocean	-0.084	0.392	**-0.060**	**0.352**	84471
Southern Ocean	-0.087	0.446	**-0.066**	**0.423**	93927

Table 1: Results for the AMSR-E period (200206 – 201109)

AMSR2	IR – only analyses		IR and PMW analyses		
Region	Mean difference (K)	Standard deviation of differences (K)	Mean difference (K)	Standard deviation of differences (K)	Number of matchups
Globe	0.053	0.452	**0.026**	**0.395**	337634
Arctic	0.065	0.552	**-0.048**	**0.526**	3040
Mediterranean Sea	-0.036	0.440	-0.042	0.433	6831
North Atlantic	0.069	0.477	**0.038**	**0.414**	59418
Tropical Atlantic	0.186	0.386	**0.084**	**0.316**	25910
South Atlantic	0.072	0.540	**0.033**	**0.468**	25840
North Pacific	0.036	0.468	**0.002**	**0.410**	116885
Tropical Pacific	0.043	0.310	0.033	**0.272**	93485
South Pacific	0.044	0.368	0.035	**0.326**	86940
Indian Ocean	0.097	0.417	**0.065**	**0.352**	47506
Southern Ocean	0.070	0.525	**0.037**	**0.459**	63027

Table 2: Results for the AMSR2 period (201207 – 201612)

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