# **SST CCI Climate Assessment Report**

## Summary

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## Methods

The SST\_CCI products and the comparison data sets are presented on a range of different grids and also, in those cases where the data are presented as anomalies, relative to different climatological averages. In order to make a direct comparison, the data were first converted into anomalies relative to the MyOcean OSTIA reanalysis climatology for the period 1985-2007. The climatology was regridded from 0.05-degree latitude by 0.05-degree longitude daily to have the same resolution as the data set being processed. Secondly, a common mask was applied to the data. Again this was based on the MyOcean OSTIA reanalysis climatology.

${figure.region\_map}

Figure 1: Maps showing regions used in the analysis of trends and indices

## Linear Trends

Time series of area-averaged temperatures were calculated from each of the data sets for the regions shown in Figure 1. Area averages were calculated as a weighted average of all non-missing grid box values within the area. The weights were proportional to the area of ocean within the grid box. In coastal grid boxes which were not entirely covered by ocean, the area of ocean was estimated using the OSTIA reanalysis climatology. Grid boxes in the climatology, which had an assigned SST, were assumed to be 100% ocean.

Area averages were calculated for each data set with its native coverage and also after the coverage had been reduced to that of HadSST3. To reduce the coverage to that of HadSST3, each data set first had to be regridded to 5 degree resolution.

Linear trends in the area averages were calculated from all non-missing monthly values using the ordinary least squares method. Trends were calculated over two periods, 1992-2010 and 1996-2010. The former period covers all complete years in the SST\_CCI data sets. The latter period excludes the problematic ATSR1/Pinatubo period.

## Indices

In addition to the time series for the regions described in Figure 1, indices for certain standard modes of variability were also calculated. These were:

Niño 1+2 [0-10S, 90-80W]

Niño 3 [5N-5S, 150-90W]

Niño 4 [5N-5S, 160E-150W]

Niño 3.4 [5N-5S, 170-120W]

Dipole Mode Index (DMI) calculated as the difference between the area-average SST anomalies for the regions [50-70E, 10S-10N] and [90-110E, 10S-10N].

Tropical Atlantic Meridional SST Gradient (TAMG) calculated as the difference between the area-average SST anomalies for the regions [60W-African Coast, 5-28N] and [60W-20E, 20S-5N]

These six indices are all based on area-averages, which were calculated in the same way as for the area averages in the section on Linear Trends.

## Results

Results of the Linear Trend and Climate Index analysis are shown below.

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${figure.Figure\_2}

Figure 2: Linear trends from January 1992 to December 2010 for each of the 61 regions and indices and each of the comparison data sets (pink and grey) and the three CCI data sets: (red) L4, (green) L3u, (blue) L2p. The comparison data sets shown in pink are Pathfinder, NOCS, Karspeck, OSTIA reanalysis and Daily OI using AMSR. The pale blue area is an estimate of the uncertainty in the trend arising from measurement and sampling errors in the HadSST3 data.

${figure.Figure\_3}

Figure 3: As for Figure 2 but each data set has been reduced to the coverage of HadSST3.

${figure.Figure\_4}

Figure 4: Linear trends from January 1997 to December 2010 for each of the 61 regions and indices and each of the comparison data sets (pink and grey) and the three CCI data sets: (red) L4, (green) L3u, (blue) L2p. The comparison data sets shown in pink are Pathfinder, NOCS, Karspeck, OSTIA reanalysis and Daily OI using AMSR. The pale blue area is an estimate of the uncertainty in the trend arising from measurement and sampling errors in the HadSST3 data.

${figure.Figure\_5}

Figure 5: as for Figure 4 but each data set has been reduced to the coverage of HadSST3.

## Multi-annual and Decadal Averages

Multi-annual and decadal averages were calculated for the periods 1991-1995, 1996-2000, 2001-2005, 2006-2010, 1991-2000 and 2001-2010. An average was calculated when at least 30% of monthly values were non-missing. In order to highlight multi-annual variability, five-year averages for each data set were also calculated as differences from the 1991-1996 average for that data set. Plots of the decadal-average differences between data sets were also plotted.

## Results

Results of the Multi-annual and Decadal Averages are shown below.

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Figure 6: 5-year average temperature anomalies relative to the average for 1991-1995 for a selection of data sets. From left to right the periods are: 1991-1995, 1996-2000, 2001-2005, and 2006-2010. For a pixel to be filled, more than 30% of months need to have a valid SST.

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Figure 7: Decadal averages for a selection of data sets. From left to right the periods are: 1991-2000, 2001-2010. For a pixel to be filled, more than 30% of months need to have a valid SST.

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Figure 8: Colocated decadal average differences between all pairs of data sets. Scale is same as for Figure 7. The difference is X minus Y so, for example, the Pathfinder columns is consistently negative because the Pathfinder has a cold bias relative to all the other data sets (i.e. Pathfinder minus other data set).

${figure.decadal\_wall\_2001}

Figure 9: Colocated decadal (2001-2010) average differences between all pairs of data sets. Scale is same as for Figure 7. The difference is X minus Y, so for example the Pathfinder column is consistently negative because the Pathfinder data set has a cold bias relative to all the other data sets (i.e. Pathfinder minus other data set).

## Autocorrelations

Lagged correlations were calculated for each data set. In order to make a direct comparison, all data sets were regridded to 5-degree monthly resolution. Lag correlations at lags of 1, 2, 3 and 4 months were calculated in all grid boxes for which at least 30% of monthly values were non-missing.

## Results

Results of the autocorrelation analysis are shown below.

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Figure 10: Lag correlations for lags from one to four months for a selection of data sets.

## Additional Timeseries Plots

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Figure 11: Regional average SST anomaly (relative to MyOcean OSTIA reanalysis) for each of the comparison data sets (grey) and the SST\_CCI products (red, green, blue).

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Figure 12: Collocated regional average SST anomaly (relative to MyOcean OSTIA reanalysis) for each of the comparison data sets (grey) and the SST\_CCI products (red, green, blue).