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Project : **SST CCI Phase-II**

Title : **SST CCI Microwave Matchup Data Content Report**

Abstract : This document describes the format, content and origin of the Multisensor Matchup Datasets used for validation of the microwave SST retrieval.

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AMENDMENT RECORD

This document shall be amended by releasing a new edition of the document in its entirety. The Amendment Record Sheet below records the history and issue status of this document.

AMENDMENT RECORD SHEET

ISSUE	DATE	REASON FOR CHANGE
A	30/08/18	Initial version
B	30/08/18	Revised with minor comments from J. Høyer and H. Kelliher.
1	31/08/18	First issue

RECORD OF CHANGES IN THIS ISSUE

Issue	Section	Reason	Change

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose and Scope

This document covers the generation and content of the MMD15 (Multisensor Matchup Dataset) used for validation of the microwave SST retrieval algorithm developed by the Danish Meteorological Institute. It contains a description of the input data used, the matchup generation process and the file-format and content of the MMD.

1.2 Acronyms

AMSR	Advanced Microwave Scanning Radiometer
AMSR-E	Advanced Microwave Scanning Radiometer - EOS (Aqua)
AMSR-2	Advanced Microwave Scanning Radiometer - 2 (GCOM-W1)
CALIOP	Cloud-Aerosol Lidar with Orthogonal Polarization
CALIPSO	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations
CDO	Climate Data Operators
CLay	Cloud Layer
DMI	Danish Meteorological Institute
ECMWF	European Centre for Medium-Range Weather Forecasts
EOS	Earth Observing System
GCOM-W1	Global Climate Observation Mission – Water 1 (JAXA)
HDF4	Hierarchical Data Format 4
HDF5	Hierarchical Data Format 5
ICOADS	International Comprehensive Ocean-Atmosphere Dataset
JAXA	Japan Aerospace Exploration Agency
L1R	Level 1
L2A	Level 2 resampled swath brightness temperatures (Aqua)
L4	Level 4
Lidar	Light detection and ranging
MMD	Multisensor Matchup Dataset
MMS	Multisensor Matchup System
MODAPS	MODIS Adaptive Processing System
MODIS	Moderate Resolution Imaging Spectroradiometer
MOHC	Met Office Hadley Centre
NetCDF	Network Common Data Format
NWP	Numerical Weather Prediction
SST	Sea Surface Temperature
VFM	Vertical Feature Mask

2.   INPUT DATA

This section lists the input data used for the generation of the Microwave Multisensor Matchup Dataset (MMD 15).

2.1   AMSR-E

AMSR-E L2A data from the Aqua platform, processed with ground-segment software version v12 at AMSR-E Science Investigator-led Processing System at the Global Hydrology Resource Center, stored in HDF4 format. Archive content on JASMIN ranging from 2002-06-01 to 2011-10-04.

The matchup data contains only the "Lo_Res_Swath i.e. the measurement data resampled to the coarse 6 GHz resolution (nominally grid resolution of 10 km).

2.2   AMSR-2

AMSR-2 L1R data from the GCOM-W1 platform, processed with ground segment software version v220 at JAXA GCOM Project processing centre, stored in HDF 5 format. Archive content on JASMIN ranging from 2012-07-02 to 2017-10-26.

The matchup data contains only the "Lo_Res_Swath i.e. the measurement data resampled to the coarse 6 GHz resolution (nominally grid resolution 62 x 35km).

2.3   CALIOP Clay/VFM

L2 data of CALIOP Lidar instrument from the CALIPSO platform, dataset version v4.10 stored in HDF 4 format. Archive content on JASMIN ranging from 2007-01-01 to 2016-12-30.

CLay: Cloud Layer Data Level 2 product at 5km ground resolution with a temporal resolution of 0.74s.

VFM: Vertical Feature Mask Level 2 data at 333m ground resolution with a temporal resolution of 0.74.s

2.4   MODIS MYD06

MODIS MYD06 Level 2 Cloud Product data from the Aqua platform, processed with ground-segment version v006 at MODIS Adaptive Processing System (MODAPS), stored in HDF 4 format. Archive content on JASMIN ranging from 2008-01-01 to 2009-12-31 and 2014-01-01 to 2014-12-31.

2.5   SST In-Situ Data

SST in-situ data assembled for the quality assurance of the SST-CCI ESA project by the University of Leicester. It consists of quality controlled measurements taken from the International Comprehensive Ocean-Atmosphere Dataset (ICOADS) version 2.5.1, and the Met Office Hadley Centre (MOHC) Ensembles dataset version 4.2.0 (EN4). The in-situ dataset version is v04.0 and is stored in NetCDF format.

Archive content on JASMIN ranging from 1978-01-01 to 2017-12-19.

2.6 ERA-Interim

Global atmospheric reanalysis data from ECMWF ERA-Interim dataset in version v1. Archive content on JASMIN ranging from 1979-01-01 to 2017-12-31.

3. MATCHUP PROCESSING

The matchup dataset for MMD15 consists of four different sub-datasets:

1. AMSR-E/CALIOP/In-Situ
2. AMSR-E/CALIOP/In-Situ/MODIS
3. AMSR-2/CALIOP/In-Situ
4. AMSR-2/CALIOP/In-Situ/MODIS

The generation of the MMD was executed on the JASMIN parallel cluster on the CEDA facility using the Multisensor Matchup System (MMS) software in version 1.4.0. The generation of the MMD is a three-step procedure with the stages:

1. Matchup detection
2. Matchup screening
3. Post processing

Steps 1 and 2 in this list create an intermediate dataset, the "raw matchups" which are the input to the post processing stage.

The detection and screening processes were executed on 96 nodes in parallel, the post processing on 48 nodes using a time granularity of 1 week per process.

3.1 Matchup Detection

All four sub-datasets use the in-situ data locations and acquisition times as reference and search for satellite overflights of the associated sensors within the parametrised constraints. These are

- Maximal time difference with respect to the in-situ acquisition time: 4.5 hrs
- Maximal geodesic distance of pixel centre with respect to the in-situ location: 3.54 km

3.2 Matchup Screening

For all pixel combinations that meet the matchup criteria a secondary screening process is applied to remove combinations that are scientifically not interesting in the current use-case. These are:

- Remove matchups where AMSR-2/AMSR-E data is at the swath border (min delta 4px in both directions)
- Remove matchups where CALIOP data is at the swath border (min delta 1px in x-direction and 10px in y-direction)

3.3 Post Processing

The post processing stage adds data to the raw matchups that is required for the scientific purpose of the MMD. In this case, it consists of

- AMSR-2/AMSR-E solar angles calculated from elevation and azimuth angles to conform to standard definition
- SST-in-situ data time series covering 144hrs around the matchup time

- ERA-Interim Numerical Weather Prediction (NWP) data covering the matchup region, extracted, projected and interpolated to the matchup locations using Climate Data Operators (CDO).

- CALIOP CLay data

- CALIOP VFM flag dataset

4.   MATCHUP DATASET FORMAT

The resulting matchup data are written to a standardised output format that allows easy use of the data. The MMD is stored in compressed NetCDF 4 data format containing copies of the sensor original data in a configurable spatial environment around the matchup location.

The MMD contains

- Global metadata (processing date, processor configuration etc.)

- MMD specific variables (normalized matchup-time, for each sensor the original file name and x/y location)

- Sensor specific variables (all variables – or a predefined subset - of the input file in the original format).

Each sensor input variable is a three dimensional dataset where the x and y dimensions are the extensions of the extraction window and the z-dimension is the matchup index.

The MMD15 uses the following extraction window sizes (centred on the matchup location):

- AMSR-E/AMSR-2: nx=21, ny=21

- CALIOP VFM/CLay: nx=1, ny=21

- MYD06: nx=21, ny=21

- In-situ: nx=1, ny=1

One MMD file is generated for each configured sub-interval of the complete processing interval. A file name convention ensures that the data content can be derived from the file name itself.

5.   MATCHUP DATASET AVAILABILITY

The matchup result data is stored at the group workspace for the SST-CCI project accessible to the team-members for further processing. A copy of the data is publicly accessible using the JASMIN "gws-access" mechanism.

Direct download is possible using an HTTP connection to

http://gws-access.ceda.ac.uk/public/esacci-sst/matchup_data/mmd_15_r02/