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Project : **CCI Phase 1 (SST)**

Title : **CCI-SST Input Output Data Definition**

Abstract : This document contains the input output data definition (IODD) for the ESA SST_CCI proiect

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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
1.0	28 Sep 2012	Initial version
2.0	20 Mar 2013	Minor updates

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose and scope

This Sea Surface Temperature (SST) Input Output Data Document identifies and describes the sets of data, which are inputs to or outputs from the components of the SST system for the European Space Agency (ESA) Climate Change Initiative (CCI). SST is one of 13 Essential Climate Variables (ECV) currently studied by CCI. The SST system will be used to generate and continuously update the SST part of the CCI climate data record (CDR).

Most of the data defined in this document have already been described in detail elsewhere. For example the SST CCI Product Specification Document (PSD) describes all SST CCI user products. Therefore most of the data sets named in this document are briefly described, with references to the original defining document. For input or output data sets not described elsewhere, a detailed description is given. In-situ data used by the SST CCI system are described in the SST CCI Data Access Requirements Document (DARD) [AD 4].

1.2 References

The following documents are applicable to this document:

ID	Title	Issue	Date
[AD 1]	ESA Climate Change Initiative Phase I - Scientific User Consultation and Detailed Specification Statement of Work (SoW), including Annex G: Sea Surface Temperature ECV	1.4	09.11.2009
[AD 2]	Sea Surface Temperature ECV Proposal		16.07.2010
[AD 3]	Sea Surface Temperature CCI User Requirements Document, SST_CCI-URD-UKMO-001 (URD)	2	30.11.2010
[AD 4]	Sea Surface Temperature Data Access Requirements Document, SST_CCI-DARD-UOL-001 (DARD)	1.0	27.01.2012
[AD 5]	Sea Surface Temperature Product Specification Document, SST_CCI-PSD-UKMO-002 (PSD)	2	11.11.2011
[AD 6]	MMD Content Specification, SST_CCI-REP-UOL-001	C	22.07.2011

The following documents are referenced in this document (see Reference Documents List, SST_CCI-REP-UOE-001):

ID	Title
[RD 42]	Ocean & Sea Ice SAF Sea Ice Product Manual
[RD 43]	Ocean & Sea Ice SAF Global Sea Ice Concentration Reprocessing Product User Manual, Product OSI-409
[RD 197]	Ocean & Sea Ice SAF Low Earth Orbiter Sea Surface Temperature Product User Manual
[RD 285]	European Committee for Space Standardisation - Software, ECSS-E40
[RD 286]	ENVISAT-1 Products Specification - http://envisat.esa.int/support-docs/productspecs/
[RD 287]	ENVISAT-1 Products Specification - Volume 7: AATSR Products Specification, IDEAS-SER-IPF-SPE-0288
[RD 288]	NOAA KLM User's Guide
[RD 289]	WMO publication No 306, Manual on Codes

1.3 Acronyms

The following SST-specific acronyms are used in this report (also see Acronyms List, SST_CCI-REP-UOE-002):

Acronym	Definition
ARC	ATSR Reprocessing for Climate
(A)ATSR	(Advanced) Along-Track Scanning Radiometer
AVHRR	Advanced Very High Resolution Radiometer
BADC	British Atmospheric Data Centre
BEAM	Earth observation toolbox and development platform
CCI	Climate Change Initiative
CF	Climate Forecast
CMIP5	Coupled Model Intercomparison Project Phase 5
CMS	Centre de Météorologie Spatiale, Météo-France
DARD	Data Access Requirements Document
DPM	Detailed Processing Model
ECDF	Edinburgh Compute and Data Facility
ECMWF	European Centre for Medium-Range Weather Forecasts
ECSS	European Cooperation for Space Standardisation
ECV	Essential Climate Variable
ESA	European Space Agency
GBCS	Generalised Bayesian Cloud Screening
GDS	GHRSST Data Processing Specification
GHRSST	Group for High-Resolution SST
GMPE	GHRSST Multi Product Ensemble
IR	Infrared
MetOp	Meteorological Operational (EUMETSAT)
MD	Match-up Dataset (single-sensor)
MMD	Multi-sensor Match-up Dataset
MMS	Multi-sensor Match-up System
NOAA	National Oceanic and Atmospheric Administration
NEODC	NERC Earth Observation Data Centre
NERC	Natural Environment Research Council
NWP	Numerical weather prediction
OSI-SAF	Ocean & Sea Ice Satellite Application Facility (EUMETSAT)
OSTIA	Operational Sea Surface Temperature and Sea Ice Analysis
PMW	Passive Microwave
SDI	Saharan Dust Index
SEVIRI	Spinning Enhanced Visible and Infrared Imager
SGE	Sun Grid Engine
SoW	Statement of Work
SST	Sea Surface Temperature

Acronym	Definition
UoE	University of Edinburgh

1.4 Document structure

After this formal introduction,

section 2 provides an overview of the SST CCI processing chain and the data required for input and produced as output

section 3 lists and describes the Level-1 satellite data products used in the SST CCI processing chain

section 4 lists and describes the Level-2 satellite data products used in the SST CI processing chain

section 5 lists and describes the Level-3 data products used in the SST CCI processing chain

section 6 lists and describes the Level-4 data products used in the SST CCI processing chain

section 7 lists and describes the auxiliary data used for the SST CCI Level-2 processing

section 8 lists and describes the auxiliary data used for the SST CCI Level-4 processing

2. THE SST PROCESSING CHAIN AND ITS PRODUCTS

The SST CCI processing chain is depicted in Figure 2-1. The figure illustrates the two variants of the processing chain: the demonstrator (also referred to as short-term) and the long-term SST processing systems. Both variants share several common components.

The processing occurs at different locations: ECDF carries out the Level-2 and Level-3 processing of NOAA AVHRR GAC, (A)ATSR and passive microwave (PMW) satellite data, CMS produces Level-3 SST from MetOp AVHRR and SEVIRI satellite data, and MetOffice produces Level-4 SST from Level-2 and Level-3 data produced by ECDF. An overview of the input and output product data used for the SST CCI processing are compiled in Table 2-1.

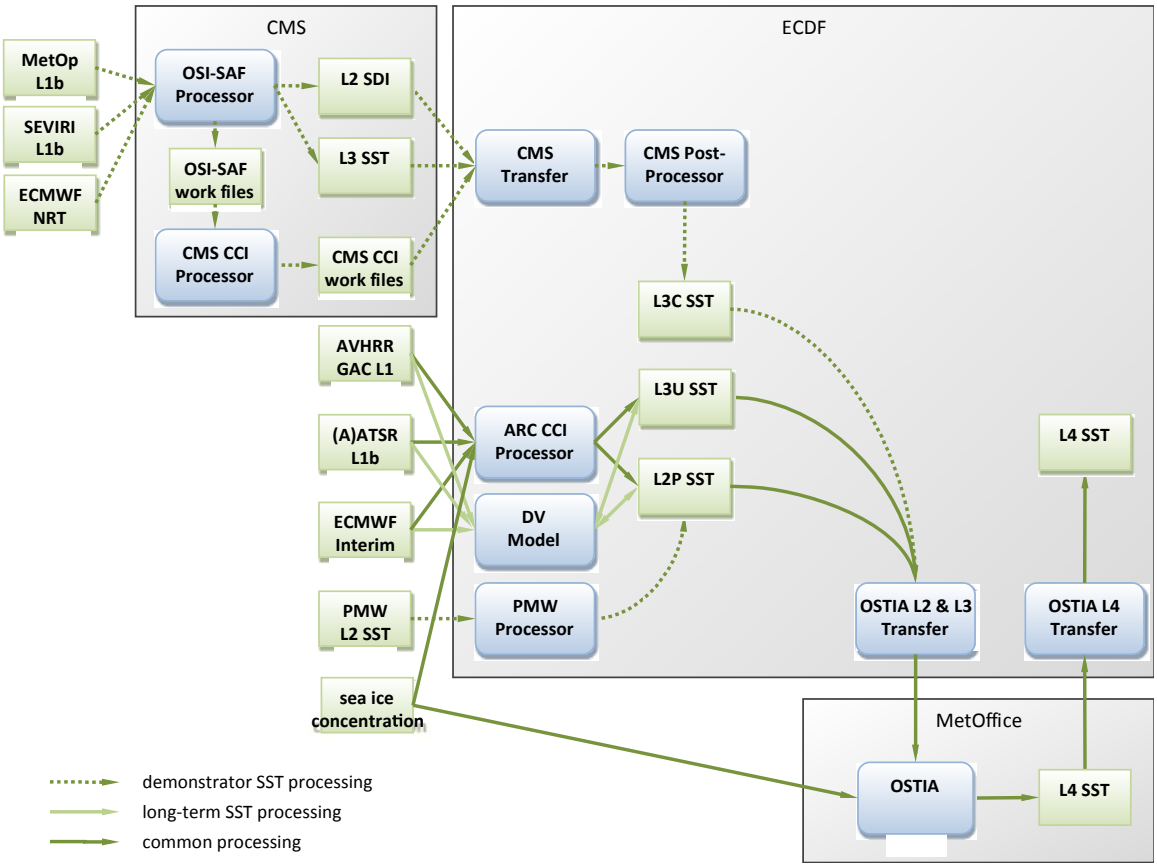

Figure 2-1: SST CCI processing chain

2.1 ECDF

The processing at ECDF mainly consists of the ARC CCI processor, the diurnal variability (DV) model, and the PMW processor. AVHRR GAC Level-1 and (A)ATSR Level 1b satellite data are the main input of the ARC CCI processor, with ECMWF Interim and sea ice concentration auxiliary data. The outputs of the ARC CCI processor are SST CCI L2P and L3U SST. The DV model uses the same inputs as the ARC CCI processor in order to modify the L2P produced by the ARC CCI. It also produces L3U SST. The PMW processor converts PMW Level-2 SST data into SST CCI L2P SST format. All inputs required for the processing are hosted in high performance fibre channel disk storage at ECDF.

Minor components in the ECDF processing are for converting outputs fetched from CMS into SST CCI L3U SST and for the data exchange with MetOffice.

2.2 CMS

The processing at CMS consists of the OSI-SAF and CMS CCI processors. MetOp AVHRR and SEVIRI L1b satellite data are the main input of the OSI-SAF processor, with ECMWF NRT auxiliary data. The OSI-SAF processor produces Level-2 SDI and Level-3 SST. The CMS CCI processor interfaces with the OSI-SAF processor and produces MetOp work files. All inputs required for the processing are available at CMS.

2.3 MetOffice

The processing at MetOffice essentially consists of the CCI-specific version of the OSTIA processor, which receives SST CCI L2P and L3U SST from ECDF and produces SST CCI L4 SST. Sea ice concentration auxiliary data are used.

Table 2-1: Data products and their roles in the SST CCI processing chain

Name	Coverage	Input for	Output from
(A)ATSR L1b	1991 to 2010	ARC CCI processor, DV model	External source (ESA)
AVHRR GAC L1	1991 to 2010	ARC CCI processor, DV model	External source (NOAA)
MetOp L1b	3 months	OSI-SAF processor	External source (EUMETSAT)
SEVIRI L1b	2004 to now	OSI-SAF processor	External source (EUMETSAT)
ECMWF NRT	1999 to now	OSI-SAF processor	External source (ECMWF)
ECMWF-interim	1991 to 2010	ARC CCI processor, DV model	External source (ECMWF)
SSM/I sea ice concentration maps	2005 to 2010	OSTIA	External source (OSI SAF HL processing centre)
Global sea ice concentration reprocessing dataset	Oct 1978 to Oct 2009	OSTIA	External source (OSI SAF HL processing centre)
SST CCI L2P SST	1991 to 2010	OSTIA	ARC CCI processor, DV model
SST CCI L3U SST	1991 to 2010	OSTIA	ARC CCI processor, DV model, CMS post-processor
SST CCI L3C SST	1991 to 2010		CMS post-processor
SST CCI L4 SST	1991 to 2010		OSTIA

In-situ data used by the SST CCI system are described in the SST CCI DARD [AD 4].

3. LEVEL-1 SATELLITE DATA PRODUCTS

In the following sections the satellite data products, which are required as inputs for the SST CCI processing are briefly described. More detailed descriptions are provided by the documents given as reference.

3.1 ATSR-1, ATSR-2, and AATSR L1b

The ATSR-1, ATSR-2, and AATSR L1b data products are required input for the ARC CCI processor and the DV model. Their contents and format are defined in the *Envisat Product Specifications* [RD 286] and the *AATSR Products Specifications* [RD 287].

Note that ATSR-1 and ATSR-2 L1b data products from ERS and ERS-2 also use the Envisat format.

3.1.1 File naming convention

The product files use a fixed length file name pattern:

TTTTTTTTTTPGGGyyyymmdd_HHMMSS_tttttttpccc_OOOOO_aaaaa_QQQQ.SS

Example:

ATS_TOA_1PRUPA20050120_001505_000065272034_00030_15114_9653.N1

Table 3-1: Elements of (A)ATSR file names

Pattern Element	Example	Title	Description
TTTTTTTTTT	AT1_TOA_1P AT2_TOA_1P ATS_TOA_1P	Product ID	10 character string identifies sensor, mode and processing level
P	R	Processing stage flag	Set to “N” for Near Real Time product Set to “V” for fully validated (consolidated) product Set to “T” for Test product Set to “S” for a special product. Letters between N and V are assigned in order of level of consolidation (i.e., closer to V = better consolidated)
GGG	UPA	Originator	Processing centre code, here UKPAC
yyyymmdd_HHMMSS	20050120_001505	Start time	UTC of first DSR
ttttttt	00006527	Duration	Duration in seconds
p	2	Phase	Mission phase
ccc	034	Cycle	Cycle within phase at beginning of orbit
OOOOO	00030	Rel. orbit	Relative orbit within cycle
aaaaa	15114	Abs. orbit	Absolute orbit
QQQQ	9653	Counter	Incremented by originator
SS	N1 E1	Extension	File name extension

3.1.2 Product data format

The ATSR-1, ATSR-2, and AATSR data product files are available in Envisat product format. Track-related geo-location and illumination geometry are provided on a sub-sampled tie-point grid. The particular product fields and variables used in SST CCI are compiled in Table 3-2.

Table 3-2: Variables in (A)ATSR L1b products used by ARC CCI processor

Variable name	Description	Reference
lat_corr_nadir lon_corr_nadir lat_corr_fward lon_corr_fward	Grid Pixel Latitude and Longitude and Topog-raphic Corrections	[RD 287] page 36
latitude longitude	Scan Pixel x and y (tie point grid)	[RD 287] page 37
sun_elev_nadir sun_azimuth_nadir view_elev_nadir view_azimuth_nadir	Nadir View Solar Angles (tie point grid)	[RD 287] page 37
sun_elev_fward sun_azimuth_fward view_elev_fward view_azimuth_fward	Forward View Solar Angles (tie point grid)	[RD 287] page 38
btemp_nadir_1200	12 micron nadir view BT	[RD 287] page 39
btemp_nadir_1100	11 micron nadir view BT	[RD 287] page 39
btemp_nadir_0370	3.7 micron nadir view BT	[RD 287] page 39
reflec_nadir_1600	1.6 micron nadir view reflectance	[RD 287] page 39
reflec_nadir:_0870	0.87 micron nadir view reflectance	[RD 287] page 39
reflec_nadir_0670	0.67 micron nadir view reflectance	[RD 287] page 39
reflec_nadir_0550	0.55 micron nadir view reflectance	[RD 287] page 39
btemp_forw_1200	12 micron forward view BT	[RD 287] page 39
btemp_nadir_1100	11 micron forward view BT	[RD 287] page 39
btemp_nadir_0370	3.7 micron forward view BT	[RD 287] page 39
reflec_nadir_1600	1.6 micron forward view reflectance	[RD 287] page 39
reflec_nadir:_0870	0.87 micron forward view reflectance	[RD 287] page 39
reflec_nadir_0670	0.67 micron forward view reflectance	[RD 287] page 39
reflec_nadir_0550	0.55 micron forward view reflectance	[RD 287] page 39
confid_flags_nadir	Confidence words nadir view, valids see reference	[RD 287] page 39
confid_flags_fward	Confidence words forward view, valids see ref.	[RD 287] page 39
cloud_flags_nadir	Cloud flags nadir view, valids see reference	[RD 287] page 39
cloud_flags_fward	Cloud flags forward view, valids see reference	[RD 287] page 39

3.2 AVHRR Global GAC L1

The AVHRR GAC Level-1 data products are required input for the ARC CCI processor and the DV model. Their contents and format are defined in the *NOAA KLM User's Guide* [RD 288].

3.2.1 File naming convention

The product files use a fixed length file name pattern:

GGG.GHRR.*ss*.*Xyyddd*.*SHHMM*.*EHHMM*.B*nnnnnnn*.*AA*

Example:

NSS.GHRR.NK.D98304.S1355.E1456.B0016465.SO

Table 3-3: Elements of AVHRR GAC L1 file names

Pattern Element	Example	Title	Description
GGG	CSS DSS NSS UKM	Processing centre	Three characters identifying where the data was created: CMS = Centre de Meteorologie Spatiale, France DSS = Dundee Satellite Receiving Station - Dundee, Scotland, UK NSS = NOAA/NESDIS - Suitland, Maryland, USA UKM = United Kingdom Meteorological Office - Bracknell, England, UK
ss	NK	Spacecraft unique ID	Two characters identifying the spacecraft platform from which the data was received: NK = NOAA-15 (formerly NOAA-K, launched 13 May 1998) NL = NOAA-16 (formerly NOAA-L, launched 21 September 2000) NM = NOAA-17 (formerly NOAA-M, launched 24 June 2002) NN = NOAA-18 (formerly NOAA-N, launched 20 May 2005)
XyyDDD	D98304	Year day	Six characters date identification field in the form XyyDDD, where "X" is a delimiter, "yy" identifies the year of century and "DDD" identifies the day of the year on which the spacecraft began recording the data set
SHHMM	S1355	Start-time	S1355, where "S" identifies this group as a start time delimiter. "1355" denotes 13 hours 55 minutes UTC (to the nearest minute) and represents the time at which spacecraft recording began.
EHHMM	E1456	Stop-time	E1456, where "E" identifies this group as an end time delimiter. "1456" denotes 14 hours 56 minutes UTC (to the nearest minute) and denotes the time of spacecraft recording of the last usable data in the data set

Bnnnnnnn	B0016465	Processing block ID	B0016465, where "B" identifies this group as a processing block ID delimiter. "0016465" is a seven digit number identifying the spacecraft revolution in which recording of this data set began and the revolution in which the data ended (the first five digits identifying the beginning revolution and last two being the two least significant digits of the orbit number identifying the ending revolution)
AA	SO	Source	Two characters identifying data acquisition source: CA = Cape Ferguson, Queensland, Australia DU = Dundee, Scotland, UK EB = Ewa Beach, Oahu, Hawaii, USA GC = Fairbanks, Alaska, USA (formerly Gilmore Creek) HO = Honolulu, Hawaii, USA MI = Miami, Florida, USA MO = Monterey, California, USA SO = Satellite Operations Control Center, Suitland, Maryland, USA SV = Svalbard, Norway WE = Western Europe, Lannion, France WI = Wallops Island, Virginia, USA

3.2.2 Product data format

The AAVHRR GAC L1 product files are available in NOAA KLM (Version 2) product format before April 2005, and in NOAA N format after April 2005. Track-related geo-location and illumination geometry are provided on a sub-sampled tie-point grid.

The particular product fields and variables used in SST CCI are compiled in Table 3-4.

Table 3-4: Variables in AVHRR GAC L1 products used by the ARC CCI processor

Variable name	Description	Reference
Earth Location	Latitude and longitude (tie point grid)	[RD 288] section 8.3.1.4.3.1
Angular Relationships	Solar zenith angle, satellite zenith angle, relative azimuth angle (tie point grid)	[RD 288] section 8.3.1.4.3.1
Sensor Data, Band Interleaved by Pixel	Recorded sensor data for channels 1 to 5	[RD 288] section 8.3.1.4.3.1
Calibration Coefficients	Calibration coefficients for channels 1 to 5	[RD 288] section 8.3.1.4.3.1

3.3 OSI-SAF Work Files (MetOp Internal)

The OSI-SAF AVHRR MetOp internal work files are produced by the EUMETSAT OSI-SAF SST operational processing chain [RD 197], which is running in near real-time at CMS.

These are twice daily files in netCDF-3 format. They contain MetOp/AVHRR infrared brightness temperatures together with OSI-SAF SSTs and cloud information on a regular global 0.05° x 0.05° grid, as well as many quality information fields related to each step of the OSI-SAF operational processing chain.

3.3.1 File naming convention

The OSI-SAF AVHRR MetOp internal work files are named according to the following convention

`sstglb_metop`*`NN_yyyymmdd_HHMMSS`*`.nc`

Example:

`sstglb_metop02_20120501_000000.nc`

Table 3-5: Elements of OSI-SAF AVHRR MetOp internal work files names

Pattern Element	Example	Title	Description
NN	02	Satellite number	Number of the MetOp satellite (metop02 = MetOp-A)
yyyymmdd_HHMMSS	20120501_000000	Reference time	Central UTC of the 12-hour period over which the MetOp/AVHRR data have been aggregated (HHMMSS is 000000 or 120000)

3.3.2 Product data format

The variables of the OSI-SAF AVHRR MetOp internal work files that are used by the CMS CCI processor are listed in Table 3-6. The detailed product file format is described in section 3.3.2.1.

Table 3-6: Variables of OSI-SAF AVHRR MetOp internal work files used by the CMS CCI processor

Variable name	Description	Reference
time	Product reference time	Section 3.3.2.1
dtime	Time departure from reference time of each grid point	Section 3.3.2.1
lat	Grid point latitude	Section 3.3.2.1
lon	Grid point longitude	Section 3.3.2.1
solzen	Sun zenith angle	Section 3.3.2.1
satzen	Satellite zenith angle	Section 3.3.2.1
IR037 IR108 IR120	Observed brightness temperatures at 3.7, 10.8 and 12.0 micron	Section 3.3.2.1
x_landmask	Land mask associated with the grid	Section 3.3.2.1
sst	OSI-SAF operational MetOp/AVHRR sea surface temperature	Section 3.3.2.1
sst_confidence_level	From 0 to 5 : unprocessed, masked, bad, suspect, acceptable, excellent	Section 3.3.2.1
n_data	Number of contributing observations per grid cell	Section 3.3.2.1

3.3.2.1 Detailed format

The detailed file format of the OSI-SAF AVHRR MetOp internal work files expressed in netCDF common data form language (CDL) is listed below.

```
netcdf sstglb_metop02_20120501_000000 {
dimensions:
       lon = 7200 ;
       lat = 3600 ;
variables:
       double time ;
              time:long_name = "reference time" ;
              time:standard_name = "time" ;
              time:units = "seconds since 1981-01-01 00:00:00" ;
              time:comment = "" ;
       double dtime(lat, lon) ;
              dtime:long_name = "" ;
              dtime:units = "seconds" ;
              dtime:_FillValue = -9999999. ;
              dtime:comment = "" ;
       double lat(lat) ;
              lat:long_name = "latitude" ;
              lat:units = "degrees_north" ;
              lat:valid_min = -89.975 ;
              lat:valid_max = 89.975 ;
              lat:_FillValue = -9999999. ;
       double lon(lon) ;
              lon:long_name = "longitude" ;
              lon:units = "degrees_east" ;
              lon:valid_min = -179.975 ;
              lon:valid_max = 179.975 ;
              lon:_FillValue = -9999999. ;
       short solzen(lat, lon) ;
              solzen:long_name = "solar zenith angle" ;
              solzen:units = "degrees" ;
              solzen:scale_factor = 0.01 ;
              solzen:add_offset = 0. ;
              solzen:validmin = 0s ;
              solzen:validmax = 18000s ;
              solzen:_FillValue = -32768s ;
       short satzen(lat, lon) ;
              satzen:long_name = "satellite zenith angle" ;
              satzen:units = "degrees" ;
              satzen:scale_factor = 0.01 ;
              satzen:add_offset = 0. ;
              satzen:validmin = 0s ;
              satzen:validmax = 9000s ;
              satzen:_FillValue = -32768s ;
       short IR037(lat, lon) ;
              IR037:lon_name = "3.7 microns infra-red channel" ;
              IR037:units = "K" ;
```

```
                IR037:scale_factor = 0.01 ;
                IR037:add_offset = 273.15 ;
                IR037:valid_min = -5000s ;
                IR037:valid_max = 6000s ;
                IR037:_FillValue = -32768s ;
                IR037:comment = "AVHRR channel 3B" ;
        short IR108(lat, lon) ;
                IR108:lon_name = "10.8 microns infra-red channel" ;
                IR108:units = "K" ;
                IR108:scale_factor = 0.01 ;
                IR108:add_offset = 273.15 ;
                IR108:valid_min = -5000s ;
                IR108:valid_max = 6000s ;
                IR108:_FillValue = -32768s ;
                IR108:comment = "AVHRR channel 4" ;
        short IR120(lat, lon) ;
                IR120:lon_name = "10.8 microns infra-red channel" ;
                IR120:units = "K" ;
                IR120:scale_factor = 0.01 ;
                IR120:add_offset = 273.15 ;
                IR120:valid_min = -5000s ;
                IR120:valid_max = 6000s ;
                IR120:_FillValue = -32768s ;
                IR120:comment = "AVHRR channel 5" ;
        byte p_cloudmask_quality(lat, lon) ;
                p_cloudmask_quality:long_name = "primary cloud mask quality flag"
;
                p_cloudmask_quality:units = "percent" ;
                p_cloudmask_quality:scale_factor = 1. ;
                p_cloudmask_quality:add_offset = 0. ;
                p_cloudmask_quality:valid_min = 0b ;
                p_cloudmask_quality:valid_max = 100b ;
                p_cloudmask_quality:_FillValue = -128b ;
                p_cloudmask_quality:comment = "from avh1c_mask bits 2-1 " ;
        byte x_landmask(lat, lon) ;
                x_landmask:long_name = "land mask" ;
                x_landmask:valid_range = 0b, 2b ;
                x_landmask:_FillValue = -128b ;
                x_landmask:flag_values = 0b, 1b, 2b ;
                x_landmask:flag_meanings = "sea land lake" ;
                x_landmask:comment = "from GMT shoreline" ;
        short x_clim_mean_sst(lat, lon) ;
                x_clim_mean_sst:long_name = "climatological mean sst" ;
                x_clim_mean_sst:units = "K" ;
                x_clim_mean_sst:standard_name = "sea_surface_temperature" ;
                x_clim_mean_sst:add_offset = 273.15 ;
                x_clim_mean_sst:scale_factor = 0.01 ;
                x_clim_mean_sst:_FillValue = -32768s ;
        short x_clim_mini_sst(lat, lon) ;
                x_clim_mini_sst:long_name = "climatological minimum sst" ;
                x_clim_mini_sst:units = "K" ;
```

```
              x_clim_mini_sst:standard_name = "sea_surface_temperature" ;
              x_clim_mini_sst:add_offset = 273.15 ;
              x_clim_mini_sst:scale_factor = 0.01 ;
              x_clim_mini_sst:_FillValue = -32768s ;
       short x_sdi(lat, lon) ;
              x_sdi:long_name = "saharan dust index" ;
              x_sdi:standard_name = "saharan_dust_index" ;
              x_sdi:add_offset = 0. ;
              x_sdi:scale_factor = 0.01 ;
              x_sdi:_FillValue = -32768s ;
              x_sdi:comment = "valeur recuperee lors du calcul du dust aersol
indicator" ;
       short x_aod(lat, lon) ;
              x_aod:long_name = "aerosol optical depth" ;
              x_aod:standard_name = "aerosol_optical_depth" ;
              x_aod:add_offset = 0. ;
              x_aod:scale_factor = 0.001 ;
              x_aod:_FillValue = -32768s ;
              x_aod:comment = "valeur recuperee lors du calcul du dust aersol
indicator" ;
       short x_sdi_dtime(lat, lon) ;
              x_sdi_dtime:long_name = "dtime" ;
              x_sdi_dtime:units = "s" ;
              x_sdi_dtime:add_offset = 0. ;
              x_sdi_dtime:scale_factor = 3. ;
              x_sdi_dtime:_FillValue = -32768s ;
              x_sdi_dtime:comment = "-27h + 27h au maximum; datation sdi = time
+ x_sdi_dtime " ;
       short w_t11_gradient(lat, lon) ;
              w_t11_gradient:long_name = "temperature 11 microns gradient" ;
              w_t11_gradient:units = "K/km" ;
              w_t11_gradient:add_offset = 0. ;
              w_t11_gradient:scale_factor = 0.01 ;
              w_t11_gradient:_FillValue = -32768s ;
              w_t11_gradient:comment = "computed in a 3x3 pixels box" ;
       short w_clim_maxi_t11_gradient(lat, lon) ;
              w_clim_maxi_t11_gradient:long_name = "maximal temperature 11
microns gradient" ;
              w_clim_maxi_t11_gradient:units = "K/km" ;
              w_clim_maxi_t11_gradient:add_offset = 0. ;
              w_clim_maxi_t11_gradient:scale_factor = 0.01 ;
              w_clim_maxi_t11_gradient:_FillValue = -32768s ;
              w_clim_maxi_t11_gradient:comment = "derived from
x_clim_maxi_sst_gradient" ;
       byte w_gradient_ind(lat, lon) ;
              w_gradient_ind:long_name = "gradient indicator" ;
              w_gradient_ind:valid_range = 0b, 100b ;
              w_gradient_ind:_FillValue = -128b ;
              w_gradient_ind:comment = "" ;
       byte w_tvalue_ind(lat, lon) ;
              w_tvalue_ind:long_name = "temperature value indicator" ;
              w_tvalue_ind:valid_range = 0b, 100b ;
```

```
              w_tvalue_ind:_FillValue = -128b ;
              w_tvalue_ind:comment = "" ;
       byte w_dust_aerosol_ind(lat, lon) ;
              w_dust_aerosol_ind:long_name = "dust aerosol indicator" ;
              w_dust_aerosol_ind:valid_range = 0b, 100b ;
              w_dust_aerosol_ind:_FillValue = -128b ;
              w_dust_aerosol_ind:comment = "" ;
       byte w_ice_ind(lat, lon) ;
              w_ice_ind:long_name = "ice indicator" ;
              w_ice_ind:valid_range = 0b, 100b ;
              w_ice_ind:_FillValue = -128b ;
              w_ice_ind:comment = "" ;
       byte w_sunglint(lat, lon) ;
              w_sunglint:long_name = "sunglint flag" ;
              w_sunglint:valid_min = 0b ;
              w_sunglint:valid_max = 1b ;
              w_sunglint:_FillValue = -128b ;
              w_sunglint:flag_values = 0b, 1b ;
              w_sunglint:flag_meanings = "no_sunglint sunglint" ;
              w_sunglint:comment = "from p_illumination" ;
       byte sst_mask_ind(lat, lon) ;
              sst_mask_ind:long_name = "sst mask indicator" ;
              sst_mask_ind:valid_range = 0b, 100b ;
              sst_mask_ind:_FillValue = -128b ;
              sst_mask_ind:comment = "note: ex cloudmask_ind" ;
       short sst(lat, lon) ;
              sst:long_name = "sst" ;
              sst:units = "K" ;
              sst:standard_name = "sea_surface_temperature" ;
              sst:add_offset = 273.15 ;
              sst:scale_factor = 0.01 ;
              sst:_FillValue = -32768s ;
              sst:ancillary_variables = "sst_confidence_level" ;
              sst:comment = "" ;
       byte sst_confidence_level(lat, lon) ;
              sst_confidence_level:_FillValue = -128b ;
              sst_confidence_level:valid_range = 0b, 5b ;
              sst_confidence_level:flag_values = 0b, 1b, 2b, 3b, 4b, 5b ;
              sst_confidence_level:flag_meanings = "unprocessed masked bad
suspect acceptable excellent" ;
              sst_confidence_level:comment = "0 et 1 non utilises sur le global"
;
       byte n_data(lat, lon) ;
              n_data:lon_name = "number of meta data pixel(s)" ;
              n_data:_FillValue = -128b ;
              n_data:comment = "" ;

// global attributes:
              :cdl_version = "alpha 1.10" ;
              :start_safo_version = "a1.1p1.1" ;
              :stop_safo_version = "a1.1p1.1" ;
```

```
                :start_file_quality_index = "1" ;
                :stop_file_quality_index = "1" ;
                :identification = "metop02 20120501 000000 00000" ;
                :satellite = "METOP02" ;
                :start_orbit_number = "28698" ;
                :stop_orbit_number = "28705" ;
                :reference_time = "2012-05-01 00:00:00.000" ;
                :start_time = "2012-04-30 18:00:00.000" ;
                :stop_time = "2012-05-01 06:00:00.000" ;
                :southernmost_latitude = -90.f ;
                :northernmost_latitude = 90.f ;
                :westernmost_longitude = -180.f ;
                :easternmost_longitude = 180.f ;
}
```

3.4 CMS CCI Work Files (MetOp Internal)

The CMS CCI AVHRR MetOp internal work files, used in the SST CCI prototype system, are derived from the OSI-SAF MetOp internal work files (see section 3.3), produced by the EUMETSAT OSI-SAF SST operational processing chain [RD 197], which is running in near real-time at CMS.

These products are twice daily files in netCDF-3 format. Besides MetOp/AVHRR infrared brightness temperatures together with OSI-SAF SSTs and cloud information on a regular global 0.05° x 0.05° grid, they also contain simulated infrared brightness temperatures and partial derivatives against surface temperature and total water vapour content, computed with RTTOV-10, in an ad-hoc processing chain developed at CMS under ESA SST CCI contract.

3.4.1 File naming convention

The CMS CCI AVHRR MetOp internal work files are named according to the following convention

`btsglb_metop`*`NN_yyyymmdd_HHMMSS`*`.nc`

Example:

`btsglb_metop02_20120501_000000.nc`

Table 3-7: Elements of CMS CCI AVHRR MetOp internal work file names

Pattern Element	Example	Title	Description
NN	02	Satellite number	Number of the MetOp satellite (metop02 = MetOp-A)
yyyymmdd_HHMMSS	20120501_000000	Reference time	Central UTC of the 12-hour period over which the MetOp/AVHRR data have been aggregated (HHMMSS is 000000 or 120000)

3.4.2 Product data format

The variables of the CMS CCI AVHRR MetOp internal work files that are used in SST CCI are listed in Table 3-8. The detailed file format is described in section 3.4.2.1.

Table 3-8: Variables of the CMS CCI AVHRR MetOp internal work files used in SST CCI

Variable name	Description	Reference
time	Product reference time	Section 3.4.2.1
dtime	Time departure from reference time of each grid point	Section 3.4.2.1

lat	Grid point latitude	Section 3.4.2.1
lon	Grid point longitude	Section 3.4.2.1
landmask	Land mask associated with the grid	Section 3.4.2.1
satzen	Satellite zenith angle	Section 3.4.2.1
solzen	Sun zenith angle	Section 3.4.2.1
guess_sst errstd_sst	Analysed sea surface temperature and associated analysis error standard deviation from near real-time OSTIA analysis	Section 3.4.2.1
model_sst model_w wind	Skin surface temperature, total water vapour content and 10m wind speed from near real-time ECMWF model outputs	Section 3.4.2.1
ope_sst	OSI-SAF operational MetOp/AVHRR sea surface temperature	Section 3.4.2.1
sst_confidence_level	From 0 to 5 : unprocessed, masked, bad, suspect, acceptable, excellent	Section 3.4.2.1
ncont	Number of contributing observations per grid cell	Section 3.4.2.1
obst37 obst108 obst120	Observed brightness temperatures at 3.7, 10.8 and 12.0 micron	Section 3.4.2.1
simut37 simut108 simut120	Simulated brightness temperatures at 3.7, 10.8 and 12.0 micron	Section 3.4.2.1
cor_simut37 cor_simut108 cor_simut120	Simulated brightness temperatures at 3.7, 10.8 and 12.0 micron after adjustment	Section 3.4.2.1
dt_dt_37 dt_dt_108 dt_dt_120	Partial derivatives : brightness temperature versus surface temperature at 3.7, 10.8 and 12.0 micron	Section 3.4.2.1
dt_dw_37 dt_dw_108 dt_dw_120	Partial derivatives : brightness temperature versus total water vapour content at 3.7, 10.8 and 12.0 micron	Section 3.4.2.1

3.4.2.1 Detailed format

The detailed file format of the CMS CCI AVHRR MetOp internal work files expressed in netCDF common data form language (CDL) is listed below.

```
netcdf btsglb_metop02_20120501_000000 {
dimensions:
       lon = 7200 ;
       lat = 3600 ;
variables:
       double time ;
              time:long_name = "reference time" ;
              time:standard_name = "time" ;
              time:units = "seconds since 1981-01-01 00:00:00" ;
```

```
        time:comment = "" ;
    float dtime(lat, lon) ;
        dtime:long_name = "" ;
        dtime:units = "seconds" ;
        dtime:_FillValue = -9999999.f ;
    float lat(lat) ;
        lat:long_name = "latitude" ;
        lat:standard_name = "latitude" ;
        lat:units = "degrees_north" ;
        lat:valid_min = -89.975 ;
        lat:valid_max = 89.975 ;
    float lon(lon) ;
        lon:long_name = "longitude" ;
        lon:standard_name = "longitude" ;
        lon:units = "degrees_east" ;
        lon:valid_min = -179.975 ;
        lon:valid_max = 179.975 ;
    byte landmask(lat, lon) ;
        landmask:long_name = "land mask" ;
        landmask:standard_name = "land_binary_mask" ;
        landmask:_FillValue = -128b ;
        landmask:flag_values = 0b, 1b ;
        landmask:flag_meanings = "no_land land" ;
    short satzen(lat, lon) ;
        satzen:long_name = "satellite zenith angle" ;
        satzen:units = "degrees" ;
        satzen:scale_factor = 0.01 ;
        satzen:add_offset = 0. ;
        satzen:validmin = 0s ;
        satzen:validmax = 9000s ;
        satzen:_FillValue = -32768s ;
    byte solzen(lat, lon) ;
        solzen:long_name = "sun zenith angle" ;
        solzen:units = "degrees" ;
        solzen:scale_factor = 1. ;
        solzen:add_offset = 90. ;
        solzen:validmin = -127b ;
        solzen:validmax = 127b ;
        solzen:_FillValue = -128b ;
    short guess_sst(lat, lon) ;
        guess_sst:long_name = "Guess sea surface temperature" ;
        guess_sst:units = "K" ;
        guess_sst:scale_factor = 0.01 ;
        guess_sst:add_offset = 273.15 ;
        guess_sst:_FillValue = -32768s ;
    short model_sst(lat, lon) ;
        model_sst:long_name = "model sea surface temperature" ;
        model_sst:units = "K" ;
        model_sst:scale_factor = 0.01 ;
        model_sst:add_offset = 273.15 ;
```

```
              model_sst:_FillValue = -32768s ;
       short errstd_sst(lat, lon) ;
              errstd_sst:long_name = "sea surface temperature analysis error
standart deviation" ;
              errstd_sst:units = "K" ;
              errstd_sst:scale_factor = 0.01 ;
              errstd_sst:add_offset = 0. ;
              errstd_sst:_FillValue = -32768s ;
       short model_w(lat, lon) ;
              model_w:long_name = "model integrated water vapor" ;
              model_w:units = "g/cm2" ;
              model_w:scale_factor = 0.01 ;
              model_w:add_offset = 0. ;
              model_w:_FillValue = -32768s ;
       short ope_sst(lat, lon) ;
              ope_sst:long_name = "OSI SAF operational METOP sea surface
temperature" ;
              ope_sst:units = "K" ;
              ope_sst:scale_factor = 0.01 ;
              ope_sst:add_offset = 273.15 ;
              ope_sst:_FillValue = -32768s ;
       byte sst_confidence_level(lat, lon) ;
              sst_confidence_level:_FillValue = -128b ;
              sst_confidence_level:valid_range = 0b, 5b ;
              sst_confidence_level:flag_values = 0b, 1b, 2b, 3b, 4b, 5b ;
              sst_confidence_level:flag_meanings = "unprocessed masked bad
suspect acceptable excellent" ;
       short ncont(lat, lon) ;
              ncont:long_name = "number of contributing observations per grid
cell" ;
              ncont:units = "" ;
              ncont:scale_factor = 1. ;
              ncont:add_offset = 0. ;
              ncont:_FillValue = -32768s ;
       short insitu_sst(lat, lon) ;
              insitu_sst:long_name = "Insitu drifter sea surface temperature" ;
              insitu_sst:units = "K" ;
              insitu_sst:scale_factor = 0.01 ;
              insitu_sst:add_offset = 273.15 ;
              insitu_sst:_FillValue = -32768s ;
       short obst37(lat, lon) ;
              obst37:long_name = "observed 3.7 micron brightness temperature " ;
              obst37:units = "K" ;
              obst37:add_offset = 273.15 ;
              obst37:scale_factor = 0.01 ;
              obst37:_FillValue = -32768s ;
       short obst108(lat, lon) ;
              obst108:long_name = "observed 11 micron brightness temperature " ;
              obst108:units = "K" ;
              obst108:add_offset = 273.15 ;
              obst108:scale_factor = 0.01 ;
```

```
            obst108:_FillValue = -32768s ;
      short obst120(lat, lon) ;
            obst120:long_name = "observed 12 micron brightness temperature " ;
            obst120:units = "K" ;
            obst120:add_offset = 273.15 ;
            obst120:scale_factor = 0.01 ;
            obst120:_FillValue = -32768s ;
      short simut37(lat, lon) ;
            simut37:long_name = "simulated 3.7 micron brightness temperature "
;
            simut37:units = "K" ;
            simut37:add_offset = 273.15 ;
            simut37:scale_factor = 0.01 ;
            simut37:_FillValue = -32768s ;
      short simut108(lat, lon) ;
            simut108:long_name = "simulated 11 micron brightness temperature "
;
            simut108:units = "K" ;
            simut108:add_offset = 273.15 ;
            simut108:scale_factor = 0.01 ;
            simut108:_FillValue = -32768s ;
      short simut120(lat, lon) ;
            simut120:long_name = "simulated 12 micron brightness temperature "
;
            simut120:units = "K" ;
            simut120:add_offset = 273.15 ;
            simut120:scale_factor = 0.01 ;
            simut120:_FillValue = -32768s ;
      short cor_simut37(lat, lon) ;
            cor_simut37:long_name = "simulated 3.7 micron brightness
temperature after bias correction " ;
            cor_simut37:units = "K" ;
            cor_simut37:add_offset = 273.15 ;
            cor_simut37:scale_factor = 0.01 ;
            cor_simut37:_FillValue = -32768s ;
      short cor_simut108(lat, lon) ;
            cor_simut108:long_name = "simulated 11 micron brightness
temperature after bias correction " ;
            cor_simut108:units = "K" ;
            cor_simut108:add_offset = 273.15 ;
            cor_simut108:scale_factor = 0.01 ;
            cor_simut108:_FillValue = -32768s ;
      short cor_simut120(lat, lon) ;
            cor_simut120:long_name = "simulated 12 micron brightness
temperature after bias correction " ;
            cor_simut120:units = "K" ;
            cor_simut120:add_offset = 273.15 ;
            cor_simut120:scale_factor = 0.01 ;
            cor_simut120:_FillValue = -32768s ;
      float dt_dt_37(lat, lon) ;
            dt_dt_37:long_name = "3.7 micron partial derivative: TB vs Ts " ;
            dt_dt_37:add_offset = 0. ;
```

```
              dt_dt_37:scale_factor = 1. ;
              dt_dt_37:_FillValue = -9999999.f ;
       float dt_dw_37(lat, lon) ;
              dt_dw_37:long_name = "3.7 micron partial derivative: TB vs W " ;
              dt_dw_37:add_offset = 0. ;
              dt_dw_37:scale_factor = 1. ;
              dt_dw_37:_FillValue = -9999999.f ;
       float dt_dt_108(lat, lon) ;
              dt_dt_108:long_name = "10.8 micron partial derivative: TB vs Ts "
;
              dt_dt_108:add_offset = 0. ;
              dt_dt_108:scale_factor = 1. ;
              dt_dt_108:_FillValue = -9999999.f ;
       float dt_dw_108(lat, lon) ;
              dt_dw_108:long_name = "10.8 micron partial derivative: TB vs W " ;
              dt_dw_108:add_offset = 0. ;
              dt_dw_108:scale_factor = 1. ;
              dt_dw_108:_FillValue = -9999999.f ;
       float dt_dt_120(lat, lon) ;
              dt_dt_120:long_name = "12.0 micron partial derivative: TB vs Ts "
;
              dt_dt_120:add_offset = 0. ;
              dt_dt_120:scale_factor = 1. ;
              dt_dt_120:_FillValue = -9999999.f ;
       float dt_dw_120(lat, lon) ;
              dt_dw_120:long_name = "12.0 micron partial derivative: TB vs W " ;
              dt_dw_120:add_offset = 0. ;
              dt_dw_120:scale_factor = 1. ;
              dt_dw_120:_FillValue = -9999999.f ;
       short oe_sst(lat, lon) ;
              oe_sst:long_name = "OE sea surface temperature" ;
              oe_sst:units = "K" ;
              oe_sst:scale_factor = 0.01 ;
              oe_sst:add_offset = 273.15 ;
              oe_sst:_FillValue = -32768s ;
       float chi2(lat, lon) ;
              chi2:long_name = "OE SST error" ;
              chi2:units = "" ;
              chi2:scale_factor = 1. ;
              chi2:add_offset = 0. ;
              chi2:_FillValue = -9999999.f ;
       short cor_sst_ope(lat, lon) ;
              cor_sst_ope:long_name = "correction to ope SST" ;
              cor_sst_ope:units = "K" ;
              cor_sst_ope:scale_factor = 0.01 ;
              cor_sst_ope:add_offset = 0. ;
              cor_sst_ope:_FillValue = -32768s ;
       short cor_sst_cycle(lat, lon) ;
              cor_sst_cycle:long_name = "correction to DW SST" ;
              cor_sst_cycle:units = "K" ;
              cor_sst_cycle:scale_factor = 0.01 ;
```

```
              cor_sst_cycle:add_offset = 0. ;
              cor_sst_cycle:_FillValue = -32768s ;
       short cor_sst_exp(lat, lon) ;
              cor_sst_exp:long_name = "correction to experimental SST" ;
              cor_sst_exp:units = "K" ;
              cor_sst_exp:scale_factor = 0.01 ;
              cor_sst_exp:add_offset = 0. ;
              cor_sst_exp:_FillValue = -32768s ;
       short oe_w(lat, lon) ;
              oe_w:long_name = "OE integrated water vapor" ;
              oe_w:units = "g/cm2" ;
              oe_w:scale_factor = 0.01 ;
              oe_w:add_offset = 0. ;
              oe_w:_FillValue = -32768s
       short wind(lat, lon) ;
              wind:long_name = "model wind" ;
              wind:units = "m/s" ;
              wind:scale_factor = 0.01 ;
              wind:add_offset = 0. ;
              wind:_FillValue = -32768s ;

// global attributes:
              :Conventions = "CF-1.0" ;
              :title = "METOP BT simulation experiment" ;
              :netcdf_version_id = "3.5" ;
              :creation_date = "2007-11-01" ;
              :history = "test" ;
              :start_date = " " ;
              :start_time = " " ;
              :stop_date = " " ;
              :stop_time = " " ;
              :spatial_resolution = "0.05 degree" ;
              :southernmost_latitude = -90.f ;
              :northernmost_latitude = 90.f ;
              :westernmost_longitude = -180.f ;
              :easternmost_longitude = 180.f ;
              :source_provider = "METEO-FRANCE" ;
}
```

4. LEVEL 2 SATELLITE DATA PRODUCTS

4.1 SST CCI L2P

The SST CCI L2P data products are output from the ARC CCI processor and the DV model. Their contents and format are defined in the *Sea Surface Temperature Product Specification Document* [AD-5].

4.1.1 File naming convention

The product files use a variable length file name pattern:

yyyymmddHHMMSS-ESACCI-L2P_GHRSST-*<SST Type>*-*<Product String>*-*SS*-v*nn.n*-fv*xx.x*.nc

Example:

20100701000000-ESACCI-L2P_GHRSST-SSTskin-AATSR-DM-v02.0-fv01.0.nc

Table 4-1: Elements of SST CCI L2P file names

Pattern Element	Example	Title	Description
yyyymmdd	20100701	Indicative date	The identifying date for this data set. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31. The date used is the best representation of the observation date for the dataset.
HHMMSS	125400	Indicative time	The indicative time of the data set, i.e. *start time of granule*. HH is the two-digit hour from 00 to 23, MM is the two- digit minute from 00 to 59, and SS is the two- digit second from 00 to 59. All times in UTC. Chosen to best represent the observation time for this dataset. Note: RDACs should ensure the applications they use to determine UTC properly account for leap seconds.
SST Type	SSTskin SSTsubskin SSTdepth SSTfnd	The type of SST data included in the file.	Conforms to the GHRSST definitions for SST: SSTskin = SST sensed by infrared instruments (at depth of approximately 10 µm) SSTsubskin = SST sensed by microwave instruments (at depth of approximately 1 mm) SSTdepth = temperature at a specific depth. The depth shall be included in the file metadata SSTfnd = temperature from which the diurnal thermocline develops each day

Product String	ATSR1 ATSR2 AATSR AMSRE AVHRR<*X*>_G	A character string identifying the SST product set. The string is used uniquely within an RDAC but may be shared across RDACs	If the satellite hosting the AVHRR is a NOAA platform, <*X*> is the satellite number, if the AVHRR is on MetOp-A, <*X*> is 'MTA'
SS	DM LT	Additional segregator	Set to LT (for long-term reprocessed) or DM (meaning "delayed mode", for demonstration outputs) to distinguish between products. For L2P auxiliary SST data products the additional segregator has the form <LT or DM>_Aux_<*R*>_<*V*_><*C*>, where <*R*> indicates the nature of the retrieval algorithm (for example 'OE1' or 'OE2'), <*V*> indicates the number of views used in the retrieval (only applicable to ATSR-type sensors, possible values are 'Nadir' and 'Dual'), and <*C*> indicates the number of channels used in the retrieval (possible values are '2_channel' and '3_channel'). For L2P auxiliary adjustment data products the additional segregator has the form <LT or DM>_Adj_<A>_00.2m_10.30, where <*A*> indicates the method for obtaining the adjustment
nn.n	02.0	Number of the GDS version used to produce the file	Set to '02.0'
xx.x	01.0	Version number of the file	

4.1.2 Product data format

The SST CCI L2P product and auxiliary files are distributed in netCDF format (Version 4) as defined in [AD-5, section 4.3 and B.1].

4.2 AMSR-E GHRSST L2P

The AMSR-E GHRSST L2P files used in the SST CCI prototype are produced by Remote Sensing Systems and will be ingested by the PMW Processor to produce corresponding SST CCI L2P products. The AMSRE files are in GHRSST L2P format, following version 1.6 of the GDS.

4.2.1 File naming convention

The product files use the GDS 1.6 file naming convention:

`<yyyymmdd>-AMSRE-REMSS-L2P-<source_file>-v01.nc`

Example:

`20070729-AMSRE-REMSS-L2P-l2b_v07_r27848.dat-v01.nc`

Table 4-2: Elements of AMSR-E GHRSST L2P file names

Pattern Element	Example	Title	Description
yyyymmdd	20070729	Date	The identifying date for this file
source_file	l2b_v07_r27848,dat	File name	The original AMSR-E input file used to produce the L2P

4.2.2 Product data format

The AMSR-E GHRSST L2P files are distributed in netCDF format (version 3) as defined by the GDS 1.6. The full specification is given below:

```
netcdf \20070729-AMSRE-REMSS-L2P-l2b_v07_r27848.dat-v01 {
dimensions:
        ni = 4193 ;
        nj = 243 ;
        time = 1 ;
variables:
        float lat(nj, ni) ;
                lat:long_name = "latitude" ;
                lat:units = "degrees_north" ;
                lat:_FillValue = -32768.f ;
        float lon(nj, ni) ;
                lon:long_name = "longitude" ;
                lon:units = "degrees_east" ;
                lon:_FillValue = -32768.f ;
        int time(time) ;
                time:long_name = "reference time of sst file" ;
                time:units = "seconds since 1981-01-01 00:00:00" ;
        short sea_surface_temperature(time, nj, ni) ;
                sea_surface_temperature:long_name = "sea surface temperature" ;
                sea_surface_temperature:units = "kelvin" ;
                sea_surface_temperature:_FillValue = -32768s ;
                sea_surface_temperature:add_offset = 273.15f ;
                sea_surface_temperature:scale_factor = 0.01f ;
                sea_surface_temperature:valid_min = -5000s ;
                sea_surface_temperature:valid_max = 5000s ;
                sea_surface_temperature:coordinates = "lon lat" ;
                sea_surface_temperature:source = "REMSS" ;
```

```
        short sst_dtime(time, nj, ni) ;
                sst_dtime:long_name = "time difference from reference time" ;
                sst_dtime:units = "second" ;
                sst_dtime:_FillValue = -32768s ;
                sst_dtime:add_offset = 0.f ;
                sst_dtime:scale_factor = 1.f ;
        byte DT_analysis(time, nj, ni) ;
                DT_analysis:long_name = "deviation from sst reference climatology"
;
                DT_analysis:units = "kelvin" ;
                DT_analysis:_FillValue = -128b ;
                DT_analysis:add_offset = 0.f ;
                DT_analysis:scale_factor = 0.1f ;
                DT_analysis:valid_min = -127b ;
                DT_analysis:valid_max = 127b ;
                DT_analysis:reference = "Reynolds V2 Weekly OI " ;
                DT_analysis:coordinates = "lon lat" ;
        byte SSES_bias_error(time, nj, ni) ;
                SSES_bias_error:long_name = "SSES bias error" ;
                SSES_bias_error:units = "kelvin" ;
                SSES_bias_error:_FillValue = -128b ;
                SSES_bias_error:add_offset = 0.f ;
                SSES_bias_error:scale_factor = 0.01f ;
                SSES_bias_error:valid_min = -127b ;
                SSES_bias_error:valid_max = 127b ;
                SSES_bias_error:coordinates = "lon lat" ;
        byte SSES_standard_deviation_error(time, nj, ni) ;
                SSES_standard_deviation_error:long_name = "SSES standard deviation
" ;
                SSES_standard_deviation_error:units = "kelvin" ;
                SSES_standard_deviation_error:_FillValue = -128b ;
                SSES_standard_deviation_error:add_offset = 0.75f ;
                SSES_standard_deviation_error:scale_factor = 0.01f ;
                SSES_standard_deviation_error:valid_min = -127b ;
                SSES_standard_deviation_error:valid_max = 127b ;
                SSES_standard_deviation_error:coordinates = "lon lat" ;
        byte wind_speed(time, nj, ni) ;
                wind_speed:long_name = "wind speed" ;
                wind_speed:units = "m s-1" ;
                wind_speed:_FillValue = -128b ;
                wind_speed:add_offset = 25.4f ;
                wind_speed:scale_factor = 0.2f ;
                wind_speed:valid_min = -127b ;
                wind_speed:valid_max = 127b ;
                wind_speed:coordinates = "lon lat" ;
                wind_speed:source = "native_AMSRE_wind" ;
                wind_speed:dtime_from_sst_in_minutes = "0" ;
        byte sea_ice_fraction(time, nj, ni) ;
                sea_ice_fraction:long_name = "sea ice fraction" ;
                sea_ice_fraction:units = "percent" ;
                sea_ice_fraction:_FillValue = -128b ;
```

```
            sea_ice_fraction:add_offset = 0.5f ;
            sea_ice_fraction:scale_factor = 0.01f ;
            sea_ice_fraction:valid_min = -127b ;
            sea_ice_fraction:valid_max = 127b ;
            sea_ice_fraction:reference = "OSI SAF sea ice concentration" ;
            sea_ice_fraction:comment = "when v1 not avail. use OSI SAF SS" ;
            sea_ice_fraction:coordinates = "lon lat" ;
      byte rejection_flag(time, nj, ni) ;
            rejection_flag:long_name = "rejection flag" ;
            rejection_flag:comment = "b0:1=near land or
ice;b1:1=RFI;b2:1=sunglint;b3:1=rain detected;b4:1=ice;b5:1=wind > 20 m/s or SST
out of bounds;b6:1=land;b7:1=edge of swath " ;
            rejection_flag:coordinates = "lon lat" ;
      byte confidence_flag(time, nj, ni) ;
            confidence_flag:long_name = "confidence flag" ;
            confidence_flag:comment = "b0:1=within 50km rain, 0.6 dif
mwoisst;b1:1=within 100km rain, 0.8 dif mwoisst;b2:1=within 150km ice, 0.6 dif
mwoisst;b3:1=more than 5deg dif mwoisst;b4:1=3-sigma test;b5:1=(tmi only) within
150 km of land and 0.6 warmer than mwoisst;b6:1=diurnal estimate > 0.6
warming;b7:1=diurnal estimate > 0.3 warming   " ;
            confidence_flag:coordinates = "lon lat" ;
      byte proximity_confidence(time, nj, ni) ;
            proximity_confidence:long_name = "proximity confidence " ;
            proximity_confidence:comment = "1=Bad, data rejected;2=Suspected
Bad, data that has any confidence flags bit 0-5 thrown;3=Unprocessed proximity
confidence flag, should be Good data;4=Good data  " ;
            proximity_confidence:coordinates = "lon lat" ;
      byte diurnal_amplitude(time, nj, ni) ;
            diurnal_amplitude:long_name = "Diurnal warming amplitude" ;
            diurnal_amplitude:units = "kelvin" ;
            diurnal_amplitude:_FillValue = -128b ;
            diurnal_amplitude:add_offset = 1.f ;
            diurnal_amplitude:scale_factor = 0.02f ;
            diurnal_amplitude:valid_min = -127b ;
            diurnal_amplitude:valid_max = 127b ;
            diurnal_amplitude:coordinates = "lon lat" ;
            diurnal_amplitude:comment = "non L2P core field" ;
      byte cool_skin(time, nj, ni) ;
            cool_skin:long_name = "cool skin" ;
            cool_skin:units = "kelvin" ;
            cool_skin:_FillValue = -128b ;
            cool_skin:add_offset = -1.f ;
            cool_skin:scale_factor = 0.01f ;
            cool_skin:valid_min = -127b ;
            cool_skin:valid_max = 127b ;
            cool_skin:coordinates = "lon lat" ;
            cool_skin:comment = "non L2P core field" ;
      byte water_vapor(time, nj, ni) ;
            water_vapor:long_name = "Atmospheric Water Vapor" ;
            water_vapor:units = "mm" ;
            water_vapor:_FillValue = -128b ;
            water_vapor:add_offset = 38.1f ;
```

```
            water_vapor:scale_factor = 0.3f ;
            water_vapor:valid_min = -127b ;
            water_vapor:valid_max = 127b ;
            water_vapor:source = "native_AMSRE_vapor" ;
            water_vapor:dtime_from_sst_in_seconds = "0" ;
            water_vapor:coordinates = "lon lat" ;
            water_vapor:comment = "non L2P core field" ;
      byte cloud_liquid_water(time, nj, ni) ;
            cloud_liquid_water:long_name = "Cloud Liquid Water" ;
            cloud_liquid_water:units = "mm" ;
            cloud_liquid_water:_FillValue = -128b ;
            cloud_liquid_water:add_offset = 1.22f ;
            cloud_liquid_water:scale_factor = 0.01f ;
            cloud_liquid_water:valid_min = -127b ;
            cloud_liquid_water:valid_max = 127b ;
            cloud_liquid_water:source = "native_AMSRE_cloud" ;
            cloud_liquid_water:dtime_from_sst_in_seconds = "0" ;
            cloud_liquid_water:coordinates = "lon lat" ;
            cloud_liquid_water:comment = "non L2P core field" ;
      byte rain_rate(time, nj, ni) ;
            rain_rate:long_name = "Rain Rate" ;
            rain_rate:units = "mm hr-1" ;
            rain_rate:_FillValue = -128b ;
            rain_rate:add_offset = 12.7f ;
            rain_rate:scale_factor = 0.1f ;
            rain_rate:valid_min = -127b ;
            rain_rate:valid_max = 127b ;
            rain_rate:coordinates = "lon lat" ;
            rain_rate:source = "native_AMSRE_rain" ;
            rain_rate:dtime_from_sst_in_seconds = "0" ;
            rain_rate:comment = "non L2P core field" ;

// global attributes:
            :Conventions = "CF-1.0" ;
            :title = "Sea Surface Temperature from AMSR-E onboard AQUA, 25 km
resolution, global" ;
            :DSD_entry_id = "USA-RSS-AMSRE-MW-L2-SST" ;
            :references = "MW SSES Report version 2.0" ;
            :institution = "Remote Sensing Systems" ;
            :contact = "support@remss.com" ;
            :GDS_version_id = "GDS-v1.0-rev1.6" ;
            :netcdf_version_id = "3.5.0" ;
            :creation_date = "2012-02-19" ;
            :product_version = "v7" ;
            :history = "none" ;
            :platform = "AQUA" ;
            :sensor = "AMSRE" ;
            :spatial_resolution = "25 km" ;
            :start_date = "2007-07-29" ;
            :start_time = "11:51:28 UTC" ;
            :stop_date = "2007-07-29" ;
```

```
            :stop_time = "13:30:19 UTC" ;
            :southernmost_latitude = -89.43f ;
            :northernmost_latitude = 89.14f ;
            :westernmost_longitude = -179.99f ;
            :easternmost_longitude = 180.f ;
            :file_quality_index = 1s ;
            :comment = "none" ;
}
```

4.3 TMI GHRSST L2P

The TMI GHRSST L2P files used in the SST CCI prototype are produced by Remote Sensing Systems and will be ingested by the PMW Processor to produce corresponding SST CCI L2P products. The TMI files are in GHRSST L2P format following version 1.6 of the GDS.

4.3.1 File naming convention

The product files use the GDS 1.6 file naming convention:

yyyymmdd-TMI-REMSS-L2P-<*source_file*>-v02.nc

Example:

20070729-TMI-REMSS-L2P-L2b_v04_041136.dat-v02.nc

Table 4-3: Elements of TMI GHRSST L2P file names

Pattern Element	Example	Title	Description
yyyymmdd	20070729	Date	The identifying date for this file
source_file	L2b_v04_041136.dat	File name	The original TMI input file used to produce the L2P

4.3.2 Product data format

The TMI GHRSST L2P files are distributed in netCDF format (version 3) as defined by GDS 1.6. The full specification is given below:

```
netcdf \20050202-TMI-REMSS-L2P-tmi_L2b_v04_041136.dat-v02 {
dimensions:
       ni = 3020 ;
       nj = 104 ;
       time = 1 ;
variables:
       float lat(nj, ni) ;
              lat:long_name = "latitude" ;
              lat:units = "degrees_north" ;
              lat:_FillValue = -32768.f ;
       float lon(nj, ni) ;
              lon:long_name = "longitude" ;
              lon:units = "degrees_east" ;
              lon:_FillValue = -32768.f ;
       int time(time) ;
              time:long_name = "reference time of sst file" ;
              time:units = "seconds since 1981-01-01 00:00:00" ;
       short sea_surface_temperature(time, nj, ni) ;
```

```
              sea_surface_temperature:long_name = "sea surface temperature" ;
              sea_surface_temperature:units = "kelvin" ;
              sea_surface_temperature:_FillValue = -32768s ;
              sea_surface_temperature:add_offset = 273.15f ;
              sea_surface_temperature:scale_factor = 0.01f ;
              sea_surface_temperature:valid_min = -5000s ;
              sea_surface_temperature:valid_max = 5000s ;
              sea_surface_temperature:coordinates = "lon lat" ;
              sea_surface_temperature:source = "REMSS" ;
       short sst_dtime(time, nj, ni) ;
              sst_dtime:long_name = "time difference from reference time" ;
              sst_dtime:units = "second" ;
              sst_dtime:_FillValue = -32768s ;
              sst_dtime:add_offset = 0.f ;
              sst_dtime:scale_factor = 10.f ;
       byte SSES_bias_error(time, nj, ni) ;
              SSES_bias_error:long_name = "SSES bias error" ;
              SSES_bias_error:units = "kelvin" ;
              SSES_bias_error:_FillValue = -128b ;
              SSES_bias_error:add_offset = 0.f ;
              SSES_bias_error:scale_factor = 0.01f ;
              SSES_bias_error:valid_min = -127b ;
              SSES_bias_error:valid_max = 127b ;
              SSES_bias_error:coordinates = "lon lat" ;
       byte SSES_standard_deviation_error(time, nj, ni) ;
              SSES_standard_deviation_error:long_name = "SSES standard deviation
" ;
              SSES_standard_deviation_error:units = "kelvin" ;
              SSES_standard_deviation_error:_FillValue = -128b ;
              SSES_standard_deviation_error:add_offset = 0.75f ;
              SSES_standard_deviation_error:scale_factor = 0.01f ;
              SSES_standard_deviation_error:valid_min = -127b ;
              SSES_standard_deviation_error:valid_max = 127b ;
              SSES_standard_deviation_error:coordinates = "lon lat" ;
       byte wind_speed(time, nj, ni) ;
              wind_speed:long_name = "wind speed" ;
              wind_speed:units = "m s-1" ;
              wind_speed:_FillValue = -128b ;
              wind_speed:add_offset = 25.f ;
              wind_speed:scale_factor = 0.2f ;
              wind_speed:valid_min = -127b ;
              wind_speed:valid_max = 127b ;
              wind_speed:coordinates = "lon lat" ;
              wind_speed:source = "native_TMI_wind" ;
              wind_speed:dtime_from_sst_in_minutes = "0" ;
       byte rejection_flag(time, nj, ni) ;
              rejection_flag:long_name = "rejection flag" ;
              rejection_flag:comment = "b0:1=SST out of
range;b1:1=Sunglint;b2:1=quality of data bad;b3:1=rain
detected;b4:1=ice;b5:1=wind > 20 m/s;b6:1=land;b7:1=edge of swath     " ;
              rejection_flag:coordinates = "lon lat" ;
```

```
        byte confidence_flag(time, nj, ni) ;
                confidence_flag:long_name = "confidence flag" ;
                confidence_flag:comment = "b0:1=within 50km rain, 0.6 dif
mwoisst;b1:1=within 100km rain, 0.8 dif mwoisst;b2:1=within 150km ice, 0.6 dif
mwoisst;b3:1=more than 5deg dif mwoisst;b4:1=3-sigma test;b5:1=(tmi only) within
150 km of land and 0.6 warmer than mwoisst;b6:1=diurnal estimate > 0.6
warming;b7:1=diurnal estimate > 0.3 warming   " ;
                confidence_flag:coordinates = "lon lat" ;
        byte proximity_confidence(time, nj, ni) ;
                proximity_confidence:long_name = "proximity confidence " ;
                proximity_confidence:comment = "1=Bad, data rejected;2=Suspected
Bad, data that has any confidence flags bit 0-5 thrown;3=Unprocessed proximity
confidence flag, should be Good data;4=Good data  " ;
                proximity_confidence:coordinates = "lon lat" ;
        byte diurnal_amplitude(time, nj, ni) ;
                diurnal_amplitude:long_name = "Diurnal warming amplitude" ;
                diurnal_amplitude:units = "kelvin" ;
                diurnal_amplitude:_FillValue = -128b ;
                diurnal_amplitude:add_offset = 1.f ;
                diurnal_amplitude:scale_factor = 0.02f ;
                diurnal_amplitude:valid_min = -127b ;
                diurnal_amplitude:valid_max = 127b ;
                diurnal_amplitude:coordinates = "lon lat" ;
                diurnal_amplitude:comment = "non L2P core field" ;
        byte cool_skin(time, nj, ni) ;
                cool_skin:long_name = "cool skin" ;
                cool_skin:units = "kelvin" ;
                cool_skin:_FillValue = -128b ;
                cool_skin:add_offset = -1.f ;
                cool_skin:scale_factor = 0.01f ;
                cool_skin:valid_min = -127b ;
                cool_skin:valid_max = 127b ;
                cool_skin:coordinates = "lon lat" ;
                cool_skin:comment = "non L2P core field" ;

// global attributes:
                :Conventions = "CF-1.0" ;
                :title = "Sea Surface Temperature from TMI onboard TRMM, 25 km
resolution, tropicsDSD_" ;
                :DSD_entry_id = "REMSS-L2P-TMI" ;
                :references = "MW SSES Report version 3.0" ;
                :institution = "Remote Sensing Systems" ;
                :contact = "support@remss.com" ;
                :GDS_version_id = "GDS-v1.0-rev1.6" ;
                :netcdf_version_id = "3.5.0" ;
                :creation_date = "2011-02-25" ;
                :product_version = "v4" ;
                :history = "none" ;
                :platform = "TRMM" ;
                :sensor = "TMI" ;
                :spatial_resolution = "25 km" ;
                :start_date = "2005-02-02" ;
```

```
                :start_time = "04:28:48 UTC" ;
                :stop_date = "2005-02-02" ;
                :stop_time = "06:04:21 UTC" ;
                :southernmost_latitude = -39.12f ;
                :northernmost_latitude = 39.04f ;
                :westernmost_longitude = -179.99f ;
                :easternmost_longitude = 180.f ;
                :file_quality_index = 1s ;
                :comment = "none" ;
}
```

5. LEVEL 3 DATA PRODUCTS

5.1 SST CCI L3U

The SST CCI L2U data products are output from the ARC CCI processor and the DV model. Their contents and format are defined in the *Sea Surface Temperature Product Specification Document* [AD-5]

5.1.1 File naming convention

The product files use a variable length file name pattern:

yyyymmddHHMMSS-ESACCI-L3U_GHRSST-*<SST Type>*-*<Product String>*-*SS*-v*nn.n*-fv*xx.x*.nc

Example:

20100701000000-ESACCI-L3U_GHRSST-SSTskin-AATSR-LT-v02.0-fv01.0.nc

Table 5-1: Elements of SST CCI L3U file names

Pattern Element	Example	Title	Description
yyyymmdd	20100701	Indicative date	The identifying date for this data set. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31. The date used is the best representation of the observation date for the dataset.
HHMMSS	125400	Indicative time	The indicative time of the data set, i.e. *start time of granule*. HH is the two-digit hour from 00 to 23, MM is the two- digit minute from 00 to 59, and SS is the two- digit second from 00 to 59. All times in UTC. Chosen to best represent the observation time for this dataset. Note: RDACs should ensure the applications they use to determine UTC properly account for leap seconds.
SST Type	SSTskin SSTsubskin SSTdepth SSTfnd	The type of SST data included in the file.	Conforms to the GHRSST definitions for SST: SSTskin = SST sensed by infrared instruments (at depth of approximately 10 µm) SSTsubskin = SST sensed by microwave instruments (at depth of approximately 1 mm) SSTdepth = temperature at a specific depth. The depth shall be included in the file metadata SSTfnd = temperature from which the diurnal thermocline develops each day

Product String	ATSR1 ATSR2 AATSR AMSRE AVHRR<*X*>_G SEVIRI_SST	A character string identifying the SST product set. The string is used uniquely within an RDAC but may be shared across RDACs	If the satellite hosting the AVHRR is a NOAA platform, <*X*> is the satellite number, if the AVHRR is on MetOp-A, <*X*> is 'MTA'
SS	DM LT	Additional segregator	Set to LT (for long-term reprocessed) or DM (meaning "delayed mode", for demonstration outputs) to distinguish between products. For L3U auxiliary SST data products the additional segregator has the form <LT or DM>_Aux_<*R*>_<*V*_><*C*>, where <*R*> indicates the nature of the retrieval algorithm (for example 'OE1' or 'OE2'), <*V*> indicates the number of views used in the retrieval (only applicable to ATSR-type sensors, possible values are 'Nadir' and 'Dual'), and <*C*> indicates the number of channels used in the retrieval (possible values are '2_channel' and '3_channel'). For L3U auxiliary adjustment data products the additional segregator has the form <LT or DM>_Adj_<A>_00.2m_10.30, where <*A*> indicates the method for obtaining the adjustment
nn.n	02.0	Number of the GDS version used to produce the file	Set to '02.0'
xx.x	01.0	Version number of the file	

5.1.2 Product data format

The SST CCI L2U product and auxiliary files are distributed in netCDF format (Version 4) as defined in [AD-5, section 4.4 and B.2].

5.2 SST CCI L3C

The SST CCI L32C data products are output from the CMS post-processor. Their contents and format are defined in the *Sea Surface Temperature Product Specification Document* [AD-5].

5.2.1 File naming convention

The product files use a variable length file name pattern:

yyyymmddHHMMSS-ESACCI-L3C_GHRSST-<*SST Type*>-<*Product String*>-*SS*-v*nn.n*-fv*xx.x*.nc

Example:

20100701000000-ESACCI-L3C_GHRSST-SSTskin-AATSR-LT-v02.0-fv01.0.nc

Table 5-2: Elements of SST CCI L3C file names

Pattern Element	Example	Title	Description
yyyymmdd	20100701	Indicative date	The identifying date for this data set. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31. The date used is the best representation of the observation date for the dataset.
HHMMSS	125400	Indicative time	The indicative time of the data set, i.e. *center time of the collation window*. HH is the two-digit hour from 00 to 23, MM is the two- digit minute from 00 to 59, and SS is the two-digit second from 00 to 59. All times in UTC. Chosen to best represent the observation time for this dataset. Note: RDACs should ensure the applications they use to determine UTC properly account for leap seconds.
SST Type	SSTskin SSTsubskin SSTdepth SSTfnd	The type of SST data included in the file.	Conforms to the GHRSST definitions for SST: SSTskin = SST sensed by infrared instruments (at depth of approximately 10 μm) SSTsubskin = SST sensed by microwave instruments (at depth of approximately 1 mm) SSTdepth = temperature at a specific depth. The depth shall be included in the file metadata SSTfnd = temperature from which the diurnal thermocline develops each day

Product String	ATSR1 ATSR2 AATSR AMSRE AVHRR<*X*>_G AVHRRMTA SEVIRI_SST	A character string identifying the SST product set. The string is used uniquely within an RDAC but may be shared across RDACs	If the satellite hosting the AVHRR is a NOAA platform, <*X*> is the satellite number, if the AVHRR is on MetOp-A, <*X*> is 'MTA'.
SS	DM LT	Additional segregator	Set to LT (for long-term reprocessed) or DM (meaning "delayed mode", for demonstration outputs) to distinguish between products. For L3C auxiliary SST data products the additional segregator has the form <LT or DM>_Aux_<*R*>_<*V*_><*C*>, where <*R*> indicates the nature of the retrieval algorithm (for example 'OE1' or 'OE2'), <*V*> indicates the number of views used in the retrieval (only applicable to ATSR-type sensors, possible values are 'Nadir' and 'Dual'), and <*C*> indicates the number of channels used in the retrieval (possible values are '2_channel' and '3_channel'). For L3C auxiliary adjustment data products the additional segregator has the form <LT or DM>_Adj_<A>_00.2m_10.30, where <*A*> indicates the method for obtaining the adjustment
nn.n	02.0	Number of the GDS version used to produce the file	Set to '02.0'
xx.x	01.0	Version number of the file	

5.2.2 Product data format

The SST CCI L2C product and auxiliary files are distributed in netCDF format (Version 4) as defined in [AD-5, section 4.4 and B.2].

5.3 MSG/SEVIRI Level 3c

The MSG/SEVIRI L3c products, used in the SST CCI prototype system, are produced by a EUMETSAT OSI-SAF SST experimental processing chain, which is running in near real-time at CMS.

These products are 3-hourly files in netCDF-3 format. They contain sea surface temperatures derived through an optimal estimation method using MSG/SEVIRI infrared brightness temperatures at 8.7, 10.8 and 12.0 micron, as well as ancillary information, on a regular 0.05° x 0.05° grid from 60° W to 60° E and 60° S to 60° N.

5.3.1 File naming convention

The MSG/SEVIRI L3C files are named according to the following convention:

`OEprd_meteosat`*`NN_yyyymmdd_HHMMSS`*`.nc`

Example:

`OEprd_meteosat09_20120501_000000.nc`

Table 5-3: Elements of MSG/SEVIRI L3c file names

Pattern Element	Example	Title	Description
NN	09	Satellite number	Number of the meteosat satellite (meteosat09 = MSG-2)
yyyymmdd_HHMMSS	20120501_000000	Reference time	Reference UTC of the MSG/SEVIRI L3C product (HHMMSS is 000000, 030000, 060000, …… or 180000)

5.3.2 Product data format

The variables of the MSG/SEVIRI L3C products that are used in SST CCI are listed in Table 5-4. The detailed product file format is described in section 5.3.2.1

Table 5-4: Variables of MSG/SEVIRI L3c products used in SST CCI

Variable name	Description	Reference
time	Product reference time	Section 5.3.2.1
dtime	Time departure from reference time of each grid point	Section 5.3.2.1
lat	Grid point latitude	Section 5.3.2.1
Lon	Grid point longitude	Section 5.3.2.1
dsst	Sea surface temperature correction from optimal estimation	Section 5.3.2.1
dtcwv	Total water vapour content correction from optimal estimation	Section 5.3.2.1
threshold_ind	From 0 to 3 : no threshold, dsst thresholded, dtcwv thresholded, dsst and dtcwv thresholded	Section 5.3.2.1
analysed_sst	Analysed sea surface temperature from near real-time OSTIA analysis	Section 5.3.2.1
tcwv	total water vapour content from near real-time ECMWF model outputs	Section 5.3.2.1

cost_quality_level	From 0 to 5 : no data, bad data, worst quality, low quality, acceptable quality, best quality	Section 5.3.2.1
sses_bias	SSES bias estimate	Section 5.3.2.1
sses_bias sses_standard_deviation	SSES bias and standard deviation estimates	Section 5.3.2.1

5.3.2.1 Detailed format

The detailed file format of the MSG/SEVIRI L3c product expressed in netCDF common data form language (CDL) is listed below.

```
netcdf OEprd_meteosat09_20120501_000000 {
dimensions:
        lon = 2400 ;
        lat = 2400 ;
variables:
        double time ;
                time:long_name = "reference time" ;
                time:standard_name = "time" ;
                time:units = "seconds since 1981-01-01 00:00:00" ;
                time:_FillValue = -9999999. ;
        float lat(lat) ;
                lat:long_name = "latitude" ;
                lat:units = "degrees_north" ;
                lat:valid_min = -90. ;
                lat:valid_max = 90. ;
        float lon(lon) ;
                lon:long_name = "longitude" ;
                lon:units = "degrees_east" ;
                lon:valid_min = -180. ;
                lon:valid_max = 180. ;
        short dsst(lat, lon) ;
                dsst:long_name = "sst correction" ;
                dsst:units = "K" ;
                dsst:scale_factor = 0.01 ;
                dsst:add_offset = 0. ;
                dsst:_FillValue = -32768s ;
        short dtcwv(lat, lon) ;
                dtcwv:long_name = "total column water vapour correction" ;
                dtcwv:units = "g.cm-2" ;
                dtcwv:scale_factor = 0.001 ;
                dtcwv:add_offset = 0. ;
                dtcwv:_FillValue = -32768s ;
        byte threshold_ind(lat, lon) ;
                threshold_ind:long_name = "realistic thresholding indicator" ;
                threshold_ind:_FillValue = -128b ;
                threshold_ind:flag_values = 0b, 1b, 2b, 3b ;
                threshold_ind:flag_meanings = "no_threshold dsst_thresholded
dtcwv_thresholded dsst_and_dtcwv_thresholded" ;
        short cost(lat, lon) ;
```

```
            cost:long_name = "cost (chi2)" ;
            cost:scale_factor = 0.001 ;
            cost:add_offset = 0. ;
            cost:_FillValue = -32768s ;
      short analysed_sst(lat, lon) ;
            analysed_sst:long_name = "analysed sea surface temperature" ;
            analysed_sst:standard_name = "sea_surface_temperature" ;
            analysed_sst:type = "foundation" ;
            analysed_sst:units = "K" ;
            analysed_sst:_FillValue = -32768s ;
            analysed_sst:scale_factor = 0.01 ;
            analysed_sst:add_offset = 273.15 ;
            analysed_sst:valid_min = -300s ;
            analysed_sst:valid_max = 4500s ;
      short tcwv(lat, lon) ;
            tcwv:long_name = "total column water vapour" ;
            tcwv:units = "g.cm-2" ;
            tcwv:scale_factor = 0.001 ;
            tcwv:add_offset = 0. ;
            tcwv:_FillValue = -32768s ;
            tcwv:comment = "from NWP" ;
      byte cost_quality_level(lat, lon) ;
            cost_quality_level:long_name = "cost quality level" ;
            cost_quality_level:_FillValue = -128b ;
            cost_quality_level:valid_min = 0b ;
            cost_quality_level:valid_max = 5b ;
            cost_quality_level:flag_meanings = "no_data bad_data worst_quality
low_quality acceptable_quality best_quality" ;
            cost_quality_level:flag_values = 0b, 1b, 2b, 3b, 4b, 5b ;
      byte sses_bias(lat, lon) ;
            sses_bias:long_name = "SSES bias estimate" ;
            sses_bias:units = "kelvin" ;
            sses_bias:_FillValue = -128b ;
            sses_bias:add_offset = 0. ;
            sses_bias:scale_factor = 0.01 ;
            sses_bias:valid_min = -127b ;
            sses_bias:valid_max = 127b ;
      byte sses_standard_deviation(lat, lon) ;
            sses_standard_deviation:long_name = "SSES standard deviation" ;
            sses_standard_deviation:units = "kelvin" ;
            sses_standard_deviation:_FillValue = -128b ;
            sses_standard_deviation:add_offset = 1. ;
            sses_standard_deviation:scale_factor = 0.01 ;
            sses_standard_deviation:valid_min = -127b ;
            sses_standard_deviation:valid_max = 127b ;
      char eqc ;
            eqc:grid_mapping_name = "equirectangular" ;
            eqc:spatial_ref = "+proj=eqc +lat_ts=0 +lat_0=0 +lon_0=0" ;
            eqc:GeoTransform = "-6679169.448 5565.975 0. 6679169.448 0. -
5565.975" ;
            eqc:false_easting = 0. ;
```

```
            eqc:false_northing = 0. ;

// global attributes:
            :Conventions = "CF-1.0" ;
            :identification = "meteosat09 20120501 000000 00000" ;
            :reference_time = "2012-05-01 00:00:00.000" ;
            :start_time = "2012-04-30 23:30:00.000" ;
            :stop_time = "2012-05-01 00:30:00.000" ;
            :version = "1.1" ;
}
```

6. LEVEL 4 ANALYSIS DATA PRODUCTS

6.1 SST CCI L4

The SST CCI L4 data products are output from OSTIA. Their contents and format are defined in the *Sea Surface Temperature Product Specification Document* [AD-5].

6.1.1 File naming convention

The product files use a variable length file name pattern:

yyyymmddHHMMSS-ESACCI-L4_GHRSST-<*SST Type*>-OSTIA-*SS*-v*nn.n*-fv*xx.x*.nc

Example:

20100701000000-ESACCI-L4_GHRSST-SSTdepth-OSTIA-LT-v02.0-fv01.0.nc

Table 6-1: Elements of SST CCI L4 file names

Pattern Element	Example	Title	Description
yyyymmdd	20100701	Indicative date	The identifying date for this data set. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31. The date used is the best representation of the observation date for the dataset.
HHMMSS	125400	Indicative time	The indicative time of the data set, i.e. *nominal time of analysis*. HH is the two-digit hour from 00 to 23, MM is the two- digit minute from 00 to 59, and SS is the two- digit second from 00 to 59. All times in UTC. Chosen to best represent the observation time for this dataset. Note: RDACs should ensure the applications they use to determine UTC properly account for leap seconds.
SST Type	SSTskin SSTsubskin SSTdepth SSTfnd	The type of SST data included in the file.	Conforms to the GHRSST definitions for SST: SSTskin = SST sensed by infrared instruments (at depth of approximately 10 μm) SSTsubskin = SST sensed by microwave instruments (at depth of approximately 1 mm) SSTdepth = temperature at a specific depth. The depth shall be included in the file metadata SSTfnd = temperature from which the diurnal thermocline develops each day

SS	DM LT	Additional segregator	Set to LT (for long-term reprocessed) or DM (meaning “delayed mode”, for demonstration outputs) to distinguish between products.
nn.n	02.0	Number of the GDS version used to produce the file	Set to ’02.0’
xx.x	01.0	Version number of the file	

6.1.2 Product data format

The SST CCI L4 product files are distributed in netCDF format (Version 4) as defined in [AD-5, section 4.5].

7. AUXILIARY DATA FOR LEVEL 2 PROCESSING

7.1 ECMWF ERA-Interim and NRT

ECMWF ERA-Interim and NRT data have the same file format; the file names can be different though, because the user when retrieving them from ECMWF can choose these.

ECMWF ERA-Interim and NRT are NWP data used as input to the ARC CCI and OSI-SAF processors for cloud detection and SST retrievals. Files are distributed in WMO GRIB format [RD 289] using the ECMWF standard code table 2 version 128.

For the processing at ECDF the ECMWF-interim auxiliary data were obtained via the BADC, which had converted some of the ECMWF files to netCDF format.

7.1.1 File naming convention

The ECMWF-interim files use the following naming convention

`<AA><B><C><yyyymmddHH><step>.<fmt>`

Example:

`spam200902021200.grb`

Table 7-1: Elements of ECMWF-interim file names

Pattern Element	Example	Title	Description
AA	gg	Grid type	Two characters indicating the gridding type: gg – Gaussian gridded data sp – Spectral harmonic data ga – accumulated data on Gaussian grid
B	a	Data type	One character indicating the data type: a – Analyses data f – forecast data
C	m	Level type	One character indicating the level type: s – Surface data m – model level data
yyyymmddHH	2005040300	Analyses time	Date and time of the NWP analyses
step	03	Forecast step	Forecast time step (offset from analyses time)
fmt	nc	File format	nc – netCDF format grb – GRIB format

7.1.2 Product data format

There are five file groups used for CCI processing at ECDF, these are summarised in the table below with full format details given in the subsequent subsections.

Table 7-2: ECMWF-interim file groups used in CCI processing at ECDF

File stem	Description	Reference
spam	Atmospheric data on spectral harmonic grid (analyses)	7.1.2.1
ggam	Atmospheric data on Gaussian grid (analyses)	7.1.2.2

ggas	Surface data on Gaussian grid (analyses)	7.1.2.3
ggfs	Surface data on Gaussian grid (forecast)	7.1.2.4
gafs	Accumulated surface data on Gaussian grid (forecast)	7.1.2.5

7.1.2.1 Spectral harmonic analyses on model levels (spam)

The spam files are in GRIB format containing the following parameters.

Table 7-3: Parameters in ECMWF-interim "spam" files

Parameter	Description	Used
129.128	Geopotential	No
130.128	Temperature	Cloud screening
135.128	Vertical velocity	No
138.128	Vorticity (relative)	No
155.128	Divergence	No
152.128	Logarithm of surface pressure	Cloud Screening

7.1.2.2 Gaussian gridded analyses on model levels (ggam)

The ggam files are in GRIB format containing the following parameters.

Table 7-4: Parameters in ECMWF-interim "ggam" files

Parameter	Description	Used
133.128	Specific humidity	Cloud screening
203.128	Ozone mass mixing ratio	Cloud screening
246.128	Cloud liquid water content	No
247.128	Cloud ice water content	No
248.128	Cloud cover	No

7.1.2.3 Gaussian gridded analyses on surface (ggas)

The ggas files are in netCDF format (version 3) using the following specification:

```
netcdf ggas200902020000 {
dimensions:
        longitude = 512 ;
        latitude = 256 ;
        surface = 1 ;
        t = UNLIMITED ; // (1 currently)
        depth = 1 ;
        depth_1 = 1 ;
        depth_2 = 1 ;
        depth_3 = 1 ;
```

```
variables:
        float longitude(longitude) ;
                longitude:long_name = "longitude" ;
                longitude:units = "degrees_east" ;
                longitude:point_spacing = "even" ;
                longitude:modulo = " " ;
        float latitude(latitude) ;
                latitude:long_name = "latitude" ;
                latitude:units = "degrees_north" ;
        float surface(surface) ;
                surface:long_name = "surface" ;
                surface:units = "level" ;
                surface:positive = "up" ;
        float t(t) ;
                t:long_name = "t" ;
                t:units = "days since 2009-02-02 00:00:00" ;
                t:time_origin = "02-FEB-2009:00:00:00" ;
        float CI(t, surface, latitude, longitude) ;
                CI:source = "GRIB data" ;
                CI:name = "CI" ;
                CI:title = "Sea-ice cover" ;
                CI:date = "02/02/09" ;
                CI:time = "00:00" ;
                CI:long_name = "Sea-ice cover" ;
                CI:standard_name = "wind_from_direction" ;
                CI:units = "(0 - 1)" ;
                CI:missing_value = 2.e+20f ;
                CI:_FillValue = 2.e+20f ;
                CI:valid_min = 0.f ;
                CI:valid_max = 1.f ;
        float ASN(t, surface, latitude, longitude) ;
                ASN:source = "GRIB data" ;
                ASN:name = "ASN" ;
                ASN:title = "Snow albedo" ;
                ASN:date = "02/02/09" ;
                ASN:time = "00:00" ;
                ASN:long_name = "Snow albedo" ;
                ASN:standard_name = "wind_speed" ;
                ASN:units = "(0 - 1)" ;
                ASN:missing_value = 2.e+20f ;
                ASN:_FillValue = 2.e+20f ;
                ASN:valid_min = 0.5f ;
                ASN:valid_max = 0.8499985f ;
        float RSN(t, surface, latitude, longitude) ;
                RSN:source = "GRIB data" ;
                RSN:name = "RSN" ;
                RSN:title = "Snow density" ;
                RSN:date = "02/02/09" ;
                RSN:time = "00:00" ;
                RSN:long_name = "Snow density" ;
                RSN:standard_name = "eastward_wind" ;
```

```
        RSN:units = "kg**-3" ;
        RSN:missing_value = 2.e+20f ;
        RSN:_FillValue = 2.e+20f ;
        RSN:valid_min = 100.f ;
        RSN:valid_max = 300.f ;
    float SSTK(t, surface, latitude, longitude) ;
        SSTK:source = "GRIB data" ;
        SSTK:name = "SSTK" ;
        SSTK:title = "Sea surface temperature" ;
        SSTK:date = "02/02/09" ;
        SSTK:time = "00:00" ;
        SSTK:long_name = "Sea surface temperature" ;
        SSTK:standard_name = "northward_wind" ;
        SSTK:units = "K" ;
        SSTK:missing_value = 2.e+20f ;
        SSTK:_FillValue = 2.e+20f ;
        SSTK:valid_min = 269.8706f ;
        SSTK:valid_max = 304.1411f ;
    float depth(depth) ;
        depth:long_name = "depth" ;
        depth:units = "cm" ;
        depth:positive = "down" ;
    float ISTL1(t, depth, latitude, longitude) ;
        ISTL1:source = "GRIB data" ;
        ISTL1:name = "ISTL1" ;
        ISTL1:title = "Ice surface temperature layer 1" ;
        ISTL1:date = "02/02/09" ;
        ISTL1:time = "00:00" ;
        ISTL1:long_name = "Ice surface temperature layer 1" ;
        ISTL1:standard_name = "atmosphere_horizontal_streamfunction" ;
        ISTL1:units = "K" ;
        ISTL1:missing_value = 2.e+20f ;
        ISTL1:_FillValue = 2.e+20f ;
        ISTL1:valid_min = 236.6075f ;
        ISTL1:valid_max = 273.1602f ;
    float depth_1(depth_1) ;
        depth_1:long_name = "depth" ;
        depth_1:units = "cm" ;
        depth_1:positive = "down" ;
    float ISTL2(t, depth_1, latitude, longitude) ;
        ISTL2:source = "GRIB data" ;
        ISTL2:name = "ISTL2" ;
        ISTL2:title = "Ice surface temperature layer 2" ;
        ISTL2:date = "02/02/09" ;
        ISTL2:time = "00:00" ;
        ISTL2:long_name = "Ice surface temperature layer 2" ;
        ISTL2:standard_name = "atmosphere_horizontal_velocity_potential" ;
        ISTL2:units = "K" ;
        ISTL2:missing_value = 2.e+20f ;
        ISTL2:_FillValue = 2.e+20f ;
```

```
              ISTL2:valid_min = 239.9525f ;
              ISTL2:valid_max = 273.1595f ;
       float depth_2(depth_2) ;
              depth_2:long_name = "depth" ;
              depth_2:units = "cm" ;
              depth_2:positive = "down" ;
       float ISTL3(t, depth_2, latitude, longitude) ;
              ISTL3:source = "GRIB data" ;
              ISTL3:name = "ISTL3" ;
              ISTL3:title = "Ice surface temperature layer 3" ;
              ISTL3:date = "02/02/09" ;
              ISTL3:time = "00:00" ;
              ISTL3:long_name = "Ice surface temperature layer 3" ;
              ISTL3:units = "K" ;
              ISTL3:missing_value = 2.e+20f ;
              ISTL3:_FillValue = 2.e+20f ;
              ISTL3:valid_min = 250.3956f ;
              ISTL3:valid_max = 272.3633f ;
       float depth_3(depth_3) ;
              depth_3:long_name = "depth" ;
              depth_3:units = "cm" ;
              depth_3:positive = "down" ;
       float ISTL4(t, depth_3, latitude, longitude) ;
              ISTL4:source = "GRIB data" ;
              ISTL4:name = "ISTL4" ;
              ISTL4:title = "Ice surface temperature layer 4" ;
              ISTL4:date = "02/02/09" ;
              ISTL4:time = "00:00" ;
              ISTL4:long_name = "Ice surface temperature layer 4" ;
              ISTL4:standard_name =
"vertical_air_velocity_expressed_as_tendency_of_sigma" ;
              ISTL4:units = "K" ;
              ISTL4:missing_value = 2.e+20f ;
              ISTL4:_FillValue = 2.e+20f ;
              ISTL4:valid_min = 262.1167f ;
              ISTL4:valid_max = 271.8987f ;
       float SWVL1(t, depth, latitude, longitude) ;
              SWVL1:source = "GRIB data" ;
              SWVL1:name = "SWVL1" ;
              SWVL1:title = "Volumetric soil water layer 1" ;
              SWVL1:date = "02/02/09" ;
              SWVL1:time = "00:00" ;
              SWVL1:long_name = "Volumetric soil water layer 1" ;
              SWVL1:standard_name =
"vertical_air_velocity_expressed_as_tendency_of_pressure" ;
              SWVL1:units = "m**3 m**-3" ;
              SWVL1:missing_value = 2.e+20f ;
              SWVL1:_FillValue = 2.e+20f ;
              SWVL1:valid_min = -1.e-38f ;
              SWVL1:valid_max = 0.471054f ;
       float SWVL2(t, depth_1, latitude, longitude) ;
```

```
        SWVL2:source = "GRIB data" ;
        SWVL2:name = "SWVL2" ;
        SWVL2:title = "Volumetric soil water layer 2" ;
        SWVL2:date = "02/02/09" ;
        SWVL2:time = "00:00" ;
        SWVL2:long_name = "Volumetric soil water layer 2" ;
        SWVL2:standard_name = "upward_air_velocity" ;
        SWVL2:units = "m**3 m**-3" ;
        SWVL2:missing_value = 2.e+20f ;
        SWVL2:_FillValue = 2.e+20f ;
        SWVL2:valid_min = -1.e-38f ;
        SWVL2:valid_max = 0.4699368f ;
    float SWVL3(t, depth_2, latitude, longitude) ;
        SWVL3:source = "GRIB data" ;
        SWVL3:name = "SWVL3" ;
        SWVL3:title = "Volumetric soil water layer 3" ;
        SWVL3:date = "02/02/09" ;
        SWVL3:time = "00:00" ;
        SWVL3:long_name = "Volumetric soil water layer 3" ;
        SWVL3:standard_name = "atmosphere_absolute_vorticity" ;
        SWVL3:units = "m**3 m**-3" ;
        SWVL3:missing_value = 2.e+20f ;
        SWVL3:_FillValue = 2.e+20f ;
        SWVL3:valid_min = -1.e-38f ;
        SWVL3:valid_max = 0.4672639f ;
    float SWVL4(t, depth_3, latitude, longitude) ;
        SWVL4:source = "GRIB data" ;
        SWVL4:name = "SWVL4" ;
        SWVL4:title = "Volumetric soil water layer 4" ;
        SWVL4:date = "02/02/09" ;
        SWVL4:time = "00:00" ;
        SWVL4:long_name = "Volumetric soil water layer 4" ;
        SWVL4:units = "m**3 m**-3" ;
        SWVL4:missing_value = 2.e+20f ;
        SWVL4:_FillValue = 2.e+20f ;
        SWVL4:valid_min = -1.e-38f ;
        SWVL4:valid_max = 0.4682949f ;
    float SP(t, surface, latitude, longitude) ;
        SP:source = "GRIB data" ;
        SP:name = "SP" ;
        SP:title = "Surface pressure" ;
        SP:date = "02/02/09" ;
        SP:time = "00:00" ;
        SP:long_name = "Surface pressure" ;
        SP:standard_name = "surface_air_pressure" ;
        SP:units = "Pa" ;
        SP:missing_value = 2.e+20f ;
        SP:_FillValue = 2.e+20f ;
        SP:valid_min = 51821.57f ;
        SP:valid_max = 104616.7f ;
```

```
        float TCW(t, surface, latitude, longitude) ;
                TCW:source = "GRIB data" ;
                TCW:name = "TCW" ;
                TCW:title = "Total column water" ;
                TCW:date = "02/02/09" ;
                TCW:time = "00:00" ;
                TCW:long_name = "Total column water" ;
                TCW:units = "kg m**-2" ;
                TCW:missing_value = 2.e+20f ;
                TCW:_FillValue = 2.e+20f ;
                TCW:valid_min = 0.3206847f ;
                TCW:valid_max = 73.40427f ;
        float TCWV(t, surface, latitude, longitude) ;
                TCWV:source = "GRIB data" ;
                TCWV:name = "TCWV" ;
                TCWV:title = "Total column water vapour" ;
                TCWV:date = "02/02/09" ;
                TCWV:time = "00:00" ;
                TCWV:long_name = "Total column water vapour" ;
                TCWV:standard_name =
"lwe_thickness_of_atmosphere_water_vapour_content" ;
                TCWV:units = "kg m**-2" ;
                TCWV:missing_value = 2.e+20f ;
                TCWV:_FillValue = 2.e+20f ;
                TCWV:valid_min = 0.3206847f ;
                TCWV:valid_max = 72.5156f ;
        float STL1(t, depth, latitude, longitude) ;
                STL1:source = "GRIB data" ;
                STL1:name = "STL1" ;
                STL1:title = "Soil temperature level 1" ;
                STL1:date = "02/02/09" ;
                STL1:time = "00:00" ;
                STL1:long_name = "Soil temperature level 1" ;
                STL1:standard_name = "surface_temperature" ;
                STL1:units = "K" ;
                STL1:missing_value = 2.e+20f ;
                STL1:_FillValue = 2.e+20f ;
                STL1:valid_min = 203.6484f ;
                STL1:valid_max = 313.447f ;
        float SD(t, surface, latitude, longitude) ;
                SD:source = "GRIB data" ;
                SD:name = "SD" ;
                SD:title = "Snow depth" ;
                SD:date = "02/02/09" ;
                SD:time = "00:00" ;
                SD:long_name = "Snow depth" ;
                SD:standard_name = "lwe_thickness_of_surface_snow_amount" ;
                SD:units = "m of water equivalent" ;
                SD:missing_value = 2.e+20f ;
                SD:_FillValue = 2.e+20f ;
                SD:valid_min = 0.f ;
```

```
        SD:valid_max = 10.f ;
    float CHNK(t, surface, latitude, longitude) ;
        CHNK:source = "GRIB data" ;
        CHNK:name = "CHNK" ;
        CHNK:title = "Charnock" ;
        CHNK:date = "02/02/09" ;
        CHNK:time = "00:00" ;
        CHNK:long_name = "Charnock" ;
        CHNK:units = " " ;
        CHNK:missing_value = 2.e+20f ;
        CHNK:_FillValue = 2.e+20f ;
        CHNK:valid_min = 0.009527728f ;
        CHNK:valid_max = 0.08831505f ;
    float MSL(t, surface, latitude, longitude) ;
        MSL:source = "GRIB data" ;
        MSL:name = "MSL" ;
        MSL:title = "Mean sea-level pressure" ;
        MSL:date = "02/02/09" ;
        MSL:time = "00:00" ;
        MSL:long_name = "Mean sea-level pressure" ;
        MSL:standard_name = "air_pressure_at_sea_level" ;
        MSL:units = "Pa" ;
        MSL:missing_value = 2.e+20f ;
        MSL:_FillValue = 2.e+20f ;
        MSL:valid_min = 95195.62f ;
        MSL:valid_max = 104612.7f ;
    float TCC(t, surface, latitude, longitude) ;
        TCC:source = "GRIB data" ;
        TCC:name = "TCC" ;
        TCC:title = "Total cloud cover" ;
        TCC:date = "02/02/09" ;
        TCC:time = "00:00" ;
        TCC:long_name = "Total cloud cover" ;
        TCC:standard_name = "cloud_area_fraction" ;
        TCC:units = "(0 - 1)" ;
        TCC:missing_value = 2.e+20f ;
        TCC:_FillValue = 2.e+20f ;
        TCC:valid_min = 9.999779e-13f ;
        TCC:valid_max = 1.f ;
    float U10(t, surface, latitude, longitude) ;
        U10:source = "GRIB data" ;
        U10:name = "U10" ;
        U10:title = "10 metre U wind component" ;
        U10:date = "02/02/09" ;
        U10:time = "00:00" ;
        U10:long_name = "10 metre U wind component" ;
        U10:standard_name = "eastward_wind" ;
        U10:units = "m s**-1" ;
        U10:missing_value = 2.e+20f ;
        U10:_FillValue = 2.e+20f ;
```

```
        U10:valid_min = -39.05307f ;
        U10:valid_max = 26.71087f ;
    float V10(t, surface, latitude, longitude) ;
        V10:source = "GRIB data" ;
        V10:name = "V10" ;
        V10:title = "10 metre V wind component" ;
        V10:date = "02/02/09" ;
        V10:time = "00:00" ;
        V10:long_name = "10 metre V wind component" ;
        V10:standard_name = "northward_wind" ;
        V10:units = "m s**-1" ;
        V10:missing_value = 2.e+20f ;
        V10:_FillValue = 2.e+20f ;
        V10:valid_min = -27.75667f ;
        V10:valid_max = 21.1101f ;
    float T2(t, surface, latitude, longitude) ;
        T2:source = "GRIB data" ;
        T2:name = "T2" ;
        T2:title = "2 metre temperature" ;
        T2:date = "02/02/09" ;
        T2:time = "00:00" ;
        T2:long_name = "2 metre temperature" ;
        T2:standard_name = "air_temperature" ;
        T2:units = "K" ;
        T2:missing_value = 2.e+20f ;
        T2:_FillValue = 2.e+20f ;
        T2:valid_min = 217.2299f ;
        T2:valid_max = 312.3011f ;
    float D2(t, surface, latitude, longitude) ;
        D2:source = "GRIB data" ;
        D2:name = "D2" ;
        D2:title = "2 metre dewpoint temperature" ;
        D2:date = "02/02/09" ;
        D2:time = "00:00" ;
        D2:long_name = "2 metre dewpoint temperature" ;
        D2:standard_name = "dew_point_temperature" ;
        D2:units = "K" ;
        D2:missing_value = 2.e+20f ;
        D2:_FillValue = 2.e+20f ;
        D2:valid_min = 213.3904f ;
        D2:valid_max = 300.2801f ;
    float STL2(t, depth_1, latitude, longitude) ;
        STL2:source = "GRIB data" ;
        STL2:name = "STL2" ;
        STL2:title = "Soil temperature level 2" ;
        STL2:date = "02/02/09" ;
        STL2:time = "00:00" ;
        STL2:long_name = "Soil temperature level 2" ;
        STL2:units = "K" ;
        STL2:missing_value = 2.e+20f ;
        STL2:_FillValue = 2.e+20f ;
```

```
        STL2:valid_min = 207.0131f ;
        STL2:valid_max = 311.7494f ;
    float SR(t, surface, latitude, longitude) ;
        SR:source = "GRIB data" ;
        SR:name = "SR" ;
        SR:title = "Surface roughness" ;
        SR:date = "02/02/09" ;
        SR:time = "00:00" ;
        SR:long_name = "Surface roughness" ;
        SR:standard_name = "surface_roughness_length" ;
        SR:units = "m" ;
        SR:missing_value = 2.e+20f ;
        SR:_FillValue = 2.e+20f ;
        SR:valid_min = 0.0009999999f ;
        SR:valid_max = 99.99905f ;
    float AL(t, surface, latitude, longitude) ;
        AL:source = "GRIB data" ;
        AL:name = "AL" ;
        AL:title = "Albedo" ;
        AL:date = "02/02/09" ;
        AL:time = "00:00" ;
        AL:long_name = "Albedo" ;
        AL:standard_name = "surface_albedo" ;
        AL:units = "(0 - 1)" ;
        AL:missing_value = 2.e+20f ;
        AL:_FillValue = 2.e+20f ;
        AL:valid_min = 0.06999999f ;
        AL:valid_max = 0.4899707f ;
    float STL3(t, depth_2, latitude, longitude) ;
        STL3:source = "GRIB data" ;
        STL3:name = "STL3" ;
        STL3:title = "Soil temperature level 3" ;
        STL3:date = "02/02/09" ;
        STL3:time = "00:00" ;
        STL3:long_name = "Soil temperature level 3" ;
        STL3:units = "K" ;
        STL3:missing_value = 2.e+20f ;
        STL3:_FillValue = 2.e+20f ;
        STL3:valid_min = 208.1016f ;
        STL3:valid_max = 311.5642f ;
    float LCC(t, surface, latitude, longitude) ;
        LCC:source = "GRIB data" ;
        LCC:name = "LCC" ;
        LCC:title = "Low cloud cover" ;
        LCC:date = "02/02/09" ;
        LCC:time = "00:00" ;
        LCC:long_name = "Low cloud cover" ;
        LCC:units = "(0 - 1)" ;
        LCC:missing_value = 2.e+20f ;
        LCC:_FillValue = 2.e+20f ;
```

```
        LCC:valid_min = 0.f ;
        LCC:valid_max = 1.f ;
    float MCC(t, surface, latitude, longitude) ;
        MCC:source = "GRIB data" ;
        MCC:name = "MCC" ;
        MCC:title = "Medium cloud cover" ;
        MCC:date = "02/02/09" ;
        MCC:time = "00:00" ;
        MCC:long_name = "Medium cloud cover" ;
        MCC:units = "(0 - 1)" ;
        MCC:missing_value = 2.e+20f ;
        MCC:_FillValue = 2.e+20f ;
        MCC:valid_min = 0.f ;
        MCC:valid_max = 1.f ;
    float HCC(t, surface, latitude, longitude) ;
        HCC:source = "GRIB data" ;
        HCC:name = "HCC" ;
        HCC:title = "High cloud cover" ;
        HCC:date = "02/02/09" ;
        HCC:time = "00:00" ;
        HCC:long_name = "High cloud cover" ;
        HCC:units = "(0 - 1)" ;
        HCC:missing_value = 2.e+20f ;
        HCC:_FillValue = 2.e+20f ;
        HCC:valid_min = 9.999779e-13f ;
        HCC:valid_max = 1.f ;
    float SRC(t, surface, latitude, longitude) ;
        SRC:source = "GRIB data" ;
        SRC:name = "SRC" ;
        SRC:title = "Skin reservoir content" ;
        SRC:date = "02/02/09" ;
        SRC:time = "00:00" ;
        SRC:long_name = "Skin reservoir content" ;
        SRC:units = "m of water" ;
        SRC:missing_value = 2.e+20f ;
        SRC:_FillValue = 2.e+20f ;
        SRC:valid_min = 0.f ;
        SRC:valid_max = 0.001190007f ;
    float TCO3(t, surface, latitude, longitude) ;
        TCO3:source = "GRIB data" ;
        TCO3:name = "TCO3" ;
        TCO3:title = "Total column ozone" ;
        TCO3:date = "02/02/09" ;
        TCO3:time = "00:00" ;
        TCO3:long_name = "Total column ozone" ;
        TCO3:units = "kg m**-2" ;
        TCO3:missing_value = 2.e+20f ;
        TCO3:_FillValue = 2.e+20f ;
        TCO3:valid_min = 0.004478014f ;
        TCO3:valid_max = 0.01183951f ;
    float LSRH(t, surface, latitude, longitude) ;
```

```
                LSRH:source = "GRIB data" ;
                LSRH:name = "LSRH" ;
                LSRH:title = "Logarithm of surface roughness length for heat" ;
                LSRH:date = "02/02/09" ;
                LSRH:time = "00:00" ;
                LSRH:long_name = "Logarithm of surface roughness length for heat"
;
                LSRH:units = " " ;
                LSRH:missing_value = 2.e+20f ;
                LSRH:_FillValue = 2.e+20f ;
                LSRH:valid_min = -20.f ;
                LSRH:valid_max = -1.386719f ;
        float SKT(t, surface, latitude, longitude) ;
                SKT:source = "GRIB data" ;
                SKT:name = "SKT" ;
                SKT:title = "Skin temperature" ;
                SKT:date = "02/02/09" ;
                SKT:time = "00:00" ;
                SKT:long_name = "Skin temperature" ;
                SKT:units = "K" ;
                SKT:missing_value = 2.e+20f ;
                SKT:_FillValue = 2.e+20f ;
                SKT:valid_min = 197.185f ;
                SKT:valid_max = 323.6345f ;
        float STL4(t, depth_3, latitude, longitude) ;
                STL4:source = "GRIB data" ;
                STL4:name = "STL4" ;
                STL4:title = "Soil temperature level 4" ;
                STL4:date = "02/02/09" ;
                STL4:time = "00:00" ;
                STL4:long_name = "Soil temperature level 4" ;
                STL4:units = "K" ;
                STL4:missing_value = 2.e+20f ;
                STL4:_FillValue = 2.e+20f ;
                STL4:valid_min = 210.4828f ;
                STL4:valid_max = 309.5672f ;
        float TSN(t, surface, latitude, longitude) ;
                TSN:source = "GRIB data" ;
                TSN:name = "TSN" ;
                TSN:title = "Temperature of snow layer" ;
                TSN:date = "02/02/09" ;
                TSN:time = "00:00" ;
                TSN:long_name = "Temperature of snow layer" ;
                TSN:standard_name = "snow_temperature" ;
                TSN:units = "K" ;
                TSN:missing_value = 2.e+20f ;
                TSN:_FillValue = 2.e+20f ;
                TSN:valid_min = 191.6718f ;
                TSN:valid_max = 311.9511f ;

// global attributes:
```

```
            :history = "Fri Oct 23 15:55:49 BST 2009 - CONVSH V1.92 16-
February-2006" ;
}
```

7.1.2.4 Gaussian gridded forecast on surface (ggfs)

The ggfs files are in netCDF format (version 3) using the following specification:

```
netcdf ggfs200902020003 {
dimensions:
       longitude = 512 ;
       latitude = 256 ;
       surface = 1 ;
       t = UNLIMITED ; // (1 currently)
       depth = 1 ;
       depth_1 = 1 ;
       depth_2 = 1 ;
       depth_3 = 1 ;
variables:
       float longitude(longitude) ;
              longitude:long_name = "longitude" ;
              longitude:units = "degrees_east" ;
              longitude:point_spacing = "even" ;
              longitude:modulo = " " ;
       float latitude(latitude) ;
              latitude:long_name = "latitude" ;
              latitude:units = "degrees_north" ;
       float surface(surface) ;
              surface:long_name = "surface" ;
              surface:units = "level" ;
              surface:positive = "up" ;
       float t(t) ;
              t:long_name = "t" ;
              t:units = "days since 2009-02-02 00:00:00" ;
              t:time_origin = "02-FEB-2009:00:00:00" ;
       float U10(t, surface, latitude, longitude) ;
              U10:source = "GRIB data" ;
              U10:name = "U10" ;
              U10:title = "10 metre U wind component" ;
              U10:date = "02/02/09" ;
              U10:time = "00:00" ;
              U10:long_name = "10 metre U wind component" ;
              U10:standard_name = "eastward_wind" ;
              U10:units = "m s**-1" ;
              U10:missing_value = 2.e+20f ;
              U10:_FillValue = 2.e+20f ;
              U10:valid_min = -38.74895f ;
              U10:valid_max = 25.35001f ;
       float V10(t, surface, latitude, longitude) ;
              V10:source = "GRIB data" ;
              V10:name = "V10" ;
```

```
        V10:title = "10 metre V wind component" ;
        V10:date = "02/02/09" ;
        V10:time = "00:00" ;
        V10:long_name = "10 metre V wind component" ;
        V10:standard_name = "northward_wind" ;
        V10:units = "m s**-1" ;
        V10:missing_value = 2.e+20f ;
        V10:_FillValue = 2.e+20f ;
        V10:valid_min = -23.59106f ;
        V10:valid_max = 21.66888f ;
    float D2(t, surface, latitude, longitude) ;
        D2:source = "GRIB data" ;
        D2:name = "D2" ;
        D2:title = "2 metre dewpoint temperature" ;
        D2:date = "02/02/09" ;
        D2:time = "00:00" ;
        D2:long_name = "2 metre dewpoint temperature" ;
        D2:standard_name = "dew_point_temperature" ;
        D2:units = "K" ;
        D2:missing_value = 2.e+20f ;
        D2:_FillValue = 2.e+20f ;
        D2:valid_min = 212.9784f ;
        D2:valid_max = 301.2701f ;
    float T2(t, surface, latitude, longitude) ;
        T2:source = "GRIB data" ;
        T2:name = "T2" ;
        T2:title = "2 metre temperature" ;
        T2:date = "02/02/09" ;
        T2:time = "00:00" ;
        T2:long_name = "2 metre temperature" ;
        T2:standard_name = "air_temperature" ;
        T2:units = "K" ;
        T2:missing_value = 2.e+20f ;
        T2:_FillValue = 2.e+20f ;
        T2:valid_min = 217.3492f ;
        T2:valid_max = 315.9524f ;
    float BLH(t, surface, latitude, longitude) ;
        BLH:source = "GRIB data" ;
        BLH:name = "BLH" ;
        BLH:title = "Boundary layer height" ;
        BLH:date = "02/02/09" ;
        BLH:time = "00:00" ;
        BLH:long_name = "Boundary layer height" ;
        BLH:units = "m" ;
        BLH:missing_value = 2.e+20f ;
        BLH:_FillValue = 2.e+20f ;
        BLH:valid_min = 7.904803f ;
        BLH:valid_max = 6521.655f ;
    float CHNK(t, surface, latitude, longitude) ;
        CHNK:source = "GRIB data" ;
```

```
            CHNK:name = "CHNK" ;
            CHNK:title = "Charnock" ;
            CHNK:date = "02/02/09" ;
            CHNK:time = "00:00" ;
            CHNK:long_name = "Charnock" ;
            CHNK:units = " " ;
            CHNK:missing_value = 2.e+20f ;
            CHNK:_FillValue = 2.e+20f ;
            CHNK:valid_min = 0.009529788f ;
            CHNK:valid_max = 0.07448469f ;
      float CAPE(t, surface, latitude, longitude) ;
            CAPE:source = "GRIB data" ;
            CAPE:name = "CAPE" ;
            CAPE:title = "Convective available potential energy" ;
            CAPE:date = "02/02/09" ;
            CAPE:time = "00:00" ;
            CAPE:long_name = "Convective available potential energy" ;
            CAPE:standard_name = "precipitation_flux" ;
            CAPE:units = "J kg**-1" ;
            CAPE:missing_value = 2.e+20f ;
            CAPE:_FillValue = 2.e+20f ;
            CAPE:valid_min = 0.f ;
            CAPE:valid_max = 0.f ;
      float FAL(t, surface, latitude, longitude) ;
            FAL:source = "GRIB data" ;
            FAL:name = "FAL" ;
            FAL:title = "Forecast albedo" ;
            FAL:date = "02/02/09" ;
            FAL:time = "00:00" ;
            FAL:long_name = "Forecast albedo" ;
            FAL:units = "(0 - 1)" ;
            FAL:missing_value = 2.e+20f ;
            FAL:_FillValue = 2.e+20f ;
            FAL:valid_min = 0.06f ;
            FAL:valid_max = 0.8450037f ;
      float FLSR(t, surface, latitude, longitude) ;
            FLSR:source = "GRIB data" ;
            FLSR:name = "FLSR" ;
            FLSR:title = "Forecast logarithm of surface roughness for heat" ;
            FLSR:date = "02/02/09" ;
            FLSR:time = "00:00" ;
            FLSR:long_name = "Forecast logarithm of surface roughness for
heat" ;
            FLSR:units = " " ;
            FLSR:missing_value = 2.e+20f ;
            FLSR:_FillValue = 2.e+20f ;
            FLSR:valid_min = -12.38819f ;
            FLSR:valid_max = 1.386228f ;
      float FSR(t, surface, latitude, longitude) ;
            FSR:source = "GRIB data" ;
            FSR:name = "FSR" ;
```

```
        FSR:title = "Forecast surface roughness" ;
        FSR:date = "02/02/09" ;
        FSR:time = "00:00" ;
        FSR:long_name = "Forecast surface roughness" ;
        FSR:units = "m" ;
        FSR:missing_value = 2.e+20f ;
        FSR:_FillValue = 2.e+20f ;
        FSR:valid_min = 2.617993e-05f ;
        FSR:valid_max = 4.f ;
    float HCC(t, surface, latitude, longitude) ;
        HCC:source = "GRIB data" ;
        HCC:name = "HCC" ;
        HCC:title = "High cloud cover" ;
        HCC:date = "02/02/09" ;
        HCC:time = "00:00" ;
        HCC:long_name = "High cloud cover" ;
        HCC:units = "(0 - 1)" ;
        HCC:missing_value = 2.e+20f ;
        HCC:_FillValue = 2.e+20f ;
        HCC:valid_min = 9.999779e-13f ;
        HCC:valid_max = 1.f ;
    float depth(depth) ;
        depth:long_name = "depth" ;
        depth:units = "cm" ;
        depth:positive = "down" ;
    float ISTL1(t, depth, latitude, longitude) ;
        ISTL1:source = "GRIB data" ;
        ISTL1:name = "ISTL1" ;
        ISTL1:title = "Ice surface temperature layer 1" ;
        ISTL1:date = "02/02/09" ;
        ISTL1:time = "00:00" ;
        ISTL1:long_name = "Ice surface temperature layer 1" ;
        ISTL1:standard_name = "atmosphere_horizontal_streamfunction" ;
        ISTL1:units = "K" ;
        ISTL1:missing_value = 2.e+20f ;
        ISTL1:_FillValue = 2.e+20f ;
        ISTL1:valid_min = 236.5837f ;
        ISTL1:valid_max = 273.1599f ;
    float depth_1(depth_1) ;
        depth_1:long_name = "depth" ;
        depth_1:units = "cm" ;
        depth_1:positive = "down" ;
    float ISTL2(t, depth_1, latitude, longitude) ;
        ISTL2:source = "GRIB data" ;
        ISTL2:name = "ISTL2" ;
        ISTL2:title = "Ice surface temperature layer 2" ;
        ISTL2:date = "02/02/09" ;
        ISTL2:time = "00:00" ;
        ISTL2:long_name = "Ice surface temperature layer 2" ;
        ISTL2:standard_name = "atmosphere_horizontal_velocity_potential" ;
```

```
            ISTL2:units = "K" ;
            ISTL2:missing_value = 2.e+20f ;
            ISTL2:_FillValue = 2.e+20f ;
            ISTL2:valid_min = 239.8963f ;
            ISTL2:valid_max = 273.16f ;
      float depth_2(depth_2) ;
            depth_2:long_name = "depth" ;
            depth_2:units = "cm" ;
            depth_2:positive = "down" ;
      float ISTL3(t, depth_2, latitude, longitude) ;
            ISTL3:source = "GRIB data" ;
            ISTL3:name = "ISTL3" ;
            ISTL3:title = "Ice surface temperature layer 3" ;
            ISTL3:date = "02/02/09" ;
            ISTL3:time = "00:00" ;
            ISTL3:long_name = "Ice surface temperature layer 3" ;
            ISTL3:units = "K" ;
            ISTL3:missing_value = 2.e+20f ;
            ISTL3:_FillValue = 2.e+20f ;
            ISTL3:valid_min = 250.3904f ;
            ISTL3:valid_max = 272.3737f ;
      float depth_3(depth_3) ;
            depth_3:long_name = "depth" ;
            depth_3:units = "cm" ;
            depth_3:positive = "down" ;
      float ISTL4(t, depth_3, latitude, longitude) ;
            ISTL4:source = "GRIB data" ;
            ISTL4:name = "ISTL4" ;
            ISTL4:title = "Ice surface temperature layer 4" ;
            ISTL4:date = "02/02/09" ;
            ISTL4:time = "00:00" ;
            ISTL4:long_name = "Ice surface temperature layer 4" ;
            ISTL4:standard_name =
"vertical_air_velocity_expressed_as_tendency_of_sigma" ;
            ISTL4:units = "K" ;
            ISTL4:missing_value = 2.e+20f ;
            ISTL4:_FillValue = 2.e+20f ;
            ISTL4:valid_min = 262.1048f ;
            ISTL4:valid_max = 271.8919f ;
      float IEWS(t, surface, latitude, longitude) ;
            IEWS:source = "GRIB data" ;
            IEWS:name = "IEWS" ;
            IEWS:title = "Instantaneous X surface stress" ;
            IEWS:date = "02/02/09" ;
            IEWS:time = "00:00" ;
            IEWS:long_name = "Instantaneous X surface stress" ;
            IEWS:units = "N m**-2" ;
            IEWS:missing_value = 2.e+20f ;
            IEWS:_FillValue = 2.e+20f ;
            IEWS:valid_min = -2.458697f ;
            IEWS:valid_max = 2.210549f ;
```

```
float INSS(t, surface, latitude, longitude) ;
        INSS:source = "GRIB data" ;
        INSS:name = "INSS" ;
        INSS:title = "Instantaneous Y surface stress" ;
        INSS:date = "02/02/09" ;
        INSS:time = "00:00" ;
        INSS:long_name = "Instantaneous Y surface stress" ;
        INSS:units = "N m**-2" ;
        INSS:missing_value = 2.e+20f ;
        INSS:_FillValue = 2.e+20f ;
        INSS:valid_min = -3.301396f ;
        INSS:valid_max = 3.64045f ;
float IE(t, surface, latitude, longitude) ;
        IE:source = "GRIB data" ;
        IE:name = "IE" ;
        IE:title = "Instantaneous moisture flux" ;
        IE:date = "02/02/09" ;
        IE:time = "00:00" ;
        IE:long_name = "Instantaneous moisture flux" ;
        IE:units = "kg m**-2 s" ;
        IE:missing_value = 2.e+20f ;
        IE:_FillValue = 2.e+20f ;
        IE:valid_min = -0.0002484142f ;
        IE:valid_max = 5.752908e-05f ;
float ISHF(t, surface, latitude, longitude) ;
        ISHF:source = "GRIB data" ;
        ISHF:name = "ISHF" ;
        ISHF:title = "Instantaneous surface heat flux" ;
        ISHF:date = "02/02/09" ;
        ISHF:time = "00:00" ;
        ISHF:long_name = "Instantaneous surface heat flux" ;
        ISHF:units = "W m**-2" ;
        ISHF:missing_value = 2.e+20f ;
        ISHF:_FillValue = 2.e+20f ;
        ISHF:valid_min = -626.0676f ;
        ISHF:valid_max = 190.6655f ;
float LCC(t, surface, latitude, longitude) ;
        LCC:source = "GRIB data" ;
        LCC:name = "LCC" ;
        LCC:title = "Low cloud cover" ;
        LCC:date = "02/02/09" ;
        LCC:time = "00:00" ;
        LCC:long_name = "Low cloud cover" ;
        LCC:units = "(0 - 1)" ;
        LCC:missing_value = 2.e+20f ;
        LCC:_FillValue = 2.e+20f ;
        LCC:valid_min = 0.f ;
        LCC:valid_max = 1.f ;
float MSL(t, surface, latitude, longitude) ;
        MSL:source = "GRIB data" ;
```

```
        MSL:name = "MSL" ;
        MSL:title = "Mean sea-level pressure" ;
        MSL:date = "02/02/09" ;
        MSL:time = "00:00" ;
        MSL:long_name = "Mean sea-level pressure" ;
        MSL:standard_name = "air_pressure_at_sea_level" ;
        MSL:units = "Pa" ;
        MSL:missing_value = 2.e+20f ;
        MSL:_FillValue = 2.e+20f ;
        MSL:valid_min = 95173.f ;
        MSL:valid_max = 104627.3f ;
    float MCC(t, surface, latitude, longitude) ;
        MCC:source = "GRIB data" ;
        MCC:name = "MCC" ;
        MCC:title = "Medium cloud cover" ;
        MCC:date = "02/02/09" ;
        MCC:time = "00:00" ;
        MCC:long_name = "Medium cloud cover" ;
        MCC:units = "(0 - 1)" ;
        MCC:missing_value = 2.e+20f ;
        MCC:_FillValue = 2.e+20f ;
        MCC:valid_min = 0.f ;
        MCC:valid_max = 1.f ;
    float SSTK(t, surface, latitude, longitude) ;
        SSTK:source = "GRIB data" ;
        SSTK:name = "SSTK" ;
        SSTK:title = "Sea surface temperature" ;
        SSTK:date = "02/02/09" ;
        SSTK:time = "00:00" ;
        SSTK:long_name = "Sea surface temperature" ;
        SSTK:standard_name = "northward_wind" ;
        SSTK:units = "K" ;
        SSTK:missing_value = 2.e+20f ;
        SSTK:_FillValue = 2.e+20f ;
        SSTK:valid_min = 270.1111f ;
        SSTK:valid_max = 304.1411f ;
    float CI(t, surface, latitude, longitude) ;
        CI:source = "GRIB data" ;
        CI:name = "CI" ;
        CI:title = "Sea-ice cover" ;
        CI:date = "02/02/09" ;
        CI:time = "00:00" ;
        CI:long_name = "Sea-ice cover" ;
        CI:standard_name = "wind_from_direction" ;
        CI:units = "(0 - 1)" ;
        CI:missing_value = 2.e+20f ;
        CI:_FillValue = 2.e+20f ;
        CI:valid_min = 0.f ;
        CI:valid_max = 1.f ;
    float SRC(t, surface, latitude, longitude) ;
        SRC:source = "GRIB data" ;
```

```
        SRC:name = "SRC" ;
        SRC:title = "Skin reservoir content" ;
        SRC:date = "02/02/09" ;
        SRC:time = "00:00" ;
        SRC:long_name = "Skin reservoir content" ;
        SRC:units = "m of water" ;
        SRC:missing_value = 2.e+20f ;
        SRC:_FillValue = 2.e+20f ;
        SRC:valid_min = -1.116728e-20f ;
        SRC:valid_max = 0.001190007f ;
    float SKT(t, surface, latitude, longitude) ;
        SKT:source = "GRIB data" ;
        SKT:name = "SKT" ;
        SKT:title = "Skin temperature" ;
        SKT:date = "02/02/09" ;
        SKT:time = "00:00" ;
        SKT:long_name = "Skin temperature" ;
        SKT:units = "K" ;
        SKT:missing_value = 2.e+20f ;
        SKT:_FillValue = 2.e+20f ;
        SKT:valid_min = 196.0966f ;
        SKT:valid_max = 333.9484f ;
    float ASN(t, surface, latitude, longitude) ;
        ASN:source = "GRIB data" ;
        ASN:name = "ASN" ;
        ASN:title = "Snow albedo" ;
        ASN:date = "02/02/09" ;
        ASN:time = "00:00" ;
        ASN:long_name = "Snow albedo" ;
        ASN:standard_name = "wind_speed" ;
        ASN:units = "(0 - 1)" ;
        ASN:missing_value = 2.e+20f ;
        ASN:_FillValue = 2.e+20f ;
        ASN:valid_min = 0.5f ;
        ASN:valid_max = 0.8499985f ;
    float RSN(t, surface, latitude, longitude) ;
        RSN:source = "GRIB data" ;
        RSN:name = "RSN" ;
        RSN:title = "Snow density" ;
        RSN:date = "02/02/09" ;
        RSN:time = "00:00" ;
        RSN:long_name = "Snow density" ;
        RSN:standard_name = "eastward_wind" ;
        RSN:units = "kg**-3" ;
        RSN:missing_value = 2.e+20f ;
        RSN:_FillValue = 2.e+20f ;
        RSN:valid_min = 100.f ;
        RSN:valid_max = 300.f ;
    float SD(t, surface, latitude, longitude) ;
        SD:source = "GRIB data" ;
```

```
        SD:name = "SD" ;
        SD:title = "Snow depth" ;
        SD:date = "02/02/09" ;
        SD:time = "00:00" ;
        SD:long_name = "Snow depth" ;
        SD:standard_name = "lwe_thickness_of_surface_snow_amount" ;
        SD:units = "m of water equivalent" ;
        SD:missing_value = 2.e+20f ;
        SD:_FillValue = 2.e+20f ;
        SD:valid_min = 0.f ;
        SD:valid_max = 10.00155f ;
    float STL1(t, depth, latitude, longitude) ;
        STL1:source = "GRIB data" ;
        STL1:name = "STL1" ;
        STL1:title = "Soil temperature level 1" ;
        STL1:date = "02/02/09" ;
        STL1:time = "00:00" ;
        STL1:long_name = "Soil temperature level 1" ;
        STL1:standard_name = "surface_temperature" ;
        STL1:units = "K" ;
        STL1:missing_value = 2.e+20f ;
        STL1:_FillValue = 2.e+20f ;
        STL1:valid_min = 205.261f ;
        STL1:valid_max = 321.9445f ;
    float STL2(t, depth_1, latitude, longitude) ;
        STL2:source = "GRIB data" ;
        STL2:name = "STL2" ;
        STL2:title = "Soil temperature level 2" ;
        STL2:date = "02/02/09" ;
        STL2:time = "00:00" ;
        STL2:long_name = "Soil temperature level 2" ;
        STL2:units = "K" ;
        STL2:missing_value = 2.e+20f ;
        STL2:_FillValue = 2.e+20f ;
        STL2:valid_min = 206.6095f ;
        STL2:valid_max = 312.4055f ;
    float STL3(t, depth_2, latitude, longitude) ;
        STL3:source = "GRIB data" ;
        STL3:name = "STL3" ;
        STL3:title = "Soil temperature level 3" ;
        STL3:date = "02/02/09" ;
        STL3:time = "00:00" ;
        STL3:long_name = "Soil temperature level 3" ;
        STL3:units = "K" ;
        STL3:missing_value = 2.e+20f ;
        STL3:_FillValue = 2.e+20f ;
        STL3:valid_min = 208.0938f ;
        STL3:valid_max = 311.5455f ;
    float STL4(t, depth_3, latitude, longitude) ;
        STL4:source = "GRIB data" ;
        STL4:name = "STL4" ;
```

```
        STL4:title = "Soil temperature level 4" ;
        STL4:date = "02/02/09" ;
        STL4:time = "00:00" ;
        STL4:long_name = "Soil temperature level 4" ;
        STL4:units = "K" ;
        STL4:missing_value = 2.e+20f ;
        STL4:_FillValue = 2.e+20f ;
        STL4:valid_min = 210.4696f ;
        STL4:valid_max = 309.5715f ;
float SP(t, surface, latitude, longitude) ;
        SP:source = "GRIB data" ;
        SP:name = "SP" ;
        SP:title = "Surface pressure" ;
        SP:date = "02/02/09" ;
        SP:time = "00:00" ;
        SP:long_name = "Surface pressure" ;
        SP:standard_name = "surface_air_pressure" ;
        SP:units = "Pa" ;
        SP:missing_value = 2.e+20f ;
        SP:_FillValue = 2.e+20f ;
        SP:valid_min = 51906.32f ;
        SP:valid_max = 104637.8f ;
float TSN(t, surface, latitude, longitude) ;
        TSN:source = "GRIB data" ;
        TSN:name = "TSN" ;
        TSN:title = "Temperature of snow layer" ;
        TSN:date = "02/02/09" ;
        TSN:time = "00:00" ;
        TSN:long_name = "Temperature of snow layer" ;
        TSN:standard_name = "snow_temperature" ;
        TSN:units = "K" ;
        TSN:missing_value = 2.e+20f ;
        TSN:_FillValue = 2.e+20f ;
        TSN:valid_min = 192.3112f ;
        TSN:valid_max = 320.8637f ;
float TCC(t, surface, latitude, longitude) ;
        TCC:source = "GRIB data" ;
        TCC:name = "TCC" ;
        TCC:title = "Total cloud cover" ;
        TCC:date = "02/02/09" ;
        TCC:time = "00:00" ;
        TCC:long_name = "Total cloud cover" ;
        TCC:standard_name = "cloud_area_fraction" ;
        TCC:units = "(0 - 1)" ;
        TCC:missing_value = 2.e+20f ;
        TCC:_FillValue = 2.e+20f ;
        TCC:valid_min = 9.999779e-13f ;
        TCC:valid_max = 1.f ;
float LSF(t, surface, latitude, longitude) ;
        LSF:source = "GRIB data" ;
```

```
        LSF:name = "LSF" ;
        LSF:title = "Total column ice water" ;
        LSF:date = "02/02/09" ;
        LSF:time = "00:00" ;
        LSF:long_name = "Total column ice water" ;
        LSF:standard_name = "large_scale_snowfall_amount" ;
        LSF:units = "kg m**-2" ;
        LSF:missing_value = 2.e+20f ;
        LSF:_FillValue = 2.e+20f ;
        LSF:valid_min = 0.f ;
        LSF:valid_max = 0.9673939f ;
    float CSF(t, surface, latitude, longitude) ;
        CSF:source = "GRIB data" ;
        CSF:name = "CSF" ;
        CSF:title = "Total column liquid water" ;
        CSF:date = "02/02/09" ;
        CSF:time = "00:00" ;
        CSF:long_name = "Total column liquid water" ;
        CSF:standard_name = "convective_snowfall_amount" ;
        CSF:units = "kg m**-2" ;
        CSF:missing_value = 2.e+20f ;
        CSF:_FillValue = 2.e+20f ;
        CSF:valid_min = 0.f ;
        CSF:valid_max = 3.718323f ;
    float TCO3(t, surface, latitude, longitude) ;
        TCO3:source = "GRIB data" ;
        TCO3:name = "TCO3" ;
        TCO3:title = "Total column ozone" ;
        TCO3:date = "02/02/09" ;
        TCO3:time = "00:00" ;
        TCO3:long_name = "Total column ozone" ;
        TCO3:units = "kg m**-2" ;
        TCO3:missing_value = 2.e+20f ;
        TCO3:_FillValue = 2.e+20f ;
        TCO3:valid_min = 0.004481006f ;
        TCO3:valid_max = 0.01184271f ;
    float TCW(t, surface, latitude, longitude) ;
        TCW:source = "GRIB data" ;
        TCW:name = "TCW" ;
        TCW:title = "Total column water" ;
        TCW:date = "02/02/09" ;
        TCW:time = "00:00" ;
        TCW:long_name = "Total column water" ;
        TCW:units = "kg m**-2" ;
        TCW:missing_value = 2.e+20f ;
        TCW:_FillValue = 2.e+20f ;
        TCW:valid_min = 0.3041072f ;
        TCW:valid_max = 72.66901f ;
    float TCWV(t, surface, latitude, longitude) ;
        TCWV:source = "GRIB data" ;
        TCWV:name = "TCWV" ;
```

```
            TCWV:title = "Total column water vapour" ;
            TCWV:date = "02/02/09" ;
            TCWV:time = "00:00" ;
            TCWV:long_name = "Total column water vapour" ;
            TCWV:standard_name =
"lwe_thickness_of_atmosphere_water_vapour_content" ;
            TCWV:units = "kg m**-2" ;
            TCWV:missing_value = 2.e+20f ;
            TCWV:_FillValue = 2.e+20f ;
            TCWV:valid_min = 0.3041036f ;
            TCWV:valid_max = 71.93267f ;
      float SWVL1(t, depth, latitude, longitude) ;
            SWVL1:source = "GRIB data" ;
            SWVL1:name = "SWVL1" ;
            SWVL1:title = "Volumetric soil water layer 1" ;
            SWVL1:date = "02/02/09" ;
            SWVL1:time = "00:00" ;
            SWVL1:long_name = "Volumetric soil water layer 1" ;
            SWVL1:standard_name =
"vertical_air_velocity_expressed_as_tendency_of_pressure" ;
            SWVL1:units = "m**3 m**-3" ;
            SWVL1:missing_value = 2.e+20f ;
            SWVL1:_FillValue = 2.e+20f ;
            SWVL1:valid_min = -1.e-38f ;
            SWVL1:valid_max = 0.4710711f ;
      float SWVL2(t, depth_1, latitude, longitude) ;
            SWVL2:source = "GRIB data" ;
            SWVL2:name = "SWVL2" ;
            SWVL2:title = "Volumetric soil water layer 2" ;
            SWVL2:date = "02/02/09" ;
            SWVL2:time = "00:00" ;
            SWVL2:long_name = "Volumetric soil water layer 2" ;
            SWVL2:standard_name = "upward_air_velocity" ;
            SWVL2:units = "m**3 m**-3" ;
            SWVL2:missing_value = 2.e+20f ;
            SWVL2:_FillValue = 2.e+20f ;
            SWVL2:valid_min = -1.e-38f ;
            SWVL2:valid_max = 0.4699268f ;
      float SWVL3(t, depth_2, latitude, longitude) ;
            SWVL3:source = "GRIB data" ;
            SWVL3:name = "SWVL3" ;
            SWVL3:title = "Volumetric soil water layer 3" ;
            SWVL3:date = "02/02/09" ;
            SWVL3:time = "00:00" ;
            SWVL3:long_name = "Volumetric soil water layer 3" ;
            SWVL3:standard_name = "atmosphere_absolute_vorticity" ;
            SWVL3:units = "m**3 m**-3" ;
            SWVL3:missing_value = 2.e+20f ;
            SWVL3:_FillValue = 2.e+20f ;
            SWVL3:valid_min = -1.e-38f ;
            SWVL3:valid_max = 0.4672639f ;
```

```
        float SWVL4(t, depth_3, latitude, longitude) ;
                SWVL4:source = "GRIB data" ;
                SWVL4:name = "SWVL4" ;
                SWVL4:title = "Volumetric soil water layer 4" ;
                SWVL4:date = "02/02/09" ;
                SWVL4:time = "00:00" ;
                SWVL4:long_name = "Volumetric soil water layer 4" ;
                SWVL4:units = "m**3 m**-3" ;
                SWVL4:missing_value = 2.e+20f ;
                SWVL4:_FillValue = 2.e+20f ;
                SWVL4:valid_min = -1.e-38f ;
                SWVL4:valid_max = 0.4682953f ;

// global attributes:
                :history = "Fri Oct 23 11:43:10 BST 2009 - CONVSH V1.92 16-
February-2006" ;
}
```

7.1.2.5 Gaussian gridded accumulated forecast on surface (gafs)

The gafs files are in netCDF format (version 3) using the following specification:

```
netcdf gafs200902020003 {
dimensions:
        longitude = 512 ;
        latitude = 256 ;
        surface = 1 ;
        t = UNLIMITED ; // (1 currently)
variables:
        float longitude(longitude) ;
                longitude:long_name = "longitude" ;
                longitude:units = "degrees_east" ;
                longitude:point_spacing = "even" ;
                longitude:modulo = " " ;
        float latitude(latitude) ;
                latitude:long_name = "latitude" ;
                latitude:units = "degrees_north" ;
        float surface(surface) ;
                surface:long_name = "surface" ;
                surface:units = "level" ;
                surface:positive = "up" ;
        float t(t) ;
                t:long_name = "t" ;
                t:units = "days since 2009-02-02 00:00:00" ;
                t:time_origin = "02-FEB-2009:00:00:00" ;
        float PARCS(t, surface, latitude, longitude) ;
                PARCS:source = "GRIB data" ;
                PARCS:name = "PARCS" ;
                PARCS:title = "Clear sky surface photosynthetically active
radiation" ;
                PARCS:date = "02/02/09" ;
                PARCS:time = "00:00" ;
```

```
              PARCS:long_name = "Clear sky surface photosynthetically active
radiation" ;
              PARCS:standard_name = "visibility_in_air" ;
              PARCS:units = "W m**-2 s" ;
              PARCS:missing_value = 2.e+20f ;
              PARCS:_FillValue = 2.e+20f ;
              PARCS:valid_min = 0.f ;
              PARCS:valid_max = 4318592.f ;
       float UVB(t, surface, latitude, longitude) ;
              UVB:source = "GRIB data" ;
              UVB:name = "UVB" ;
              UVB:title = "Downward UV radiation at the surface" ;
              UVB:date = "02/02/09" ;
              UVB:time = "00:00" ;
              UVB:long_name = "Downward UV radiation at the surface" ;
              UVB:standard_name = "water_evaporation_amount" ;
              UVB:units = "w m**-2 s" ;
              UVB:missing_value = 2.e+20f ;
              UVB:_FillValue = 2.e+20f ;
              UVB:valid_min = 0.f ;
              UVB:valid_max = 4501952.f ;
       float PAR(t, surface, latitude, longitude) ;
              PAR:source = "GRIB data" ;
              PAR:name = "PAR" ;
              PAR:title = "Photosynthetically active radiation at the surface" ;
              PAR:date = "02/02/09" ;
              PAR:time = "00:00" ;
              PAR:long_name = "Photosynthetically active radiation at the
surface" ;
              PAR:standard_name = "atmosphere_cloud_ice_content" ;
              PAR:units = "w m**-2 s" ;
              PAR:missing_value = 2.e+20f ;
              PAR:_FillValue = 2.e+20f ;
              PAR:valid_min = 0.f ;
              PAR:valid_max = 1480806.f ;
       float E(t, surface, latitude, longitude) ;
              E:source = "GRIB data" ;
              E:name = "E" ;
              E:title = "Evaporation" ;
              E:date = "02/02/09" ;
              E:time = "00:00" ;
              E:long_name = "Evaporation" ;
              E:standard_name = "lwe_thickness_of_water_evaporation_amount" ;
              E:units = "m of water" ;
              E:missing_value = 2.e+20f ;
              E:_FillValue = 2.e+20f ;
              E:valid_min = -0.002337382f ;
              E:valid_max = 0.0005753203f ;
       float TISR(t, surface, latitude, longitude) ;
              TISR:source = "GRIB data" ;
              TISR:name = "TISR" ;
```

```
              TISR:title = "TOA incident solar radiation" ;
              TISR:date = "02/02/09" ;
              TISR:time = "00:00" ;
              TISR:long_name = "TOA incident solar radiation" ;
              TISR:units = "W m**-2 s" ;
              TISR:missing_value = 2.e+20f ;
              TISR:_FillValue = 2.e+20f ;
              TISR:valid_min = 0.f ;
              TISR:valid_max = 1.488768e+07f ;
       float LSP(t, surface, latitude, longitude) ;
              LSP:source = "GRIB data" ;
              LSP:name = "LSP" ;
              LSP:title = "Stratiform precipitation (Large-scale precipitation)"
;
              LSP:date = "02/02/09" ;
              LSP:time = "00:00" ;
              LSP:long_name = "Stratiform precipitation (Large-scale
precipitation)" ;
              LSP:standard_name =
"lwe_thickness_of_large_scale_precipitation_amount" ;
              LSP:units = "m" ;
              LSP:missing_value = 2.e+20f ;
              LSP:_FillValue = 2.e+20f ;
              LSP:valid_min = -3.870432e-15f ;
              LSP:valid_max = 0.01586008f ;
       float CP(t, surface, latitude, longitude) ;
              CP:source = "GRIB data" ;
              CP:name = "CP" ;
              CP:title = "Convective precipitation" ;
              CP:date = "02/02/09" ;
              CP:time = "00:00" ;
              CP:long_name = "Convective precipitation" ;
              CP:standard_name =
"lwe_thickness_of_convective_precipitation_amount" ;
              CP:units = "m" ;
              CP:missing_value = 2.e+20f ;
              CP:_FillValue = 2.e+20f ;
              CP:valid_min = 0.f ;
              CP:valid_max = 0.01181912f ;
       float SF(t, surface, latitude, longitude) ;
              SF:source = "GRIB data" ;
              SF:name = "SF" ;
              SF:title = "Snowfall (convective + stratiform)" ;
              SF:date = "02/02/09" ;
              SF:time = "00:00" ;
              SF:long_name = "Snowfall (convective + stratiform)" ;
              SF:standard_name = "lwe_thickness_of_snowfall_amount" ;
              SF:units = "m of water equivalent" ;
              SF:missing_value = 2.e+20f ;
              SF:_FillValue = 2.e+20f ;
              SF:valid_min = -3.854894e-15f ;
```

```
        SF:valid_max = 0.004602216f ;
    float BLD(t, surface, latitude, longitude) ;
        BLD:source = "GRIB data" ;
        BLD:name = "BLD" ;
        BLD:title = "Boundary layer dissipation" ;
        BLD:date = "02/02/09" ;
        BLD:time = "00:00" ;
        BLD:long_name = "Boundary layer dissipation" ;
        BLD:standard_name = "dissipation_in_atmosphere_boundary_layer" ;
        BLD:units = "W m**-2 s" ;
        BLD:missing_value = 2.e+20f ;
        BLD:_FillValue = 2.e+20f ;
        BLD:valid_min = 33.44933f ;
        BLD:valid_max = 1333099.f ;
    float SSHF(t, surface, latitude, longitude) ;
        SSHF:source = "GRIB data" ;
        SSHF:name = "SSHF" ;
        SSHF:title = "Surface sensible heat flux" ;
        SSHF:date = "02/02/09" ;
        SSHF:time = "00:00" ;
        SSHF:long_name = "Surface sensible heat flux" ;
        SSHF:standard_name = "surface_upward_sensible_heat_flux" ;
        SSHF:units = "W m**-2 s" ;
        SSHF:missing_value = 2.e+20f ;
        SSHF:_FillValue = 2.e+20f ;
        SSHF:valid_min = -6654264.f ;
        SSHF:valid_max = 2067553.f ;
    float SLHF(t, surface, latitude, longitude) ;
        SLHF:source = "GRIB data" ;
        SLHF:name = "SLHF" ;
        SLHF:title = "Surface latent heat flux" ;
        SLHF:date = "02/02/09" ;
        SLHF:time = "00:00" ;
        SLHF:long_name = "Surface latent heat flux" ;
        SLHF:standard_name = "surface_upward_latent_heat_flux" ;
        SLHF:units = "W m**-2 s" ;
        SLHF:missing_value = 2.e+20f ;
        SLHF:_FillValue = 2.e+20f ;
        SLHF:valid_min = -5845327.f ;
        SLHF:valid_max = 1438720.f ;
    float SSRD(t, surface, latitude, longitude) ;
        SSRD:source = "GRIB data" ;
        SSRD:name = "SSRD" ;
        SSRD:title = "Surface solar radiation downwards" ;
        SSRD:date = "02/02/09" ;
        SSRD:time = "00:00" ;
        SSRD:long_name = "Surface solar radiation downwards" ;
        SSRD:standard_name = "surface_downwelling_shortwave_flux_in_air" ;
        SSRD:units = "W m**-2 s" ;
        SSRD:missing_value = 2.e+20f ;
```

```
        SSRD:_FillValue = 2.e+20f ;
        SSRD:valid_min = 0.f ;
        SSRD:valid_max = 1.188217e+07f ;
    float STRD(t, surface, latitude, longitude) ;
        STRD:source = "GRIB data" ;
        STRD:name = "STRD" ;
        STRD:title = "Surface thermal radiation downwards" ;
        STRD:date = "02/02/09" ;
        STRD:time = "00:00" ;
        STRD:long_name = "Surface thermal radiation downwards" ;
        STRD:units = "W m**-2 s" ;
        STRD:missing_value = 2.e+20f ;
        STRD:_FillValue = 2.e+20f ;
        STRD:valid_min = 364624.f ;
        STRD:valid_max = 5423144.f ;
    float SSR(t, surface, latitude, longitude) ;
        SSR:source = "GRIB data" ;
        SSR:name = "SSR" ;
        SSR:title = "Surface solar radiation" ;
        SSR:date = "02/02/09" ;
        SSR:time = "00:00" ;
        SSR:long_name = "Surface solar radiation" ;
        SSR:standard_name = "surface_net_upward_longwave_flux" ;
        SSR:units = "W m**-2 s" ;
        SSR:missing_value = 2.e+20f ;
        SSR:_FillValue = 2.e+20f ;
        SSR:valid_min = 1.08e-11f ;
        SSR:valid_max = 1.116267e+07f ;
    float STR(t, surface, latitude, longitude) ;
        STR:source = "GRIB data" ;
        STR:name = "STR" ;
        STR:title = "Surface thermal radiation" ;
        STR:date = "02/02/09" ;
        STR:time = "00:00" ;
        STR:long_name = "Surface thermal radiation" ;
        STR:standard_name = "surface_net_upward_shortwave_flux" ;
        STR:units = "W m**-2 s" ;
        STR:missing_value = 2.e+20f ;
        STR:_FillValue = 2.e+20f ;
        STR:valid_min = -2261462.f ;
        STR:valid_max = 423119.8f ;
    float TSR(t, surface, latitude, longitude) ;
        TSR:source = "GRIB data" ;
        TSR:name = "TSR" ;
        TSR:title = "Top solar radiation" ;
        TSR:date = "02/02/09" ;
        TSR:time = "00:00" ;
        TSR:long_name = "Top solar radiation" ;
        TSR:standard_name = "toa_net_upward_shortwave_flux" ;
        TSR:units = "W m**-2 s" ;
        TSR:missing_value = 2.e+20f ;
```

```
        TSR:_FillValue = 2.e+20f ;
        TSR:valid_min = 0.f ;
        TSR:valid_max = 1.391816e+07f ;
    float TTR(t, surface, latitude, longitude) ;
        TTR:source = "GRIB data" ;
        TTR:name = "TTR" ;
        TTR:title = "Top thermal radiation" ;
        TTR:date = "02/02/09" ;
        TTR:time = "00:00" ;
        TTR:long_name = "Top thermal radiation" ;
        TTR:standard_name = "toa_net_upward_longwave_flux" ;
        TTR:units = "W m**-2 s" ;
        TTR:missing_value = 2.e+20f ;
        TTR:_FillValue = 2.e+20f ;
        TTR:valid_min = -3603207.f ;
        TTR:valid_max = -1339975.f ;
    float EWSS(t, surface, latitude, longitude) ;
        EWSS:source = "GRIB data" ;
        EWSS:name = "EWSS" ;
        EWSS:title = "East-west surface stress" ;
        EWSS:date = "02/02/09" ;
        EWSS:time = "00:00" ;
        EWSS:long_name = "East-west surface stress" ;
        EWSS:standard_name = "surface_downward_eastward_stress" ;
        EWSS:units = "N m**-2 s" ;
        EWSS:missing_value = 2.e+20f ;
        EWSS:_FillValue = 2.e+20f ;
        EWSS:valid_min = -25801.11f ;
        EWSS:valid_max = 22493.55f ;
    float NSSS(t, surface, latitude, longitude) ;
        NSSS:source = "GRIB data" ;
        NSSS:name = "NSSS" ;
        NSSS:title = "North-south surface stress" ;
        NSSS:date = "02/02/09" ;
        NSSS:time = "00:00" ;
        NSSS:long_name = "North-south surface stress" ;
        NSSS:standard_name = "surface_downward_northward_stress" ;
        NSSS:units = "N m**-2 s" ;
        NSSS:missing_value = 2.e+20f ;
        NSSS:_FillValue = 2.e+20f ;
        NSSS:valid_min = -33942.86f ;
        NSSS:valid_max = 40122.26f ;
    float SUND(t, surface, latitude, longitude) ;
        SUND:source = "GRIB data" ;
        SUND:name = "SUND" ;
        SUND:title = "Sunshine duration" ;
        SUND:date = "02/02/09" ;
        SUND:time = "00:00" ;
        SUND:long_name = "Sunshine duration" ;
        SUND:units = "s" ;
```

```
        SUND:missing_value = 2.e+20f ;
        SUND:_FillValue = 2.e+20f ;
        SUND:valid_min = 0.f ;
        SUND:valid_max = 10800.f ;
    float LGWS(t, surface, latitude, longitude) ;
        LGWS:source = "GRIB data" ;
        LGWS:name = "LGWS" ;
        LGWS:title = "Latitudinal component of gravity wave stress" ;
        LGWS:date = "02/02/09" ;
        LGWS:time = "00:00" ;
        LGWS:long_name = "Latitudinal component of gravity wave stress" ;
        LGWS:units = "N m**-2 s" ;
        LGWS:missing_value = 2.e+20f ;
        LGWS:_FillValue = 2.e+20f ;
        LGWS:valid_min = -46492.46f ;
        LGWS:valid_max = 24337.29f ;
    float MGWS(t, surface, latitude, longitude) ;
        MGWS:source = "GRIB data" ;
        MGWS:name = "MGWS" ;
        MGWS:title = "Meridional component of gravity wave stress" ;
        MGWS:date = "02/02/09" ;
        MGWS:time = "00:00" ;
        MGWS:long_name = "Meridional component of gravity wave stress" ;
        MGWS:units = "N m**-2 s" ;
        MGWS:missing_value = 2.e+20f ;
        MGWS:_FillValue = 2.e+20f ;
        MGWS:valid_min = -20783.21f ;
        MGWS:valid_max = 55803.41f ;
    float GWD(t, surface, latitude, longitude) ;
        GWD:source = "GRIB data" ;
        GWD:name = "GWD" ;
        GWD:title = "Gravity wave dissipation" ;
        GWD:date = "02/02/09" ;
        GWD:time = "00:00" ;
        GWD:long_name = "Gravity wave dissipation" ;
        GWD:units = "W m**-2 s" ;
        GWD:missing_value = 2.e+20f ;
        GWD:_FillValue = 2.e+20f ;
        GWD:valid_min = -2.488257f ;
        GWD:valid_max = 849349.5f ;
    float RO(t, surface, latitude, longitude) ;
        RO:source = "GRIB data" ;
        RO:name = "RO" ;
        RO:title = "Runoff" ;
        RO:date = "02/02/09" ;
        RO:time = "00:00" ;
        RO:long_name = "Runoff" ;
        RO:units = "m" ;
        RO:missing_value = 2.e+20f ;
        RO:_FillValue = 2.e+20f ;
        RO:valid_min = 0.f ;
```

```
        RO:valid_max = 0.009932756f ;
    float TP(t, surface, latitude, longitude) ;
        TP:source = "GRIB data" ;
        TP:name = "TP" ;
        TP:title = "Total precipitation" ;
        TP:date = "02/02/09" ;
        TP:time = "00:00" ;
        TP:long_name = "Total precipitation" ;
        TP:units = "m" ;
        TP:missing_value = 2.e+20f ;
        TP:_FillValue = 2.e+20f ;
        TP:valid_min = -3.870432e-15f ;
        TP:valid_max = 0.02419233f ;
    float CSF(t, surface, latitude, longitude) ;
        CSF:source = "GRIB data" ;
        CSF:name = "CSF" ;
        CSF:title = "Convective snowfall" ;
        CSF:date = "02/02/09" ;
        CSF:time = "00:00" ;
        CSF:long_name = "Convective snowfall" ;
        CSF:units = "m of water equivalent" ;
        CSF:missing_value = 2.e+20f ;
        CSF:_FillValue = 2.e+20f ;
        CSF:valid_min = 0.f ;
        CSF:valid_max = 0.002008307f ;
    float LSF(t, surface, latitude, longitude) ;
        LSF:source = "GRIB data" ;
        LSF:name = "LSF" ;
        LSF:title = "Large-scale snowfall" ;
        LSF:date = "02/02/09" ;
        LSF:time = "00:00" ;
        LSF:long_name = "Large-scale snowfall" ;
        LSF:units = "m of water equivalent" ;
        LSF:missing_value = 2.e+20f ;
        LSF:_FillValue = 2.e+20f ;
        LSF:valid_min = -3.854894e-15f ;
        LSF:valid_max = 0.004581235f ;
    float LSPF(t, surface, latitude, longitude) ;
        LSPF:source = "GRIB data" ;
        LSPF:name = "LSPF" ;
        LSPF:title = "Large-scale precipitation fraction" ;
        LSPF:date = "02/02/09" ;
        LSPF:time = "00:00" ;
        LSPF:long_name = "Large-scale precipitation fraction" ;
        LSPF:standard_name = "northward_sea_water_velocity" ;
        LSPF:units = "s" ;
        LSPF:missing_value = 2.e+20f ;
        LSPF:_FillValue = 2.e+20f ;
        LSPF:valid_min = 0.f ;
        LSPF:valid_max = 10800.f ;
```

```
        float TSRC(t, surface, latitude, longitude) ;
                TSRC:source = "GRIB data" ;
                TSRC:name = "TSRC" ;
                TSRC:title = "Top net solar radiation, clear sky" ;
                TSRC:date = "02/02/09" ;
                TSRC:time = "00:00" ;
                TSRC:long_name = "Top net solar radiation, clear sky" ;
                TSRC:units = "W m**-2" ;
                TSRC:missing_value = 2.e+20f ;
                TSRC:_FillValue = 2.e+20f ;
                TSRC:valid_min = 0.f ;
                TSRC:valid_max = 1.389542e+07f ;
        float TTRC(t, surface, latitude, longitude) ;
                TTRC:source = "GRIB data" ;
                TTRC:name = "TTRC" ;
                TTRC:title = "Top upward thermal radiation, clear sky" ;
                TTRC:date = "02/02/09" ;
                TTRC:time = "00:00" ;
                TTRC:long_name = "Top upward thermal radiation, clear sky" ;
                TTRC:units = "W m**-2" ;
                TTRC:missing_value = 2.e+20f ;
                TTRC:_FillValue = 2.e+20f ;
                TTRC:valid_min = -3591984.f ;
                TTRC:valid_max = -1486456.f ;
        float SSRC(t, surface, latitude, longitude) ;
                SSRC:source = "GRIB data" ;
                SSRC:name = "SSRC" ;
                SSRC:title = "Surface net solar radiation, clear sky" ;
                SSRC:date = "02/02/09" ;
                SSRC:time = "00:00" ;
                SSRC:long_name = "Surface net solar radiation, clear sky" ;
                SSRC:standard_name =
"surface_net_downward_shortwave_flux_assuming_clear_sky" ;
                SSRC:units = "W m**-2" ;
                SSRC:missing_value = 2.e+20f ;
                SSRC:_FillValue = 2.e+20f ;
                SSRC:valid_min = 0.f ;
                SSRC:valid_max = 1.113208e+07f ;
        float STRC(t, surface, latitude, longitude) ;
                STRC:source = "GRIB data" ;
                STRC:name = "STRC" ;
                STRC:title = "Surface net thermal radiation, clear sky" ;
                STRC:date = "02/02/09" ;
                STRC:time = "00:00" ;
                STRC:long_name = "Surface net thermal radiation, clear sky" ;
                STRC:standard_name =
"surface_net_downward_longwave_flux_assuming_clear_sky" ;
                STRC:units = "W m**-2" ;
                STRC:missing_value = 2.e+20f ;
                STRC:_FillValue = 2.e+20f ;
                STRC:valid_min = -2261722.f ;
```

```
            STRC:valid_max = -24013.f ;
      float ES(t, surface, latitude, longitude) ;
            ES:source = "GRIB data" ;
            ES:name = "ES" ;
            ES:title = "Snow evaporation" ;
            ES:date = "02/02/09" ;
            ES:time = "00:00" ;
            ES:long_name = "Snow evaporation" ;
            ES:standard_name = "divergence_of_wind" ;
            ES:units = "m of water" ;
            ES:missing_value = 2.e+20f ;
            ES:_FillValue = 2.e+20f ;
            ES:valid_min = -0.00059132f ;
            ES:valid_max = 0.0001217099f ;
      float SMLT(t, surface, latitude, longitude) ;
            SMLT:source = "GRIB data" ;
            SMLT:name = "SMLT" ;
            SMLT:title = "Snowmelt" ;
            SMLT:date = "02/02/09" ;
            SMLT:time = "00:00" ;
            SMLT:long_name = "Snowmelt" ;
            SMLT:standard_name = "eastward_wind_shear" ;
            SMLT:units = "m of water" ;
            SMLT:missing_value = 2.e+20f ;
            SMLT:_FillValue = 2.e+20f ;
            SMLT:valid_min = 0.f ;
            SMLT:valid_max = 0.004405756f ;

// global attributes:
            :history = "Fri Oct 23 11:43:53 BST 2009 - CONVSH V1.92 16-
February-2006" ;
}
```

7.2 CLAVR-x

CLAVR-x files contain the cloud mask for AVHRR GAC files as generated by the CLAVR-x software using HDF5 format.

7.2.1 File naming convention

The CLAVR-x files use the following naming convention

`<GAC file>.cmr.h5`

Example:

`NSS.GHRR.NP.D10365.S0315.E0510.B0976869.WI.cmr.h5`

Here <GAC file> is the name of the input AVHRR GAC L1 file (see section 3.2).

7.2.2 Product data format

The CLAVR-x files are in HDF5 format and contain a single dataset: clavr-x_cld_mask_results Dataset {13749, 409}.

7.3 OSI-401: SSM/I Sea Ice Concentration Maps

OSI-401 is the operational sea ice concentration dataset produced by OSI-SAF. It is used in CCI processing when the reprocessed dataset OSI-409 (see section 7.4) is unavailable.

7.3.1 File naming convention

The netCDF product files have the following naming convention:

`ice_conc_<area>_<proj>-<gridRes>_multi_<yyyymmdd>1200.nc`

Example:

`ice_conc_nh_polstere-100_multi_201001021200.nc`

Table 7-5: Elements of the OSI-401 file names

Pattern Element	Example	Title	Description
area	nh	Hemisphere	Each file contains one hemisphere. Set to 'nh' for Northern Hemisphere or 'sh' for Southern Hemisphere
proj	ease	Projection	Projection of the data grid. Set to 'ease' for equal area Lambert azi-muthal projection or 'polstere' for Polar Stereographic projection
gridRes	125	Grid resolu-tion	Set to '125' for 12.5km, or '100' for 10km
yyyymmdd	20021202	Product reference date	The identifying date for the file. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31.

7.3.2 Product data format

OSI-401 files are netCDF Version 3 format as described in [RD-42] and **Error! Reference source not found.**. The variables that are used in SST CCI are listed in Table 7-6.

Table 7-6: Variables in OSI-401 products used in SST CCI

Variable name	Description	Reference
time	Reference time of product	[RD 42]
xc	X coordinate of projection	[RD 42]
yc	Y coordinate of projection	[RD 42]
ice_con	Sea ice concentration	[RD 42]
status_flag	Status flag of sea ice concentration retrieval	[RD 42]

7.4 OSI-409: Global Sea Ice Concentration Reprocessing Dataset

OSI-409 is the reprocessed sea ice concentration dataset produced by OSI-SAF. It is used in CCI processing when available (up to October 2009). The reprocessing dataset is available on two projections and grids; it is the dataset on the 10 km polar stereographic grid that will be used in the Level processing. The dataset consists of daily netCDF files.

7.4.1 File naming convention

The netCDF product files have the following naming convention:

`ice_conc_<area>_<proj>-<gridRes>_reproc_<yyyymmdd>1200.nc`

Example:

`ice_conc_nh_polstere-100_reproc_200212021200.nc`

Table 7-7: Elements of the OSI-409 file names

Pattern Element	Example	Title	Description
area	nh	Hemisphere	Each file contains one hemisphere. Set to 'nh' for Northern Hemisphere or 'sh' for Southern Hemisphere
proj	ease	Projection	Projection of the data grid. Set to 'ease' for equal area Lambert azimuthal projection or 'polstere' for Polar Stereographic projection
gridRes	125	Grid resolution	Set to '125' for 12.5km, or '100' for 10km
yyyymmdd	20021202	Product reference date	The identifying date for the file. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31.

7.4.2 Product data format

The variables of the OSI-409 products that are used in SST CCI are listed in Table 8.2. The detailed product file format is described in [RD-43]

Table 7-8: Variables in OSI-409 products used in SST CCI

Variable name	Description	Reference
time	Reference time of product	[RD 43]
xc	X coordinate of projection	[RD 43]
yc	Y coordinate of projection	[RD 43]**Error! Reference source not found.**
ice_con	Sea ice concentration	[RD 43]
standard_error	Total uncertainty (one standard deviation) of concentration of sea ice	[RD 43]
status_flag	Status flag of sea ice concentration retrieval	[RD 43]

7.5 TOMS OMI GOME-1 GOME-2 Absorbing Aerosol Index

7.5.1 File naming convention

The netCDF product files have the following naming convention:

`aai_<yyyymmdd>.nc`

Example:

`aai_20040307.nc`

Table 7-9: Elements of the Absorbing Aerosol Index file names

Pattern Element	Example	Title	Description
yyyymmdd	20021202	Product reference date	The identifying date for the file. yyyy is the four-digit year, mm is the two-digit month from 01 to 12, and dd is the two-digit day of month from 01 to 31.

7.5.2 Product data format

The detailed file format of the Absorbing Aerosol Index product expressed in netCDF common data form language (CDL) is listed below.

```
netcdf aai_20040301 {
dimensions:
       nx = 288 ;
       ny = 180 ;
variables:
       float lon(nx) ;
              lon:long_name = "longitude" ;
              lon:units = "degrees_east" ;
       float lat(ny) ;
              lat:long_name = "latitude" ;
              lat:units = "degrees_north" ;
       float aerosol_absorbing_index(ny, nx) ;
              aerosol_absorbing_index:long_name = "Aerosol: Absorbing Aerosol
Index" ;
              aerosol_absorbing_index:units = "percent" ;
              aerosol_absorbing_index:_FillValue = -32768.f ;

// global attributes:
              :title = "Global Aerosol - Absorbing Aerosol Index" ;
              :institution = "University of Leicester" ;
              :contact = "Christopher Whyte (cw101@le.ac.uk)" ;
              :creation_date = "Tue Jul 19 10:16:54 2011" ;
              :callsign = "TOMS-EarthProbe" ;
}
```

8. AUXILIARY DATA FOR LEVEL 4 ANALYSIS

8.1 OSI-401: SSM/I Sea Ice Concentration Maps

This operational product is used in the 2nd demo ECV and for post October 2009 in the long term ECV. The files are obtained from OSI-SAF in netCDF format. The OSI-401 dataset used for the Level-4 analysis is the same as that used for the Level-2 processing described in Section 7.3.

8.2 OSI-409: Global Sea Ice Concentration Reprocessing Dataset

The dataset used for Level-4 analysis is the same as that used for Level-2 processing described in section 7.4.

The OSI-409 dataset is used in the long-term system, but is only available up to October 2009. The operational product (OSI-401, see section 8.1) will be used for post October 2009.