(A)ATSR Data Exploitation : Provision of (A)ATSR data in GHRSST-PP L2P format with SSES

In situ and Met Office NWP Ancillary Data Format Description

Deliverable 2.4

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Revision History

Author(s)	*Revision date*	*Version*	*Summary of Changes*
J. Stark	4 Feb 2008	1.0	Initial Version
J. Stark	22 Feb 2008	1.1	Space ConneXions comments

Contents

1. Introduction

This document describes the in situ and Met Office Unified Model™ (UK) NWP data provided to the University of Leicester and RAL for incorporation into the (A)ATSR L2P data set. The document is divided into two sections describing the NWP data and the in situ data.

This document describes the datasets supplied by the Met Office to cover the reanalysis period considered within the L2P project only, and does not address the continued real time data provision that will be needed in an operational system.

2. Data format for Met Office NWP data

The data are supplied as NetCDF, packed into signed bytes using the CF-1.0 (Eaton *et al*., 2003) standard for packing the data, using “scale_factor” and “add_offset” metadata. The data have been compressed using bzip2, a freely available compression tool (www.bzip2.org). A single file is provided for each of the years 2002 to 2006 inclusive, with one record every 6 hours, giving (365*4 =) 1460 records for non-leap years. The Met Office data have been homogenised onto a single grid with 640 points in longitude and 480 in latitude, although earlier years were at a lower resolution. Bilinear interpolation has been used for the gridding. To reduce unnecessary interpolation errors, the original source grid has been preserved where possible. For this reason the wind speed is offset by half a grid spacing from the solar irradiance, as this is the model representation of the data. A coordinate set has been provided (latt/lont and latv/lonv) for each variable.

A few of the fields were missing due to operational archiving problems. These fields were filled with missing data indicators (_FillValue).

The following subsections look at each of the required parameters in turn.

2.1. Wind speed

The wind speed at a nominal height of 10m (the definition of surface wind speed used in the GHRSST-PP Data processing Specification or GDS). Since vertical motion is usually negligible the speed has been constructed as the vector magnitude of the horizontal 10m wind components, $\sqrt{u^2+v^2}$ where u and v are the horizontal components of the wind velocity.

A scale factor of 0.1m/s has been used, giving a maximum representable value of 25.3ms^{-1} using NetCDF bytes and an offset of 12.7ms^{-1}. Although the values 25.4 and

25.5 could be coded, these have been used to indicate wind speeds that exceed 25.3ms^{-1} and missing data respectively. The resolution of 0.1ms^{-1} should be sufficient, since most GHRSST L2P data current only specifies the wind speed in 1ms^{-1} increments.

2.2. Surface solar irradiance (SSI)

The surface solar irradiance is derived from the surface shortwave downwelling radiance. A scale factor of 5 Wm^{-2} has been used, with an offset of 600Wm^{-2} allowing values from -35Wm^{-2} to 1230Wm^{-2} to be represented. A packed data value of 127 is used to represent values greater than the largest representable, and -128 is used to indicate missing data.

3. In situ data

In situ data from the ICOADS (Reynolds *et al*.) data set has been provided in ASCII format.

There is one ASCII file per month for the period August 1991 to June 2007. There are 19 columns in each file as follows, with contents described below.

Column	***Description***	***Comment***
1	Callsign	8 alphanumeric characters
2	Latitude	Stored in units of tenths of a degree
3	Longitude	Stored in units of tenths of a degree
4	Year	
5	Month	
6	Day	
7	Hour	The format is HHFF, where HH is the hour (00 to 23) and FF is the fractional hour in hundredths e.g. 2375 is twenty three point seven five hours i.e. quarter to midnight. The range of admissible times is 0000 to 2399.
8	Marine Air Temperature (MAT)	Stored in units of 1/10 degrees C, missing data is signified by the number -32768
9	Sea Surface Temperature (SST)	Stored in units of 1/10 degrees C, missing data is signified by the number -32768
10	Mean Sea Level Pressure (MSLP)	Stored in units of millibars, missing data is signified by the number -32768
11	Ship Speed And Direction.	The encoding is direction*100+speed, where speed is in knots and direction is int(degrees/45).
12	Deck ID	
13	Source ID	
14	Obtype	0=drifting buoy 1=moored buoy 2=ship
15	Basic QC flags (Table 2)	
16	SST QC flags (Table 3)	
17	MAT QC flags (Table 4)	
18	AST QC flags (Table 5)	
19	MSLP QC flags	

Table 1: In situ data contents

The QC flags (and other elements) are described in detail in the following subsections.

3.1. Element QC

This variable is a string of eight bits containing information on the QC status of the observation.

Bit Number	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***
Indicates	Duplicate	Blacklisted	Bad place	Bad date	Bad time	Failed track check	Over land	Day ob.

Table 2: Basic QC Flags

- Bit 8 is set if the observation is a worse duplicate of some other observation (the better observation it is a duplicate of is NOT flagged).
- Bit 7 is set if the observation source (callsign) is blacklisted.
- Bit 6 is set if the longitude or latitude are invalid (outside +-180 or +-90.)
- Bit 5 is set if the observation date is invalid. (Day < 1 or > no. of days in month; month < 1 or > 12 etc.)
- Bit 4 is set if the observation time is invalid. (Hour < 0 or > 23 etc.)
- Bit 3 is set if the observation was marked bad by ship tracking.
- Bit 2 is set if the observation position is not over the sea.
- Bit 1 is set if the observation was made during the day (between 1 hour after sunrise and 1 hour after sunset.)

3.2. Element SST QC

This variable is a string of eight bits containing information on the QC status of the SST value for the observation.

Bit Number	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***
Indicates	Not used			No SST given	SST below -1.8C	No SST normal available	SST >8C away from climatology	SST failed buddy check

Table 3: SST QC Flags

- Bits 6-8 are unused
- Bit 5 is set if the observation has no SST.
- Bit 4 is set if the SST is below -1.8C (the freezing point of sea-water).
- Bit 3 is set if the observation comes from a time and place where there is no SST normal available.
- Bit 2 is set if the SST is more than 8C away from the climatology value.
- Bit 1 is set if the SST fails a buddy check.

3.3. Element MAT QC

This variable is a string of eight bits containing information on the QC status of the MAT value for the observation.

Bit Number	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***
Indicates	Not used			No MAT given	Not used	No MAT normal available	MAT >10C away from climatology	MAT failed buddy check

Table 4: MAT QC Flags

- Bits 6-8 are unused
- Bit 5 is set if the observation has no MAT.
- Bit 4 is not used.
- Bit 3 is set if the observation comes from a time and place where there is no MAT normal available.
- Bit 2 is set if the MAT is more than 10C away from the climatology value.
- Bit 1 is set if the MAT fails a buddy check.

3.4. Element AST QC

This variable is a string of eight bits containing information on the QC status of the AST value for the observation.

Bit Number	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***
Indicates	Not used					No AST normal available	AST >10C away from climatology	AST failed buddy check

Table 5: AST QC Flags

- Bits 4-8 are unused
- Bit 3 is set if the observation comes from a time and place where there is no AST normal available.
- Bit 2 is set if the AST is more than 10C away from the climatology value.
- Bit 1 is set if the AST fails a buddy check.

3.5. Element MSLP QC

At the moment this variable is unused as the MDS does not process pressures.

4. Sea Ice data

We suggest using the data supplied with ERA-40, which is effectively HadISST.

5. References

Eaton, B., J.Gregory, B.Drach, K.Taylor and S.Hankin, 2003, NetCDF Climate and Forecast (CF) Metadata Conventions, Version 1.0. Available online from http://cf-pcmdi.llnl.gov/documents/cf-conventions/1.0/

Appendix 1 Sample CDL for Met Office NWP data

```
netcdf 2002_wind {
dimensions:
        time = UNLIMITED ; // (1460 currently)
        latv = 480 ;
        lonv = 640 ;
        latt = 481 ;
        lont = 640 ;
variables:
        int time(time) ;
                time:_FillValue = -2147483648 ;
                time:units = "hours since 1970-1-1 00:00:00" ;
                time:long_name = "time" ;
        float latv(latv) ;
                latv:_FillValue = -1.e+30f ;
                latv:units = "degrees_north" ;
                latv:long_name = "latitude" ;
                latv:comment = "velocity points" ;
        float lonv(lonv) ;
                lonv:_FillValue = -1.e+30f ;
                lonv:units = "degrees_east" ;
                lonv:long_name = "longitude" ;
                lonv:comment = "velocity points" ;
        float latt(latt) ;
                latt:_FillValue = -1.e+30f ;
                latt:units = "degrees_north" ;
                latt:long_name = "latitude" ;
                latt:comment = "temperature points" ;
        float lont(lont) ;
                lont:_FillValue = -1.e+30f ;
                lont:units = "degrees_east" ;
                lont:long_name = "longitude" ;
                lont:comment = "temperature points" ;
        byte wind_speed(time, latv, lonv) ;
                wind_speed:_FillValue = -128b ;
                wind_speed:valid_min = -127b ;
                wind_speed:valid_max = 126b ;
                wind_speed:units = "m s-1" ;
                wind_speed:long_name = "Wind Speed" ;
                wind_speed:standard_name = "wind_speed" ;
                wind_speed:comment = "Wind speeds greater than or equal to 25.4m/s have been set
to 25.4m/s. Rounding has been performed to the nearest multiple of scale_factor." ;
                wind_speed:scale_factor = 0.1 ;
                wind_speed:add_offset = 12.7 ;
        byte swf(time, latt, lont) ;
                swf:_FillValue = -128b ;
                swf:valid_min = -127b ;
                swf:valid_max = 126b ;
                swf:units = "W m-2" ;
                swf:long_name = "Shortwave Flux" ;
                swf:standard_name = "surface_net_downward_shortwave_flux" ;
                swf:comment = "Fluxes greater than or equal to 1235 Wm-2 have been reduced to 1235
Wm-2. Rounding has been performed to the nearest multiple of scale_factor." ;
                swf:scale_factor = 5. ;
                swf:add_offset = 600. ;

// global attributes:
                :Conventions = "CF-1.0" ;
                :title = "Wind Speed Data for (A)ATSR L2-GHRSST" ;
                :contact = "john.stark@metoffice.gov.uk" ;
                :history = "Created from UKMO Global NWP model PP data" ;
                :spatial_resolution = "0.5625 degree" ;
                :southernmost_latitude = -90.f ;
                :northernmost_latitude = 90.f ;
```

```
                :westernmost_longitude = -180.f ;
                :easternmost_longitude = 180.f ;
                :start_date = "2002-01-01 UTC" ;
                :start_time = "00:00:00 UTC" ;
                :stop_date = "2002-12-31 UTC" ;
                :stop_time = "18:00:00 UTC" ;
}
```