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fiducial reference temperature measurements

esa

Fiducial Reference Measurements for validation of Surface Temperature from Satellites (FRM4STS)

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	Signature		*Signature*

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Fiducial Reference Measurements for validation of Surface Temperature from Satellites (FRM4STS)

WEB BASED LIBRARY OF CALIBRATION AND VALIDATION DOCUMENTS FOR NON-RECOVERABLE SST INSTRUMENTS

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28 February 2018

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EXECUTIVE SUMMARY

FRM4STS Option 1 comprised a body of work to examine every aspect of the reporting and management of SST originating from the global drifter fleet: past, present and future. In addition to the production of a technical report that outlines best practice for the future, particularly with regard to SI traceability of drifter SST, and a scientific and technical workshop to bring together the drifter SST community to examine the issues around the creation and maintenance of a drifter SST database traceable to SI and agree best practice for the future, the work required the creation of tools to comb and mine historical databases and platform files for metadata relating to drifter measurement of SST. This latter activity is the subject of this short report.

The motivation for the study was the increased emphasis being placed by climate scientists and the satellite community on the drifter SST record, and for the need to better quantify the traceability of the measurements to SI, and to elucidate the uncertainty budgets associated with the measurements. Indeed, the quality of satellite SST retrievals currently depends ultimately on the uncertainties associated with drifter observations, and for that reason alone ESA were keen to better quantify and document these uncertainties.

It was immediately recognised that this should not be a one-shot activity, and that for the endeavour to be valuable, means should be put in place to ensure that it continued to be updated on a regular basis. Fortunately, the Data Buoy Co-operation Panel (DBCP), an IOC-WMO body that seeks to co-ordinate global data buoy activities, and which has been proactive in establishing better links with the satellite community, has accepted its responsibility in this area and has committed its Technical Co-ordinator at JCOMMOPS in Brest to taking on this task.

Lovro Valcic, an IT expert and former colleague of the author, enthusiastically addressed the initial difficult task of bringing together the multifarious metadata sources – manufacturers' job files, JCOMMOPS archives and buoy operator deployment logs – and it is mostly his work that is reported here. This is very much a body of work in progress, and Mr Valcic is in dialogue with JCOMMOPS about the handover of the task to themselves, its integration into their ongoing activities in the field of metadata integration, and the sustained maintenance of the capability.

DATA SOURCES USED IN THE PRESENT STUDY

1. MANUFACTURER'S JOB FILES

Many manufacturers are, and have been, involved in the manufacture of the 'standard' SVP drifter over a period of more than 20 years. Not all of these manufacturers are still in existence, and, furthermore none of them in any case adhered strictly to the SVP 'standard' published by the DBCP[1]. Nonetheless, a considerable effort by the manufacturing community and the US Global Drifter Program (GDP) has made the majority of historical job files available to this study.

Typically, of interest to our study, the job file will list the drifter's telecommunications ID, the type of SST sensor, the transfer function that converts sensor output to a field in the transmitted message, and the resolution of the reported SST estimate. It will not in general contain any traceability or calibration data, nor, crucially, the WMO ID which is assigned to the drifter on deployment, and is the identifier best known to the downstream data users, be they a national weather service, an ocean laboratory, a satellite SST expert, or a climate scientist. Unfortunately a WMO ID is not necessarily unique, and may be recycled some months after the drifter originally bearing it has ceased operation.

A typical manufacturer job file is attached as Annex B.

2. DEPLOYMENT LOG FILES

Buoy programme operators maintain log files of their deployments. These may include details of the deployment location, the assigned WMO ID, further details of the SST sensor, and the dates of partial and/or complete failure, including the date of drogue loss, of itself of use in understanding what the SST senor might actually have been measuring. Each buoy operator adopts different protocols, spanning different time periods. The most comprehensive is the GDP deployment log file, listing more than 20000 drifter deployments over a period of nearly 40 years.

Examples of deployment logs are given in Annex C.

3. JCOMMOPS METADATA FILES

JCOMMOPS has struggled over many years to collect a comprehensive metadata dataset, which to some extent has prompted our study. The main reason for this is that it requires all operators to take the trouble to submit their metadata, an activity which until recently has been seen to be of low priority.

However, they do maintain a database of all drifters that have ever reported on the Global Telecommunication System of the World Meteorological Organization, the main route by which drifter data reaches end users and the designated archives. This comprehensive list is vital in linking a drifter's WMO ID, by which it is known to the end user, to its telecommunications ID (with which it was equipped at the point of manufacture) and all the associated metadata.

An extract of this database is given at Annex D.

THE DATA MINING PROCESS

This is summarised in the following slides (Annex A). The work is ongoing and is the subject of a close dialogue between Mr Valcic and the designated officers at JCOMMOPS who will be responsible for its ongoing maintenance and integration with their other metadata gathering activities.

ANNEX A – AN OVERVIEW OF THE DATA MINING PROCESS

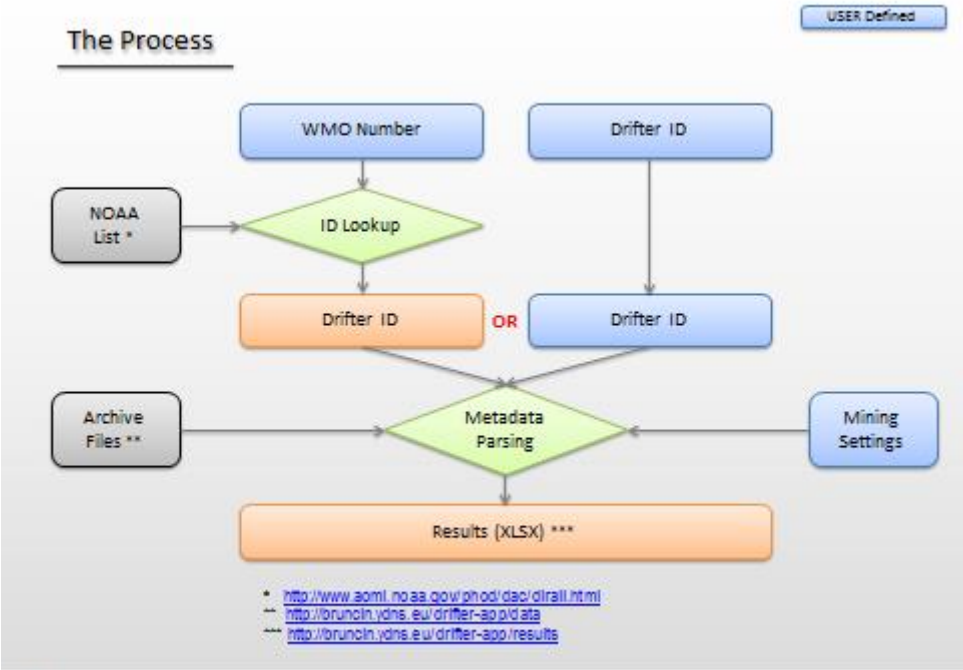
1 https://www.wmo.int/pages/prog/amp/mmop/documents/dbcp/Dbcp4/DBCP-4-svpb_design_ref_rev2.pdf

In General

- Develop an exploratory tool for mining SST Drifter metadata
- Focused on existing data sources stored in various file types
- Developed a Windows based tool first
  - Perl, LibreOffice
- Developed a Linux server based tool second
  - Perl, LibreOffice, MySQL, PHP, JavaScript, Ajax
- Server available @ http://bruncin.ydns.eu/drifter-app
  - Username: drifter
  - Password: sstData!

The Archive

- **Individual files**
- **Various file formats**
  - PDF 56 4.4%
  - RTF 91 7.2%
  - TXT 469 37.2%
  - DOC 646 51.2%
- **Various file structure**
  - No typical or standardized way of describing key fields and metadata
- **Q:** Should we develop a standardized web form for metadata input?



Mining Settings

- You can choose which keywords to extract from all available data files
  - Delimited by new line in Tools > Search Parameters
- You can choose keyword synonimes
  - Delimited by ":" and listed on the same line
- You can also add a commnet line
  - By starting the line with "#"
- Current Settings

```
# Fields to search for, 1 field perl line
# Alternate fields are defined with  :
Buoy ID:Argos ID:Iridium ID:telecom ID:IMEI:ID Number
Manufacturer
Sensor array
Drogue description
Transmitter type
Message Length
Repetition rate
Battery voltage equation
```


Next steps
o Use the feedback from the comunity to fine tune and extract the legacy metadata
o Develop and maintain a standard metadata format
o Start with the common base and extend from there
o e.g. EGO standard format for the sea gliders
o Develop a web/app/cloud tool for metadata management
o Enter legacy metadata
o Enter your metadata
o Access and manage the metadata
o Associate metadata with data products
o Automate as mucn as possible

ANNEX B – EXTRACT FROM A MANUFACTURER'S JOB FILE

ARGOS IDs 29347, 29348, 29349.

Manufacturer METOCEAN Data Systems Ltd. (Job 817A)
(SCN 1016 V2.63, FID 2088, SID 2022)

Sensor Array Sea Surface Temperature, Battery Voltage, Optical Colour Monitor

Surface Float 35.5 cm diameter, fiberglass surface float. Construction; 1.5 oz per sq. ft (500g/m^2)fiberglass mat; outer gel coat for UV protection and prevent water absorption.

Drogue Depth centered at 15.4 m

Drogue Length 12.19 m

Duty Cycle Continuous (100 % On)

Message Length 256 bits

Message Format:

8 bits	Checksum
12 bits	Radiance channel 1 (Lu683)
8 bits	Std Deviation channel 1
12 bits	Radiance channel 2 (Lu670)
8 bits	Std Deviation channel 2
12 bits	Radiance channel 3 (Lu555)
8 bits	Std Deviation channel 3
12 bits	Radiance channel 4 (Lu510)
8 bits	Std Deviation channel 4
12 bits	Radiance channel 5 (Lu490)
8 bits	Std Deviation channel 5
12 bits	Radiance channel 6 (Lu443)
8 bits	Std Deviation channel 6
12 bits	Radiance channel 7 (Lu412)
8 bits	Std Deviation channel 7
12 bits	Irradiance channel (Ed490)
8 bits	Std Deviation irradiance channel
6 bits	Data Age
4 bits	Number of averages in OCM data
2 bits	Message ID (Always zero for this product)
4 bits	Blank, set to zero
6 bits	Battery Voltage
10 bits	Sea Surface Temperature
8 bits	Percentage Time On Surface during surface check function
8 bits	Average Surface Time
8 bits	Average submerged wait
8 bits	Average pressure sensor volts
8 bits	Surface voltage
8 bits	Maximum depth voltage
8 bits	Last night length

Observation Cycle OCM data is gathered once every 90 seconds and averaged over a one hour period. Pressure sensor calibration is performed at the beginning of the averaging period. The data is processed and transmit message are updated once per hour.

Transmission Repetition Rate 90 seconds

Temperature Sensor Type 0.1 degree C interchangable thermistor, model YSI 44032 in a capped 316ss Swagelock through-hull fitting at base of surface float.

Temperature Equation Temp (C) = n * 0.05 - 2
NOTE: METOCEAN temperature sensors are compensated in software therefore the equation is the total calculation required.)

ANNEX C – EXTRACT FROM DEPLOYMENT LOG FILES

1. EXTRACT FROM A GDP DEPLOYMENT LOG

ID	WMO#	Dep Date	Dep. Lat	Dep. Long	Ship	Manufacturer	Type	Prgm
63224600	4401530	2016 09 01	36 00.0N	062 48.0W	CMA CGM MAUPASSAN	!DBi	BD2GI	20921
145778	5100817	2016 08 31	10 20.4N	124 05.2W	R/V REVELLE	!Pacific Gy	SVPGS3	6129
63225620	4401532	2016 08 31	33 42.0N	070 00.0W	CMA CGM MAUPASSAN	!DBi	BD2GI	20921
63473590	2301542	2016 08 28	02 58.2N	079 40.0E	AWASSI EXPRESS	!DBi	BD2GI	21312
62327970	4601509	2016 08 27	48 33.8N	160 05.2W	WESTWOOD RAINIER	!SIO	BD2GHI	21312
63473570	2301541	2016 08 27	00 00.1S	082 49.5E	AWASSI EXPRESS	!DBi	BD2GI	21312
145722	5100811	2016 08 26	10 04.5N	125 00.8W	R/V REVELLE	!Pacific Gy	SVPGS3	6129
145733	5100812	2016 08 26	10 03.5N	124 59.9W	R/V REVELLE	!Pacific Gy	SVPGS3	6129
62327980	4601510	2016 08 26	48 33.7N	167 56.5E	WESTWOOD RAINIER	!SIO	BD2GHI	21312
63353030	1401510	2016 08 26	01 00.0N	046 09.0E	CMA CGM LA TOUR	!SIO	SVPGHI	21312
63354040	1401515	2016 08 26	01 00.0N	046 09.0E	CMA CGM LA TOUR	!SIO	SVPGHI	21312
63472610	5301505	2016 08 26	03 05.5N	086 15.0E	AWASSI EXPRESS	!DBi	BD2GI	21312
145718	5100816	2016 08 23	10 03.2N	125 00.6W	R/V REVELLE	!Pacific Gy	SVPGS3	6129
63269720	6203506	2016 08 22	52 46.2N	043 42.6W	SEAKEEPERS - Silv	!Metocean	SVP3GI	21312
62328970	4601512	2016 08 21	50 47.8N	145 07.5W	WESTWOOD RAINIER	!SIO	BD2GHI	21312
62052460	6101586	2016 08 17	36 30.1N	014 21.9E	UNKNOWN	!Pacific Gy	SVP3GI	2222
62720290	1601514	2016 08 17	49 32.0S	063 59.0E	OSIRIS	!Metocean	BD2GI	21312
62729290	1601513	2016 08 17	48 07.0S	060 00.0E	OSIRIS	!Metocean	BD2GI	21312
62729310	1601518	2016 08 17	48 51.0S	062 00.0E	OSIRIS	!Metocean	BD2GI	21312
62749250	6101587	2016 08 17	36 24.6N	014 19.9E	UNKNOWN	!Pacific Gy	SVP3GI	2222
62836830	6101588	2016 08 17	36 19.2N	014 18.3E	UNKNOWN	!Pacific Gy	SVP3GI	2222
62837560	6101589	2016 08 17	36 13.7N	014 16.8E	UNKNOWN	!Pacific Gy	SVP3GI	2222
62837770	6101590	2016 08 17	36 08.9N	014 15.6E	UNKNOWN	!Pacific Gy	SVP3GI	2222
62723310	1601515	2016 08 16	47 39.0S	058 02.0E	OSIRIS	!Metocean	BD2GI	21312
62725280	1601516	2016 08 16	46 54.0S	054 17.0E	OSIRIS	!Metocean	BD2GI	21312

2. EXTRACT FROM AN ESURFMAR DEPLOYMENT LOG

WMO	Iridium IMEI	Version & Job Id.	Owner	Dep. Date	Dep. Lat	Dep. Lon
	Region	Ship name	From	SST probe type & S/N	SST depth (m)	End SST date
4400612	300034013012860	Metocean-1.0	E-Surfmar	09/10/2010	43.0	-58.0
	North Atlantic	Canadian CG	Halifax	YSI 46000	0.15	21/03/2011
4400724	300034012278800	Metocean-1.0	E-Surfmar	04/11/2010	49.0	-42.0
	North Atlantic	Antwerpen Express	Halifax	YSI 46000	0.15	11/02/2011
4400602	300034013205680	Metocean-1.0	E-Surfmar	04/11/2010	49.6	-38.0
	North Atlantic	Antwerpen Express	Halifax	YSI 46000	0.15	28/03/2011
4400603	300034013206760	Metocean-1.0	E-Surfmar	05/11/2010	50.3	-32.0
	North Atlantic	Antwerpen Express	Halifax	YSI 46000	0.15	21/02/2011
6200597	300034013612160	Metocean-1.0	E-Surfmar	05/11/2010	50.0	-35.0
	North Atlantic	Antwerpen Express	Halifax	YSI 46000	0.15	08/01/2011
6200598	300034013809440	Metocean-1.0	E-Surfmar	05/11/2010	50.5	-29.0
	North Atlantic	Antwerpen Express	Halifax	YSI 46000	0.15	29/03/2011
1300979	300034013409170	Metocean-1.0	E-Surfmar	03/12/2010	33.0	-20.5
	North Atlantic	Fort Ste Marie Le Havre		YSI 46000	0.15	24/03/2011
1300980	300034013112260	Metocean-1.0	E-Surfmar	04/12/2010	27.7	-25.0
	North Atlantic	Fort Ste Marie Le Havre		YSI 46000	0.15	23/03/2011
1300981	300034013615160	Metocean-1.0	E-Surfmar	05/12/2010	24.0	-31.0
	North Atlantic	Fort Ste Marie Le Havre		YSI 46000	0.15	05/05/2011
4100633	300034013610160	Metocean-1.0	E-Surfmar	06/12/2010	21.6	-40.0
	North Atlantic	Fort Ste Marie Le Havre		YSI 46000	0.15	26/03/2011
1300972	300034013808440	Metocean-1.0	E-Surfmar	06/12/2010	23.5	-33.0
	North Atlantic	Fort Ste Marie Le Havre		YSI 46000	0.15	04/06/2011
4100634	300034013803460	Metocean-1.0	E-Surfmar	07/12/2010	20.4	-45.0
	North Atlantic	Fort Ste Marie Le Havre		YSI 46000	0.15	28/04/2011
1700931	300234010303820	Metocean-1.0	Met Office	10/12/2010	-50.0	8.0
	South Atlantic	Ernest Shackelton	Southampton	YSI 46000	0.15	16/03/2013
1700928	300234010303920	Metocean-1.0	Met Office	11/12/2010	-55.0	3.6
	South Atlantic	Ernest Shackelton	Southampton	YSI 46000	0.15	19/05/2013
1700933	300234010305910	Metocean-1.0	Met Office	12/12/2010	-60.0	0.1
	South Atlantic	Ernest				

ANNEX D – EXTRACT FROM THE JCOMMOPS DATABASE

JCOMMOPS WMO-PLATFORM cross reference list as of 2017-11-19 (with WMO Ids that are numerical)

WMO;TELECOM ID;TELECOM SYSTEM;PTFM NAME;PTFM FAMILY;PTFM TYPE;CONTACT NAME;EMAIL;PROGRAM;ROLE;AGENCY;COUNTRY;ALLOC_DATE;DEALLOC_DATE;ARGOS_PROG

4800552;300234011461430;IRIDIUM;SVP;DB;SVP;Ignatius Rigor;ignatius@uw.edu;IABP US;Program Manager;University of Washington ;USA;2014-02-26;2016-11-30;
4800556;135084;ARGOS;DB;DB;DB;Chris O'Connors;christopher.o'connors@noaa.gov;NIC-IABP;Program Manager;;USA;2014-03-10;;
4800560;300234011974530;IRIDIUM;SVP;DB;SVP;Ignatius Rigor;ignatius@uw.edu;IABP US;Program Manager;University of Washington ;USA;2014-03-10;2016-10-15;
4800564;135081;ARGOS;DB;DB;DB;Chris O'Connors;christopher.o'connors@noaa.gov;NIC-IABP;Program Manager;;USA;2014-03-24;2015-07-06;
4800568;300234061363210;IRIDIUM;SVP;DB;SVP;Ignatius Rigor;ignatius@uw.edu;IABP US;Program Manager;University of Washington ;USA;2014-04-28;2016-09-01;
4800570;126477;ARGOS;XIB;ICE_BUOYS;ICEBUOY;Ignatius Rigor;ignatius@uw.edu;IABP US;Program Manager;University of Washington ;USA;2014-07-22;;
4800593;300234060435540;IRIDIUM;SVP_METOCEAN;DB;SVP;Chris Marshall;chris.marshall@ec.gc.ca;EC-IABP;Program Manager;ENVIRONMENT CANADA;CAN;2013-10-06;2015-03-24;
4800597;100009;IRIDIUM;O-BUOY;ICE_BUOYS;ICEBUOY;Ignatius Rigor;ignatius@uw.edu;IABP;Program Manager;University of Washington ;USA;2013-11-12;2015-11-30;
4800598;100010;IRIDIUM;O-BUOY;ICE_BUOYS;ICEBUOY;Ignatius Rigor;ignatius@uw.edu;IABP;Program Manager;University of Washington ;USA;2013-11-12;2015-09-24;
4800627;137807;IRIDIUM;DB;DB;DB; ;;DBCP;;;;2014-09-25;2015-08-14;
4800633;300234062555760;IRIDIUM;ICEBALL;ICE_BUOYS;ICEBUOY;Ignatius Rigor;ignatius@uw.edu;IABP US;Program Manager;University of Washington ;USA;1900-01-01;;
4800638;300234062551190;IRIDIUM;SVP;DB;SVP;Ignatius Rigor;ignatius@uw.edu;IABP;Program Manager;University of Washington ;USA;1900-01-01;2015-12-14;
4800639;300234062555770;IRIDIUM;SVP;DB;SVP; ;;DBCP;;;;1900-01-01;2015-04-17;
4800644;300234062551780;IRIDIUM;SVP;DB;SVP;Ignatius Rigor;ignatius@uw.edu;IABP;Program Manager;University of Washington ;USA;1900-01-01;2015-09-30;
4800645;300234062552770;IRIDIUM;SVP;DB;SVP;Ignatius Rigor;ignatius@uw.edu;IABP;Program Manager;University of Washington ;USA;1900-01-01;2016-11-29;
4800646;300234011472110;IRIDIUM;ICEBALL;ICE_BUOYS;ICEBUOY;Ignatius Rigor;ignatius@uw.edu;IABP;Program Manager;University of Washington ;USA;1900-01-01;2015-11-05;
4800680;300234060233160;IRIDIUM;ICEBALL;ICE_BUOYS;ICEBUOY; ;;IABP-UW;;;USA;1900-01-01;2015-07-02;
5100639;101796;ARGOS3;DB_CLEARWATER;DB;DB;Mayra Pazos;mayra.pazos@noaa.gov;AOML;Program Manager;National Oceanic and Atmospheric Administation;USA;2013-07-01;2015-07-30;
5100645;114759;ARGOS3;SVP_CLEARWATER;DB;SVP;Mayra Pazos;mayra.pazos@noaa.gov;AOML;Program Manager;National Oceanic and Atmospheric Administation;USA;2013-07-13;2015-10-21;
5100648;114932;ARGOS3;SVP_CLEARWATER;DB;SVP;Mayra Pazos;mayra.pazos@noaa.gov;AOML;Program Manager;National Oceanic and Atmospheric Administation;USA;2013-07-14;2015-07-31;
3300555;114590;ARGOS3;DB_METOCEAN;DB;DB;Mayra Pazos;mayra.pazos@noaa.gov;AOML;Program Manager;National Oceanic and Atmospheric Administation;USA;2015-01-08;2016-11-29;
3300556;123314;ARGOS;SVP_METOCEAN;DB;SVP;Mayra Pazos;mayra.pazos@noaa.gov;AOML;Program Manager;National Oceanic and Atmospheric Administation;USA;2013-10-17;2015-08-05;
3300557;116077;ARGOS3;DB_PACIFIC-GYRE;DB;DB;Mayra Pazos;mayra.pazos@noaa.gov;AOML;Program Manager;National Oceanic and Atmospheric Administation;USA;2015-01-08;2016-02-19;
3300558;60079900;IRIDIUM;DB_SIO;DB;DB; ;;DBCP;;;;2013-10-31;2017-04-12;
3300559;60298720;IRIDIUM;DB_SIO;DB;DB; ;;DBCP;;;;2013-10-31;2016-04-05;
4400025;;UNKNOWN;MB;MB;MET_MB;Karen Grissom;karen.grissom@noaa.gov;NDBC-NOAA-NWS;Program Manager;;USA;1900-01-01;;
4400034;;UNKNOWN;METMB;MB;MET_MB;Karen Grissom;karen.grissom@noaa.gov;NDBC-NOAA-NWS;Program Manager;;USA;2009-08-11;;
4400037;;UNKNOWN;METMB;MB;MET_MB;Karen Grissom;karen.grissom@noaa.gov;NDBC-NOAA-NWS;Program Manager;;USA;2009-08-11;;
4400043;;UNKNOWN;MB;MB;MET_MB;CBIBS NOAA;cbibs@noaa.gov;NOAA-CBIBS;Program Manager;;USA;1900-01-01;;
4400050;;UNKNOWN;MB;MB;MET_MB;Gilbert EMZIVAT;gilbert.emzivat@meteo.fr;Meteo France MB;Program Manager;Meteo France;FRA;2011-11-30;;

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