ALADIN Project Stay report

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Period: 17th to 30th March 2013

Topic title: Radar Data Assimilation

1 Introduction

This document reports the activities/achievements done during a stay in OMSZ on the topic of Radar Data Assimilation, applied in particular to the Portuguese case. Roger Randramampianina provided the local tuition and the travelling and perdiem funds were provided by the ALADIN project through the FR-LACE flat-rate budget. This topic was considered on the ALADIN annual working plan.

This stay comprised the following steps:

1. the installation and execution of the HARMONIE system in a local PC under a Debian Linux operating system;
2. the installation and execution of the CONRAD application under the HARMONIE system;
3. the creation of a version of the Hungarian BUFR decoding software to convert the Portuguese PPIs into Météo-France BUFR format.
4. the initial implementation of Portuguese radar BUFR's into an AROME 3D-Var experiment under the HARMONIE environment on ecgate (ECMWF).

Simultaneously, information has been exchanged with the local NWP team what concerns the application of CANARI and also the direct coupling of AROME with ARPEGE.

In the following sections the main achievements on each of the different topics are reported.

2 Execution of the HARMONIE system in a local PC

In order to set the appropriate working environment and in order to get acquainted with the HARMONIE system, a local installation of the system was initiated with version 37h1.2 on a PC with a Debian Linux operating system.

The local PC was a two quadri-core system, therefore, the installation was done under a multi-processors environment, using the configuration file **linux.gfortran.mpi.** The system environment settings were then changed accordingly.

Physiographic data base files and IFS initial and coupling files were copied from a test experiment and used for the predefined domain TEST11 (11x11 points).

This experiment configuration was made to evolve up to the moment radar data input should be given. After the ingestion of the radar data, the foreseen step in this installation should be on the usage of OPLACE files as data input.

Due to the short time of this stay, progress onto the implementation of radar data in the HARMONIE system was done using directly the Portuguese radar data and a different computing platform. In particular, an HARMONIE experiment prepared at ECMWF on ecgate/c2a computing platforms over the Portuguese domain AROMEPTG (corresponding to the AROME/PTG configuration at the Portuguese operational system) was used.

3 Installation and execution of CONRAD

The first step in order to evaluate the possibility to use Portuguese radar data into the AROME 3D-Var system is to try to convert this data into BUFR using the Météo-France template (**MF-BUFR**). In fact, in the case of reflectivities, the program **BatorODB** reads the radar data and prepares it to the AROME 3D-Var when it is under the MF-BUFR format. Originally, the Portuguese radar data was available under an OPERA BUFR template. Since, the application **CONRAD** [1] was developed to provide the conversion between different data formats (including AEMET OPERA BUFR format) into MF-BUFR, the use of CONRAD to convert the Portuguese data should be a natural step of the present work.

Although CONRAD is already present in the release 37h1.2, it is not fully set and therefore it is not possible to install it conveniently, just by using the HARMONIE system. Therefore some support was requested to AEMET and a 2011 full testing standalone CONRAD package was provided, the **CONRAD_AEMET** application. This application of CONRAD uses both the CONRAD libraries and the OPERA BUFR decoder libraries.

It was possible to see that the appliaction CONRAD_AEMET was prepared to read OPERA BUFR format for observations that are in polar representation while this was not the case of Portuguese data. Portuguese BUFR PPIs were already under the cartesian representation therefore a huge development effort should be undertake in order to prepare an interface of CONRAD to the Portuguese case.

Since it was not possible in the short time of this stay, to progress with the mentioned development, another approach to solve the problem was adopted. In particular, as a solution it was adopted the one that is being used under pre-operational mode at OMSZ, that is to use an adaptation of the **aromebufr.cpp** application developed by the Hungarian radar team that reads PPIs of reflectivity under the Portuguese radar native software, **IRIS** (www.vaisala.com), template.

4 Conversion of the Portuguese PPIs into MF-BUFR format

In order to convert the Portuguese PPIs (now under the IRIS binary format) into MF-BUFRs, a new version of the Hungarian application aromebufr.cpp was created, under the name **iristoarome.cpp**. This application was written in C++ by the radar Hungarian team. In order to get the Portuguese radar data structures, a set of IRIS include files were used, starting in **IrisProd.h**.

The iristoarome.cpp application is able to read the Portuguese PPIs and to convert them into the Météo-France BUFR format that is used by the AROME 3D-Var. However, further work on **iristoarome.cpp** should still be done in order to add BUFR header information not included in the IRIS's files but provided by the Portuguese radar settings.

In appendix the list of the Portuguese PPI header (Appendix A) and of the Portuguese MF-BUFR header (Appendix B) is included.

The recently converted 2D-PPIs of the Portuguese radars were then available under the 3D MF-BUFR format to be ingested by the AROME 3D-Var system (in testing mode).

5 Implementation of Portuguese radar information into AROME 3D-Var

Radar data under MF-BUFR format were calculated from a set of available PPIs, from the 2013.03.16 at 17:20UTC, provided by the Portuguese radar team and these files have been used to test the possible intake by the AROME 3D-Var.

For that an HARMONIE experiment was set up for this date having as target the assimilation at the cycle of 18UTC. An experiment prepared for the Portuguese domain AROMEPTG with cycle 37h1.2 on ecgate (ECMWF) has been used (experiment **ptg37h12_conr**). The option **RADAR_OBS=1** was set up in the script **include.ass** and the script **RunBatodb** was adjusted accordingly.

Tests were done using the Portuguese MF-BUFR data and the Hungarian MF-BUFR data in order to viable a test bed for comparison. Moreover, a previous version of RunBator, the version 37t1_bf.04 was also used for comparison. The results are expressed in Table 1.

Table 1 – Results from different HARMONIE experiments using radar data

RunBator version	data used	log messages	obs
37h1.2	Portuguese	6 not recognised BUFR file as radarv Selected Obs = 0 -->0 datas. Total selected Obs = 0 -->0 datas.	SMS task completed
37h1.2	Hungarian	10 not recognised BUFR file as radarv Selected Obs = 0 -->0 datas. Total selected Obs = 0 -->0 datas.	SMS task completed
37t1_bf.04	Portuguese	****** Traitement initial ****** Parametres 1 Lecture = BUFR 08550 -radarv Type base = ECMA NB slot = 1 NB pool = 4 Date = 20130326 Heure = 18 ECMWF BUFR DECODING SOFTWARE VERSION - 7.2 1 APRIL 2007. Your path for bufr tables is : */scratch/ms/pt/pte/hm_home/ptg37h12_conr/lib/util/auxlibs/bufr_000381/bufrtables/* fichier BUFR.08550 : INBOBS = 262144 INBWAG = 4718592 Traitement du fichier BUFR.08550 -type : radarv BUFR TABLES TO BE LOADED B0000000000085011012.TXT,D0000000000085011012.TXT	SMS task completed

```
====>>                  RADAR
++++++++++++++++++++++++++++++++++++++++
====>>      8550    :       DOPPLER   RADAR

la   valeur   de   sensibilite   vaut   -110
la   valeur   de   constante   vaut   6284

**** ELEVATION :   0.00000000000000000E+00

-           DECOMPTE          FINAL:
nb_obs/elevation             =        0
nombre     de     wagons           =      0
nombre    de    wagons    total    =      0
nbre      d'obs                   =       0
nbre     d'obs     total           =      0
nbre    de    radars    total      =      1

     Selected Obs =          0  -->
0                   datas.
Total     selected     Obs     =             0
-->                    0        datas.
INBOBS  =         0   INBWAG  =             0

WARNING  :  bator  -  no  data  in  pool     1


WARNING  :  bator  -  no  data  in  pool     2


WARNING  :  bator  -  no  data  in  pool     3


WARNING : bator - no data in pool    4
```

Some investigation allowed to conclude that the actual version of the RunBator task in the HARMONIE system, the version 37h1.2, introduced changes that did not keep the possibility of ingesting the MF-BUFR template in Cartesian projection and with fixed size by 512x512. In this way, the experiment ptg37h12_conr has now the export version of bator (the version 37t1_bf.04) that should be used to make progress the impact study of Portuguese radar data assimilation on the AROME/Portugal forecasts, once the Portuguese radar metadata is added to the application iristoarome.cpp. Note that we reversed the bator program in HARMONIE just to be sure that the above mentioned reading problem was a consequence of some local changes in HARMONIE bator, which were meant to read BUFR data in polar projection and with flexible sized PPI fields.

6 Acknowledgements

Acknowledgements are due to István Sebõk from the Hungarian radar team (OMSZ) for writing the application which converts Portuguese reflectivity PPIs into MF-BUFR and to Roland Steib for giving some guidance on MF-BUFR template; to Carlos Geijo from AEMET from providing the CONRAD-AEMET package and to Paulo Pinto from the Portuguese radar team (IPMA) for providing the IRIS include files as well as the radar testing data used along this work.

Bibliography

[1] Salomonsen, M. et al. (2012), Quality control of radar data for NWP assimilation using PRORAD and CONRAD, Met.no note, Norway

Appendix A: Portuguese PPI header

---------- Product Summary for LIS130325160030.PPIT0PH ----------
Ingest site name : 'lisboa_radar', Version: 8.12
Ingest hardware name: 'lisboa_radar'
Product site name : 'lisbon_analysis', Version: 8.12
File size: 262784 bytes (Disk space: 262784 bytes)
Product type is: PPI
PCO name: PPZ_MJM, TCO name: REFLECTVOL_A
PRF: 450Hz, Wavelength: 5.32cm, Nyquist: 5.99m/s(V), 5.99m/s(W)
XMT Polarization: Horizontal, Wind:???
Constant:62.84 dB, I0:-109.85 dBm, Cal Noise:-81.03 dBm, Bandwidth:578 kHz.
ZFlags: SP_T, block_zc, ATTN_ZC, target_zc, dpatten_zc, dpatten_z
VFlags: SP_V, 3lag_w, ship_v, unfold_vc, fall_vc, storm_vc
Heights: Radar: 193m, Ground: 173m, Melting: ????m MSL
Size is: 512x512x1 pixels
Scale is: 1000.00 x 1000.00 x 0.00 m/pixel
Center Location: 39 4.3'N, 8 24.0'W, ref: 0 meters
Projection type is: Azimuthal Eqdist
Projection Reference Point: 39 4.3'N, 8 24.0'W
Equitorial Radius: 0.00000 km, Flattening: 1/0.00000
Radar position is: 256.0, 256.0 pixels
Product data type is dBZ (2)
Color count:16, Color set: 1, variable
Seams: 2.00 7.00 12.00 18.00 21.00 23.00 28.00 34.00 37.00 39.00 44.00 50.00 53.00 55.00 60.00 66.00
Maximum range: 256.0 km

Ingest time: 16:00:30 25 MAR 2013 GMT (0 minutes west) DST:0/0
Volume scan time: 16:00:30 25 MAR 2013 GMT (LT: GMT 0 minutes)
Oldest Ing time: 16:00:30 25 MAR 2013 LT
Product Gen time: 16:46:47 25 MAR 2013 UTC
Input count: 1
Product is not composited.

PPI elevation angle: 0.10 degrees
Displaying cartesian data with skip factor 26

Appendix B: Portuguese MF-BUFR header

********** S E C T I O N 0
Length: 1242960
Edition: 2
********** S E C T I O N 1
Length: 18
Master Table: 0
Subcentre: 0
Centre: 85
Update Sequence Number: 1
Optional Section: 1
Type: 6
Subtype: 0
Local Subtype: 0
VersionMaster: 11
VersionLocal: 12
Date: 2013.03.26.
Time: 17:20:00
********** S E C T I O N 2
Length: 16
14 41 181 116 104 81 135 152 160 0 128 0
********** S E C T I O N 3
Length: 158
Observed data
Non-compressed data
Subsets: 512

3 21 011
3 01 011
3 01 013
3 01 001
3 01 021
0 02 205
0 02 193
0 25 193
3 21 010
0 02 207
0 25 004
0 02 121
0 02 122
0 02 123
0 02 124
0 02 125
0 02 126
0 02 127
0 02 128
2 01 131
0 02 129
2 01 000
0 02 130
0 02 131
3 21 006
3 21 007
0 02 136
0 02 198
0 02 199
0 02 200
0 02 206

3 21 196
0 05 033
0 06 033
0 30 021
0 30 022
0 05 192
0 06 192
0 04 025
0 04 025
3 21 008
0 49 239
0 49 192
0 49 193
0 49 194
0 49 195
0 49 196
0 49 197
0 49 198
0 49 199
0 49 200
0 49 208
0 49 224
1 01 000
0 31 001
0 21 219
3 21 205
3 21 207
0 07 021
0 04 005
0 04 006
1 01 000
0 31 001
0 48 192
1 05 000
0 31 002
1 03 000
0 31 002
0 30 002
0 49 227
0 49 228
1 02 000
0 31 002
0 49 206
0 49 243
********** S E C T I O N 4
Length: 1242756
3 21 011[0]

0 30 031[0]	PICTURE TYPE	???? Code Table: 0 30 031->0
0 30 032[4]	COMBINATION WITH OTHER DATA	0 FLAG TABLE 30032
0 29 002[20]	CO-ORDINATE GRID TYPE	???? Code Table: 0 29 002->0
3 01 011[23]		
0 04 001[23]	YEAR	2013 YEAR
0 04 002[35]	MONTH	3 MONTH
0 04 003[39]	DAY	26 DAY
3 01 013[45]		
0 04 004[45]	HOUR	17 HOUR
0 04 005[50]	MINUTE	20 MINUTE
0 04 006[56]	SECOND	35 SECOND
3 01 001[62]		
0 01 001[62]	WMO BLOCK NUMBER	8 NUMERIC

0 01 002[69] WMO STATION NUMBER 550 NUMERIC
3 01 021[79]
0 05 001[79] LATITUDE (HIGH ACCURACY) 0.07137 DEGREE
0 06 001[104] LONGITUDE (HIGH ACCURACY) 0.59993 DEGREE
0 02 205[130] TYPE DE RADAR ???? Code Table: 0 02 205->6
0 02 193[138] TYPE DE CALCULATEUR ???? Code Table: 0 02 193->3
0 25 193[146] NUMERO DE VERSION LOGICIELLE DU CALCULA 284 NUMERIC
3 21 010[162]
0 02 101[162] TYPE OF ANTENNA ???? Code Table: 0 02 101->0
0 07 002[166] HEIGHT OR ALTITUDE 170 M
0 02 102[182] ANTENNA HEIGHT ABOVE TOWER BASE 20 M
0 02 103[190] RADOME 1 FLAG TABLE 2103
0 02 104[192] ANTENNA POLARISATION ???? Code Table: 0 02 104->0
0 02 105[196] MAXIMUM ANTENNA GAIN MISSING
0 02 106[202] 3-DB BEAMWIDTH 1 DEGREE
0 02 107[208] SIDELOBE SUPPRESSION 25 dB
0 02 108[214] CROSSPOL DISCRIMINATION (ON AXIS) MISSING
0 02 109[220] ANTENNA SPEED (AZIMUTH) 15 DEGREE/S
0 02 110[232] ANTENNA SPEED (ELEVATION) 15 DEGREE/S
0 02 132[244] AZIMUTH POINTING ACCURACY 0.01 DEGREE
0 02 133[250] ELEVATION POINTING ACCURACY 0.01 DEGREE
0 02 207[256] SENS DE BALAYAGE EN AZIMUT ???? Code Table: 0 02 207->1
0 25 004[258] ECHO PROCESSING ???? Code Table: 0 25 004->1
0 02 121[260] MEAN FREQUENCY 0 Hz
0 02 122[267] FREQUENCY AGILITY RANGE MISSING
0 02 123[275] PEAK POWER 0 W
0 02 124[282] AVERAGE POWER 0 W
0 02 125[289] PULSE REPETITION FREQUENCY 450 Hz
0 02 126[297] PULSE WIDTH 0 S
0 02 127[303] RECEIVER INTERMEDIATE FREQUENCY 5.9e+07 Hz
0 02 128[310] INTERMEDIATE FREQUENCY BANDWIDTH 3.6e+06 Hz
2 01 131[316] Data Description Operator
0 02 129[316] MINIMUM DETECTABLE SIGNAL -110 dB
2 01 000[324] Data Description Operator
0 02 130[324] DYNAMIC RANGE 110 dB
0 02 131[331] SENSITIVITY TIME CONTROL (STC) 1 FLAG TABLE 2131
3 21 006[333]
0 25 001[333] RANGE-GATE LENGTH 250 M
0 25 002[339] NUMBER OF GATES AVERAGED 1 NUMERIC
0 25 003[343] NUMBER OF INTEGRATED PULSES 16 NUMERIC
0 25 005[351] ECHO INTEGRATION MISSING
3 21 007[353]
0 25 009[353] CALIBRATION METHOD 2 FLAG TABLE 25009
0 25 010[357] CLUTTER TREATMENT ???? Code Table: 0 25 010->5
0 25 011[361] GROUND OCCULTATION CORRECTION (SCREENING) ???? Code Table: 0 25 011->0
0 25 012[363] RANGE ATTENUATION CORRECTION ???? Code Table: 0 25 012->0
0 25 013[365] BRIGHT-BAND CORRECTION MISSING
0 25 015[367] RADOME ATTENUATION CORRECTION MISSING
0 25 016[369] CLEAR-AIR ATTENUATION CORRECTION 0 dB/M
0 25 017[375] PRECIPITATION ATTENUATION CORRECTION MISSING
0 02 136[377] RANGE PROCESSED BY RANGE ATTENUATION CORRECTION 300000 M
0 02 198[393] INDICATEUR D'ARRET OU DE PANNE MISSING
0 02 199[401] CONSTANTE RADAR 6284 DB
0 02 200[417] INDICATEUR DE FONCTIONNEMENT DE L ELIMINATEUR ECHOS FIXES ???? Code Table: 0 02 200->1
0 02 206[419] INDICATEUR DE POSITIONNEMENT EN SITE INHIBE ???? Code Table: 0 02 206->0
3 21 196[421] 4 bit per pixel radar image, east-west view
1 03 000[421] Replication Operator
0 31 001[421] DELAYED DESCRIPTOR REPLICATION FACTOR 1 NUMERIC
0 02 135[429] ANTENNA ELEVATION 0 DEGREE

0 06 194[444] PORTEE DE DEBUT DE TRAITEMENT D'UN SITE 0 M
0 06 195[460] PORTEE DE FIN DE TRAITEMENT D'UN SITE 300000 M
0 05 033[476] PIXEL SIZE ON HORIZONTAL - 1 100000 M
0 06 033[492] PIXEL SIZE ON HORIZONTAL - 2 100000 M
0 30 021[508] NUMBER OF PIXELS PER ROW 512 NUMERIC
0 30 022[520] NUMBER OF PIXELS PER COLUMN 512 NUMERIC
0 05 192[532] DISTANCE OUEST-EST DU COIN NORD-OUEST DE L'IMAGE AU RADAR 0 M
0 06 192[556] DISTANCE NORD-SUD DU COIN NORD-OUEST DE L'IMAGE AU RADAR 0 M

0 04 025[580] TIME PERIOD OR DISPLACEMENT 0 MINUTE
0 04 025[592] TIME PERIOD OR DISPLACEMENT 50 MINUTE
3 21 008[604]
0 25 006[604] Z TO R CONVERSION ???? Code Table: 0 25 006->0
0 25 007[607] Z TO R CONVERSION FACTOR 1 NUMERIC
0 25 008[619] Z TO R CONVERSION EXPONENT 0.32 NUMERIC
0 49 239[628] FACTEUR DE CORRECTION GLOBAL MENSUEL (PLUIE PLUVIOMETRE)/(PLUIE MISSING
0 49 192[637] CQ INTEGRITE DU MESSAGE MISSING
0 49 193[641] CODE DE QUALITE ARRET-PANNE ???? Code Table: 0 49 193->0
0 49 194[645] CODE DE QUALITE ETALONNAGE ???? Code Table: 0 49 194->0
0 49 195[649] CODE DE QUALITE ELIMINATEUR D'ECHOS FIXES ???? Code Table: 0 49 195->0
0 49 196[653] CQ CONTROLE TEMPOREL ???? Code Table: 0 49 196->1
0 49 197[657] CQ CONTROLE SPATIAL ???? Code Table: 0 49 197->1
0 49 198[661] CQ CONTROLE DE COHERENCE ECHOS FIXES ???? Code Table: 0 49 198->1
0 49 199[665] CQ COMPARAISON AVEC LES DONNEES SATELLITAIRES ???? Code Table: 0 49 199->1
0 49 200[669] TAUX DE PIXELS IDENTIFIES PROPAGATION ANORMALE -1 NUMERIC
0 49 208[683] DONNEES AVEC/SANS CORRECTION D ADVECTION 0 FLAG TABLE
0 49 224[685] INDICATEUR RADAR DOPPLER 1 FLAG TABLE
1 01 000[687] Replication Operator
0 31 001[687] DELAYED DESCRIPTOR REPLICATION FACTOR 80 NUMERIC
0 21 219[695] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -100 DBZ

0 21 219[703] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -40 DBZ

0 21 219[711] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -9 DBZ

0 21 219[719] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -8 DBZ

0 21 219[727] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -7 DBZ

0 21 219[735] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -6 DBZ

0 21 219[743] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -5 DBZ

0 21 219[751] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -4 DBZ

0 21 219[759] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -3 DBZ

0 21 219[767] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -2 DBZ

0 21 219[775] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES -1 DBZ

0 21 219[783] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 0 DBZ

0 21 219[791] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 1 DBZ

0 21 219[799] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 2 DBZ

0 21 219[807] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 3 DBZ

0 21 219[815] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 4 DBZ

0 21 219[823] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 5 DBZ

0 21 219[831] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 6 DBZ

0 21 219[839] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 7 DBZ

0 21 219[847] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 8 DBZ

0 21 219[855] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 9 DBZ

0 21 219[863] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 10 DBZ

0 21 219[871] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 11 DBZ

0 21 219[879] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 12 DBZ

0 21 219[887] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 13 DBZ

0 21 219[895] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 14 DBZ

0 21 219[903] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 15 DBZ

0 21 219[911] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 16 DBZ

0 21 219[919] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 17 DBZ

0 21 219[927] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 18 DBZ

0 21 219[935] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 19 DBZ

0 21 219[943] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 20 DBZ

0 21 219[951] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 21 DBZ

0 21 219[959] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 22 DBZ

0 21 219[967] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 23 DBZ

0 21 219[975] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 24 DBZ

0 21 219[983] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 25 DBZ

0 21 219[991] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 26 DBZ

0 21 219[999] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 27 DBZ

0 21 219[1007] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 28 DBZ

0 21 219[1015] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 29 DBZ

0 21 219[1023] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 30 DBZ

0 21 219[1031] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 31 DBZ

0 21 219[1039] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 32 DBZ

0 21 219[1047] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 33 DBZ

0 21 219[1055] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 34 DBZ

0 21 219[1063] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 35 DBZ

0 21 219[1071] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 36 DBZ

0 21 219[1079] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 37 DBZ

0 21 219[1087] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 38 DBZ

0 21 219[1095] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 39 DBZ

0 21 219[1103] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 40 DBZ

0 21 219[1111] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 41 DBZ

0 21 219[1119] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 42 DBZ

0 21 219[1127] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 43 DBZ

0 21 219[1135] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 44 DBZ

0 21 219[1143] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 45 DBZ

0 21 219[1151] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 46 DBZ

0 21 219[1159] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 47 DBZ

0 21 219[1167] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 48 DBZ

0 21 219[1175] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 49 DBZ

0 21 219[1183] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 50 DBZ

0 21 219[1191] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 51 DBZ

0 21 219[1199] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 52 DBZ

0 21 219[1207] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 53 DBZ

0 21 219[1215] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 54 DBZ

0 21 219[1223] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 55 DBZ

0 21 219[1231] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 56 DBZ

0 21 219[1239] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 57 DBZ

0 21 219[1247] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 58 DBZ

0 21 219[1255] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 59 DBZ

0 21 219[1263] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 60 DBZ

0 21 219[1271] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 61 DBZ

0 21 219[1279] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 62 DBZ

0 21 219[1287] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 63 DBZ

0 21 219[1295] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 64 DBZ

0 21 219[1303] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 65 DBZ

0 21 219[1311] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 66 DBZ

0 21 219[1319] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 67 DBZ

0 21 219[1327] REFLECTIVITE MINIMALE POUR LA VALEUR DU PIXEL POUR LES IMMAGES 68 DBZ

3 21 205[1335]
0 49 228[1335] CODE VITESSE RADIALE (8 BITS) 0 NUMERIC
0 49 229[1343] VALEUR MINIMALE DE LA VITESSE RADIALE EN M/S -60 M/S
0 49 228[1354] CODE VITESSE RADIALE (8 BITS) 240 NUMERIC
0 49 230[1362] VALEUR MAXIMALE DE LA VITESSE RADIALE EN M/S 60 M/S
0 49 231[1373] ECART ENTRE DEUX CODES CONS  CUTIFS DE LA VITESSE RADIALE EN M/S 0.5 M/S
3 21 207[1381]
0 49 235[1381] COORDONNEES X DU POINT NW D APPLICATION DU PREMIER VECTEUR ADVE 15 NUMERIC
0 49 236[1389] COORDONNEES Y DU POINT NW D APPLICATION DU PREMIER VECTEUR ADVE 15 NUMERIC
0 49 237[1397] RESOLUTION EN X DU CHAMP D ADVECTION (NOMBRE DE PIXELS) 32 NUMERIC
0 49 238[1405] RESOLUTION EN Y DU CHAMP D ADVECTION (NOMBRE DE PIXELS) 32 NUMERIC
0 07 021[1413] ELEVATION (SEE NOTE 2) 0 DEGREE
0 04 005[1428] MINUTE 20 MINUTE
0 04 006[1434] SECOND 35 SECOND
1 01 000[1440] Replication Operator
0 31 001[1440] DELAYED DESCRIPTOR REPLICATION FACTOR 2 NUMERIC
0 48 192[1448] BIT DE CALAGE 0 NUMERIC
0 48 192[1449] BIT DE CALAGE 0 NUMERIC
1 05 000[1450] Replication Operator