



IASI

Doc n° IA-TN-0000-3109-CNE

Issue : 1

Date : 05/04/2007

Rev :

Date :

Sheet : 1

of : 13

**IASI Level 1 Cal/Val
Activity Reports for the Phase A**

Prepared by :

IASI Level 1 Cal/Val Team

Verified by :

D. Blumstein CNES

G. Ponce CNES

Application autorised by :

G.Chalon CNES

CONFIGURATION CONTROL

YES

NO


HASI

Doc n° IA-TN-0000-3109-CNE

Issue : 1

Date : 05/04/2007

Rev :

Date :

Sheet : 2

of : 13

DISTRIBUTION

X	NOM/PRENOM		SIGLE	BPI	TELEPHONE	FAX
x	BAILLY	Isabelle	DCT/PS/TIS	1321	05.61.28.18.64	05.61.27.31.67
x	BERNARD	Frédéric	DCT/SI/CD	2101	05.61.27.47.20	05.61.28.18.12
x	BLUMSTEIN	Denis	DCT/PO/EV	2504	05.61.28.26.35	05.61.27.41.72
x	BUIL	Christian	DCT/SI/IN	3601	05.61.27.38.97	05.61.28.26.92
x	CARLIER	Thierry	DCT/PO/EV	2504	05.61.28.20.39	05.61.27.41.72
x	RENAUT	Didier	DSP			
x	CAYLA	François	SISCLE	2504	04.68.41.31.25	04.68.45.44.79
x	CHALON	Gilles	DCT/PO/EV	2504	05.61.27.32.27	05.61.27.41.72
x	SIMEONI	Denis	ALCATEL		04.92.92.79.61	04.92.92.33.20
	DE DGUEBOUADZE	Frédéric	DCT/SA/AB	1605	05.61.28.34.40	05.61.28.18.46
x	FJORTOFT	Roger	DCT/SI/EI			
x	GAUDEL	Ines	DCT/SI/EI	902	05.61.28.23.23	05.61.28.27.01
	GEOFFRAY	Hervé	DCT/SI/CD	2101	05.61.28.27.66	05.61.28.18.12
x	HEBERT	Philippe-Jean	DCT/SI/IN	3601	05.61.27.35.58	05.61.28.26.92
x	HOURCASTAGNOU	Jean-Noel	DCT/SI/EI	902	05.61.27.49.18	05.61.27.36.61
x	JANOTTO	Anne-Marie	DCT/PS/TIS	1321	05.61.28.16.52	05.61.26.46.10
	JEGOU	Roger	ESTEC Toulouse	2504	05.61.28.19.30	05.61.27.41.72
x	KAYAL	GÖkhan	EUMETSAT			
	LAPEYRE	Jacques	DCT/AQ/GP	2513	05.61.27.45.05	05.61.27.41.72
x	LARIGAUDERIE	Carole	DCT/PO/EV	2504		
	LE GALLUDEC	Jacques	DCT/PO/GP	2502	05.61.28.17.45	05.61.28.24.04
	MACIASZEK	Thierry	DCT/IB/2I	2504	05.61.27.41.99	05.61.27.41.72
x	MILLET	Bruno	DCT/SB/CC	2504	05.61.28.24.00	05.61.27.41.72
x	MORENO	Richard	DCT/PS/TIS	1321	05.61.28.25.36	05.61.27.30.84
x	PHULPIN	Thierry	DCT/SI/IM	2504	05.61.27.39.01	05.61.27.41.72
x	PONCE	Ghislaine	DCT/PO/EV	2504	05.61.27.37.10	05.61.27.41.72
	SECRETARIAT Projet		DCT/PO/EV	2504	05.61.27.34.60	05.61.27.41.72
X	DOCUMENTATION					
x	TOURNIER	Bernard	NOVELTIS	2504	05.62.88.11.15	05.62.88.11.10
x	LAVANANT	Lydie	METEO FRANCE CMS			
x	ROQUET	Hervé	METEO FRANCE CMS			
x	BRUNEL	Pascal	METEO FRANCE CMS			
x	MARGUINAUD	Philippe	METEO FRANCE CMS			
x	CAMY-PEYRET	Claude	LPMAA			
x	GOUDY	Philippe	DCT/PO/D			
x	MARSAL	Olivier	DCT/PO/EV			
x	BELON	Bruno	DCT/PO/EV			
x	CAZAUX	Christian	DCT/BL/D			
x	AVIGNON	Michel	DCT/SI/D			
x	GLEYZES	Jean-Pierre	DCT/PS/TIS			
x	COSTERASTE	Josiane	DCT/SI/IN			
x	HENRY	Patrice	DCT/SI/MO			
x	PIERANGELO	Clémence	DCT/SI/MO			
x	MARTINUZZI	Jean-Michel	DCT/SI/IM			
x	BARDOUX	Alain	DCT/SI/CD			
x	CAZAUX	Christian	DCT/BL/D			
x	CHADOUTAUD	Pierre	DCT/BL/OB			
x	EVRARD	Jean	DCT/BL/NB			

Diffusion partielle :
- corps du texte
- DR22



HASI

Doc n° IA-TN-0000-3109-CNE

Issue : 1

Date : 05/04/2007

Rev :

Date :

Sheet : 3

of : 13

x	LACOURTY	Michel	DCT/BL/OB	
x	BOISSIN	Benoît	DSP/OT	



Doc n° IA-TN-0000-3109-CNE

Issue : 1

Date : 05/04/2007

Rev :

Date :

Sheet : 4

of : 13

DOCUMENT CHANGE RECORD

ISSUE	REV	DATE	visa Project Control	DESCRIPTION OF MODIFICATIONS
1		05/04/2007		Original Issue

		<p>Doc n° IA-TN-0000-3109-CNE</p> <p>Issue : 1 Date : 05/04/2007</p> <p>Rev : Date :</p> <p>Sheet : 5 of : 13</p>
---	--	--

TABLE OF CONTENTS

1. INTRODUCTION	5
2. REFERENCE DOCUMENTS.....	6
3. IASI L1 CAL/VAL PHASES OBJECTIVES.....	7
4. SUMMARY OF MAIN EVENTS.....	8
5. CONCLUSION	10
ANNEX – MILESTONES FOR THE IASI LEVEL 1 CAL/VAL A.....	11

		Doc n° IA-TN-0000-3109-CNE Issue : 1 Date : 05/04/2007 Rev : Date : Sheet : 6 of : 13
---	--	---

1. INTRODUCTION

This short note introduces the file of reports written by the IASI Level 1 Cal/Val Team in the course of the first phase of the IASI Calibration and Validation (from the 2nd of January 2007 to 27th of March 2007). The list of these reports is provided in section 2. It is worth to note the contribution of METEO FRANCE (CMS Lannion) to this activity (cf. [DR25]).

The objectives of the Phase A of the IASI L1 Cal/Val are recalled in section 3 and annex A (table taken from the IASI L1 Cal/Val Plan IA-PL-0000-2597 -CNE).

The section 4 is a reminder of the main events on IASI that had an impact on the activities. It provides when necessary a link between the reports and the events. In this section we also report shortly on the IASI Balloon flight (LPMAA and CNES Balloon teams).

For a summary on IASI performances assessment we refer to the document [DR23].

For practical reasons, only the two summary documents (this one and [DR23]) are distributed to a large public. All the other working papers listed in section 2 are accessible through the CNES website dedicated to the IASI mission.



Doc n° IA-TN-0000-3109-CNE
 Issue : 1 Date : 05/04/2007
 Rev : Date :
 Sheet : 7 of : 13

2. REFERENCE DOCUMENTS

The reports are written continuously as the activities progress. They receive an internal reference before they are incorporated as an annex into the main report that summarizes the results of each phase. These 3 main reports are then normally introduced inside the project documentation.

N°	Intern. Ref.	Title	Author	Date
DR1	IA-CVA03-01	Determination of DPS monitoring limits by simulation	Tournier	05/01/07
DR2	IA-CVA03-02	ZPD Changes analysis	Tournier	05/01/07
DR3	IA-CVA03-03	Spikes Analysis	Cayla	09/01/07
DR4	IA-CVA03-04	DPS Processing Status after parameters update	Tournier/Cayla	16/01/07
DR5	IA-CVA05-01	Functional OPS filtering Analysis	Tournier	02/02/07
DR6	IA-CVA05-02	IIS processing chain working and monitored by TEC	Cayla	31/01/07
DR7	IA-CVA05-03	AVHRR radiance analysis working and monitored by TEC	Cayla	06/02/07
DR8	IA-CVA05-04	Analysis of the reduced spectra evolution	Tournier	02/02/07
DR9	IA-CVA05-05	IIS radiance analysis working and monitored by TEC	Cayla	15/02/07
DR10	IA-CVA07-05	Sounder interpixels calibration	Phulpin	15/03/07
DR11	IA-CVA07-06	Verification of the spectral Calibration in B3	Tournier	14/03/07
DR12	IA-CVA07-07	Assessment of the IIS-AVHRR Coregistration	Fjørtoft	10/02/07
DR13	IA-CVA07-08	Cube Corner Constant Offset Computation	Gaudel/Bach	14/02/07
DR14	IA-CVA07-09	IIS-Sounder co-registration	Blumstein	12/02/07
DR15	IA-CVA07-10	Sounder IPSF check	Cayla	28/02/07
DR16	IA-CVA07-11	Assessment of the Ice contamination rate	Fjørtoft	13/02/07
DR17	IA-CVA07-12	Analysis of on-board radiometric calibration residuals	Blumstein	09/03/07
DR18	IA-CVA07-13	Spectral calibration homogeneity in overlaps B1/B2 & B2/B3	Blumstein	21/02/07
DR19	IA-CVA07-14	Spectral calibration in B1 and B2 validated	Tournier	23/03/07
DR20	IA-CVA07-15	Assessment of the IASI Sounder Geolocalisation	Fjørtoft	06/03/07
DR21	IA-CVA07-16	Line of sight short term stability	Cayla	13/03/07
DR22	IA-CVA07-17	Interferometric axis filtering	Tournier	13/03/07
DR23	IA-CVA07-18	First assessment of IASI performance	Cayla	27/03/07
DR24	IA-CVA07-19	IIS / Sounder intercalibration	Phulpin	15/03/07
DR25	IA-CVA07-20	Radiance spatial distribution in Sounder FOV analysis	Lavanant	20/03/07
DR26	IA-CVA07-21	Assessment of the interband calibration error	Fjørtoft	20/03/07
DR27	IA-CVA10-01	Onboard spectra Pixel 3, CD1 anomaly analysis	Tournier/Blumstein	22/03/07
DR28	IA-CVA10-02	Verification of the OPS configuration parameters	Tournier	22/03/07
DR29	IA-CVA10-03	Configuration parameters updating at end of Cal/Val A	Baque/Blumstein	27/03/07
DR30	IA-CVA10-04	CGS L1 products analysis after parameter updating at end of Cal/Val A	Blumstein/Tournier	04/04/07

		<p>Doc n° IA-TN-0000-3109-CNE</p> <p>Issue : 1 Date : 05/04/2007</p> <p>Rev : Date :</p> <p>Sheet : 8 of : 13</p>
---	--	--

3. IASI L1 CAL/VAL PHASES OBJECTIVES

The IASI L1 Cal/Val Plan (IA-PL-0000-2597 –CNE) defines the objectives of the different phases.

During the Commissioning Phase, the IASI instrument is calibrated, and its product quality verified with respect to performance requirements and validated against independent measurements. The Commissioning phase is split in three distinct sub phases.

- ? Phase A : Instrument activation and evaluation¹,
- ? Phase B : Early validation of the Level 1 Products,
- ? Phase C : In depth validation of the Level 1 Products.

The accuracy of the validation and the diversity of the conditions in which the validations are performed increase with time. Accordingly, the type of reference measurements used for these validations and their accuracy evolve according to the various phases defined above (from stand alone IASI measurements to comparison with other space borne instruments and to meteorological soundings and dedicated correlative measurements like those to be provided by IASI balloon)

More specifically, the activities performed during the Phase A were mainly dedicated to :

- Determine the level of monitoring thresholds that allow the instrument and its processing to continue to behave nominally in spite of external perturbations (e.g. spikes),
- Optimize the parameters of the on-board and L1 processing in order to achieve the required performance,
- Determine small modifications of the L1 processing to improve its behaviour with real data (mainly error handling)
- Validate these modifications and characterise the performance.
- Verify on a daily basis the behaviour of all the processing chain (on-board and on-ground). This activity is of course performed with a lot of support from the operational IASI TEC team.

These activities were split into about 35 elementary tasks for ease of coordination (see annex A).

Note: The tasks referenced under the headlines A1 and A2 in this annex were performed during the first phase of the IASI commissioning (IIOV) under the responsibility of the Instrument Team.

¹ or Instrument In-Orbit Verification

		Doc n° IA-TN-0000-3109-CNE Issue : 1 Date : 05/04/2007 Rev : Date : Sheet : 9 of : 13
---	--	---

4. SUMMARY OF MAIN EVENTS

The first week of January was dedicated to the definition of update of the on-board processing parameters ([DR1-3]) and to the estimation of the contamination rate by water ice after the IASI decontamination that was performed middle of December (doc IA-CVA7-01 which was a first version of [DR16] is not provided).

The on-board processing parameters that were modified are :

- the spectra coding tables (reduction of the coding noise thanks to a reduction of the margins allowed by observation of the minimum and maximum spectra observed during December)
- monitoring limits for the algorithms dedicated to NZPD/Reduced Spectra computation and Spikes detection. These limits allow to reject interferograms that are affected by perturbations like spikes. If these are not rejected they could lead to an alteration of the Reduced Spectra tables that are used for on-board radiometric calibration. In fact, this possibility is not only theoretical but was practically observed on IASI data acquired during the Christmas holidays.

Therefore, it was especially important to upload this new version of parameters. The parameters were send to Eumetsat on the 8th of January and uploaded in the instrument on the 15th of January. The document [DR4] reports the analysis which showed that the implementation of these new parameters were a success.

In the meantime, on the 7th and 8th of January, IASI experienced a rare event (occurrence twice a year or less depending on the year) when the moon went in the field of view of the Cold Space (CS1) calibration view. Everything worked as expected. This event was predicted a long time in advance (report done during IIOV phase). The optimal way to handle this situation during the routine phase must be studied using the real data of these 2 days in the next phases of the Cal/Val (before next August).

The following weeks were dedicated to the verification of the L1 processing behaviour with real data and to a first preliminary optimisation of some fundamental parameters ([DR5-9]). This analysis was performed using the L1 processor that is present in the IASI TEC (copy, hardware and software, of the processor of the EUMETSAT/CGS). In this phase a few modifications of the L1 processing algorithms have been designed and validated.

During this period and the beginning of first assessment of the IASI performances, the IASI balloon flight and its preparation took place. The IASI balloon was launched successfully on the 22nd of February at 15:05 UTC thanks to the efforts of the LPMAA IASI Balloon and CNES Balloon teams. This flight was a success with measurements available for 2 successive METOP passes in spite of some technical difficulties with the cold calibration target. The data were analyzed for rough correctness with minimal time delay. They will be further used for accurate assessment of the IASI Spectral Response Function during the Phase C of the Cal/Val (operational and programmatic constraints did not allow to have a flight around April or May which would have been the optimal dates with respect to the IASI schedule).

Then, the main part of the Cal/Val activity began with the first assessment of the IASI performances in flight. The main problem discovered during this phase was a spectral shift of about 3.10^{-5} in the data. Update of

		Doc n° IA-TN-0000-3109-CNE Issue : 1 Date : 05/04/2007 Rev : Date : Sheet : 10 of : 13
---	--	--

processing parameters, sounder IPSF (shape of the sounder field of view) and computation of a new Spectral Database solved the problem to a large extent. The last bit of improvements will be obtained during phase B with further optimisation of the IPSF. The other performances have been verified to the level objective that was assign to the Cal/Val Phase A. We will not discuss further all the reports produced during this phase ([DR10-26]). Instead, the reader should refer to the synthesis provided in [DR23].

Just before the end of the phase A, we had the bad surprise on the 19th of March to observe an anomaly consecutive to a reset of the Reduced Spectra on Pixel 3, CD1 to their initial value². [DR27] reports on the analysis of this anomaly. A patch of the DPS concerning the handling of some error conditions will be prepared by SAAB. The nominal state of the instrument processing was resumed after update of the on-board processing parameters which was implemented on the 2nd of April 2007.

[DR28-29] define the update of the processing parameters at the end of Cal/Val A and reports on their validation before they are sent to EUMETSAT/CGS.

[DR30] presents the results of parameter updating through the analysis of the L0 and L1 products received by the TEC in Near Real Time. L0 products contains the raw scientific telemetry of the IASI instrument. L1 products are produced by the IASI L1 processing in the EUMETSAT CGS. So this analysis checked both the on-board and the on-ground processing. As a summary, everything works now as expected and the instrument and its processing deliver products that are of good quality, ready for the next Cal/Val activities.

² This initial value is set by the ground as part of the operation which is called DPS initialisation.

		<p>Doc n° IA-TN-0000-3109-CNE</p> <p>Issue : 1 Date : 05/04/2007</p> <p>Rev : Date :</p> <p>Sheet : 11 of : 13</p>
---	--	---

5. CONCLUSION

As reported in all the reference documents, the objectives of the first phase of the IASI L1 Cal/Val have been successfully achieved.

The instrument and processing performances have been verified to a level better than twice the specifications (after update of L1 processing and processing parameters optimisation) on a limited set of geophysical situations. These first results are very encouraging. It must be noted that for some aspects this assessment is preliminary and must be confirmed by the use of many more data. One single concern is that the radiometric interband calibration is only marginally compliant with the objectives and that a temporally structured variation of the measured spectra on stable target (internal black body) is observed (near the overlaps only). This will need further investigations during the phase B.

The instrument and associated processing is in a stable state with all monitorings activated. The product are of good quality. They are ready for the next phase of the Cal/Val where the performances will be verified with an increased accuracy and diversity of conditions. Moreover direct intercalibration with the other infrared instruments on METOP (AVHRR and HIRS) will be performed.

The priority activities for the Cal/Val Phase B have been refined with the experience gained during the last months. They will be :

- Spectral Calibration (fine IPSF characterization, etc.),
- Analysis of the need for LFD unlocking,
- Radiometric post-calibration (effect of viewing direction),
- Spikes filtering limits optimisation.



Doc n° IA-TN-0000-3109-CNE

Issue : 1

Date : 05/04/2007

Rev :

Date :

Sheet : 12

of : 13

ANNEX – MILESTONES FOR THE IASI LEVEL 1 CAL/VAL A

Milestones are decomposed in 3 levels and sublevels for ease of management. A milestone at a given level is passed when all the sublevel milestones below it are passed.

In the following table the general milestones are listed first. Then comes the decomposition in sublevels. For example :

- general milestones 0 and A are listed first,
- then come sublevel 1 milestones A0,A1
- then come sublevel 2 milestones A1.1,...,A1.6
- then sublevel 1 A2 milestone
- etc.

Note: Step A1 and A2 are part of the IASI SIOV.

Ident	Milestone Description
0	Cal/Val pre-launch activities & training completed. Parameters file validated
A	Instrument and System Activation & Evaluation completed (End of Phase A)
A0	Metop orbit parameters available in TEC and orbital events sequence computed
A1	Raw Measurements OK (1st level of assessment)
A1.0	IASI scientific telemetry(L0 Products) available in TEC. Processing OK.
A1.1	Sounder Detection Chain Gain & Offset OK
A1.2	Comparison of Raw interferograms with ground test data OK
A1.3	Comparison of Raw images with ground test data OK
A1.4	Comparison of Raw spectra (average and noise) with ground test data
A1.5	IIS Radiometric noise assessed
A1.6	"Hardware" flags, if any, explained
A2	Spectra computed by DPS
A2.1	Reduced spectra computed by TEC and uploaded in DPS
A2.2	NZPD DPS processing OK
A2.3	Spectra coding tables optimized by TEC and uploaded in DPS
A2.4	Lack of Underflows/Overflows in Coded spectra
A2.5	Stability of the reduced spectra assessed
A2.6	External Calibration Views OK (on cal views: BB, CS1, CS2, SM & earth views: SP1, SP15, SP30 and nadir)
A2.7	Sounder gain and offset assessed
A2.8	DPS spectra Radiometric Noise assessed
A3	L0 Data Quality monitoring performed by DPS and monitored by TEC (1st level)
A3.1	Failure Detection criteria for DPS processing verified by TEC and uploaded in DPS
A3.2	Flags generated by DPS, if any, explained
A3.3	L0 Data Quality monitored by TEC
A4	Full Resolution, fully navigated AVHRR products available in TEC
A5	L1 spectra & images computed by OPS-TEC (functional test)
A5.1	Optimized coding tables installed in OPS-TEC
A5.2	Spectral Data Base and other parameters computed pre-flight in OPS-TEC
A5.3	IIS processing chain working and monitored by TEC
A5.4	Spectral Calibration working and monitored by TEC
A5.5	Filtering process working and monitored by TEC
A5.6	L1 spectra processing (1A, 1B & 1C) working



Doc n° IA-TN-0000-3109-CNE

Issue : 1

Date : 05/04/2007

Rev :

Date :

Sheet : 13

of : 13

Ident	Milestone Description
A5.7	Coregistration IIS/AVHRR working and monitored by TEC
A5.8	AVHRR Radiance analysis working and monitored by TEC
A5.9	IIS Radiance analysis working and monitored by TEC
A5.10	Localisation of IASI product working and monitored by TEC
A6	L1 Product Quality monitoring performed by OPS/TEC (1st step)
A6.1	Failure Detection criteria for OPS processing verified by TEC and uploaded in OPS-TEC software
A6.2	Flags generated by OPS, if any, explained
A7	First assesement of IASI Performance (on limited amount of data)
A7.1	Non Linearity correction table computed by TEC and uploaded in DPS
A7.2	Band Merging, Band Limits optimized and uploaded in DPS
A7.3	Contamination rate by water ice assessed
A7.4	Residuals of the on-board radiometric calibration analyzed by OPS
A7.5	Interband radiometric calibration errors assessed on earth targets and SM cal. views
A7.6	Interpixel radiometric calibration errors assessed on earth targets
A7.7	IIS-AVHRR co-registration assessed
A7.8	IIS-sounder co-registration assessed
A7.9	Homogeneity of IIS/Sounder radiometric calibration assessed
A7.10	Sounder IPSF checked (approximately)
A7.11	Radiance spatial distribution in sounder FOV validated
A7.12	Cube Corner Offset stability checked
A7.13	Operational spectral calibration in B3 verified (stability assessed)
A7.14	Spectral calibration homogeneity in interbands B1/B2 and B2/B3 verified
A7.15	Spectral calibration in B1 & B2 bands validated (approx.)
A7.16	Level of micro-vibrations assessed
A7.17	Navigation of the products validated
A7.18	Line of sight short term stability assessed
A8	Archive some data necessary for long term evaluation in phase B and phase C
A8.1	All opportunities for simultaneous measurements with other sounder (AIRS, TES,...)
A8.2	All the situations when moon path is close to CS1 or CS2
A9	Not used
A10	Configuration parameters for DPS and Level 1 processing updated for Phase B