

IFS/Arpège Memorandum

From: Claude Fischer (Météo-France)

To: (ECMWF) DR, RD Division & Section Heads

To: (Météo-France) Arpège diffusion list

To: (ALADIN) Piet Termonia

To: (HIRLAM) Daniel Santos-Muñoz

File: RD16-xxx

Subject: Minutes of the IFS/Arpège coordination meeting held on 6 June 2016.

Participants:

Météo-France: Alain Joly, François Bouyssel, Claude Fischer, Ryad El Khatib, Stéphane Martinez, Jean-François Mahfouf (only morning); afternoon: Patrick Moll, Dominique Puech, Philippe Marguinaud, Alexandre Mary, Etienne Arbogast

ECMWF: Stephen English, Deborah Salmond, Peter Lean

ALADIN: Piet Termonia

HIRLAM: Daniel Santos-Muñoz

1. Adoption of Agenda

adopted

2. Approval of Minutes of meeting of 21 January 2016

approved

3. Review of list of actions from last meeting

1. after CY43, review the coding norms and update the list of F2003 features; check about F2008 ? => *the decision is taken to adopt the full F2003 ANSI norm for IFS-Arpège codes from CY44 onwards. A new list of accepted features will be prepared for F2008. Action on Deborah: provide an initial proposal of F2008 suggested features for IFS-Arpège.*
2. Prototype of a new Confluence page to share information about IFS-Arpège cycle status and co-ordination. Claude to propose a logical content and layout for the page, and to liaise with

Steve for the implementation. => *Claude had proposed a list of features for describing a known problem, a bug or a fix. The discussion first was about whether the Confluence-page information was intended to replace technical information usually added in the FLUBs. The answer clearly was 'no'; we certainly want the FLUBs to be as informative as possible, including any necessary or useful technical information (validation, code changes causing numerical differences, non-reproducibility, fixes or improvements of specific codes, impacts on performance etc.). It was agreed that Claude's list of descriptive features for the Confluence page should be reviewed and shortened, and that the content of the Confluence page should be focusing on complicated bugs which potentially can affect many configurations and/or partners, and on fixes which had been implemented recently but with no back-phasing to older cycles (this is then to alert other partners that they might consider implementing this fix in any local, older code version if required). Furthermore, the 'write' permission to the Confluence page will be restricted to a small number of persons; the 'read' access however shall be widely open and promoted in the EC/MF/LAM partners community. For the start, the suggestion is to have 2 MF and 2 EC people with 'write' ability. Action on Deborah: propose a reviewed list of descriptive elements for the Confluence page, based on specific examples of recent fixes.*

3. Build of CY43: => *this whole action was completed successfully. Action closed.*
 - 3.1. MF to send EC the Arpège re-factoring options + LAM geometry updates for end of January, for inclusion in CY42R3
 - 3.2. EC to complete and test CY42R3, and send this release to MF
 - 3.3. MF to send the specific branch CY42_cy43 to EC for evaluation, possibly along with a specific list of difficult routines (Stéphane, Claude, Christophe)
 - 3.4. MF with support by EC, to merge CY42_cy43 on top of CY42R3 => “big pre-CY43 code”. We may plan a specific phone call between MF and EC in order to assess progress and details about this merge
 - 3.5. final exchange of “big pre-CY43”, tests in MF and EC. Declaration to be discussed, either by MF or EC, by end of February or beginning of March
4. Build of next scientific interim cycles after CY43: hold a specific technical videoconference between EC, MF and LAM partners, in order to discuss the status of code contributions in CY43T1 and CY43R1/R2, and to exchange experience and good practice information about how to phase a scientific branch from CY42 to CY43. Scheduled for 13 April. *Done, action closed.*
5. Claude to set a Doodle inquiry and find a date for a MF/LAM technical videoconference in preparation of CY43T1. *Done, action closed.*
6. Action on EC: to provide MF and LAM partners a technical note about how to install ATLAS (tools, supplementary libraries, etc.). *Deborah had got confirmation by Willem De Coninck that the technical note was ready and can be disseminated. Deborah will send it to the participants. Action closed.*

4. MF information about progress and plans of E-suites and cycles

François presented the progress report of Météo-France, for the Arpège and Arome systems. He presented the following aspects:

- Operational « main » NWP systems: spatial resolutions of the global and regional systems, content of the suites based on CY41T1_op1, Arome-Nowcasting, Arome-Overseas.
- Migration on BULL Phase 2 : the second Phase 2 BULL cluster is to be installed at MF in July, and it is expected that this cluster will be fully operating by November 2016. Then, MF will have their two Phase 2 BULL clusters in place, for until the beginning of 2019.
- Status of AROME-EPS : the regional EPS system will have 12 members run twice a day (09 and 21 UTC), with a resolution of 2.5km and 90 levels. It is presently being ported to operations, and it is expected that the operational declaration shall occur in December 2016.
- Next e-suite (CY42_op1) : two major components of the next Arpège e-suite should be the new convection scheme PCMT and the implementation of the SURFEX surface scheme.
- Longer term plans : R&D work on the EnVar system (within OOPS) is ongoing, with steady progress on the research side. On the system side, an upgrade of the resolution of the global systems (Arpège, AEARP, PEARP) is expected, as well as the introduction of an Arome EDA (2017/2018). For Arome, a two-moment microphysics parametrization will be tested. Several new sources of observations are targeted : Lidar winds from ADM/AEOLUS, assimilation of new scatterometer data (ScatSat), preparation for IRS/MTG, consider new satellites (FY3-C, FY3-D, JPSS1, etc.), European radar data (OPERA), Mode-S data, all-sky microwave radiances using a Bayesian inversion approach, etc.

More details can be found in François's presentation.

Claude listed the content of the interim cycle CY43T1, which is being finalized at MF. This cycle contains both GMAP, Aladin and HirLAM contributions. The precise list can be asked to Claude.

Action on MF: provide EC with the source code of CY43T1 asap, possibly based on the forthcoming pre-release version 4 (Stéphane, Claude, to Deborah).

5. EC information about progress and plans of E-suites and cycles

Steve presented an overview of the current resolutions of the IFS-based systems (HRES, ENS, 4D-VAR, EDA). He listed the content of the present new interim cycle CY43R1, which is a scientific cycle.

Headlines of CY43R1: ¼ deg ocean, retuning of EDA post resolution change, satellite improvements. Stratospheric weak constraint formulation remains uncertain, final tests progressing with and without this option to give more time. Final EDA settings still being evaluated, likely truncation TL159->TL399, plus EDA SST and sea ice perturbations (some positive impact).

The items below are or may be postponed to 43R3 :

- 12-hour overlapping window postponed to 43R3 to give users more time.
- Aircraft bias correction and TEMP QC changes also postponed due to mixed results that need further understanding.

Proposed timetable of CY43R1 :

- 4 July: RD could start handing over to FD 43r1
- 1 August: FD could start running the FD e-suite, starting from RD suite
- 25 August: FD e-suite reaches real-time
- 25 September: confirm implementation date to Member States
- 25 October: operational implementation

More details on specific results are in Steve's presentation: EDA errors, SST perturbations, assimilation of NEXRAD snowfall obs over USA, impact of slant-path RT calculations, updated obs error covariances for IASI and CRIS, improvements in boundary layer clouds, replacement of MTSAT-2 with HIMAWARI-8, etc.

6. HIRLAM comments

Daniel mentioned that Hirlam still had difficulties to get involved in OOPS, due to a lack of expertized staff in C++. Roel Stappers (met.no) was expected to visit EC (and then MF) in order to become more familiar with OOPS and IFS. Hirlam was also involved in ESCAPE.

Claude mentioned that at KNMI, they were developing a slant-path GNSS delay obs operator, which probably would be committed to the shared codes later. Perhaps after CY45, once the re-factoring of the IFS code for OOPS is completed ? Deborah mentioned that developments by Niels Bormann (slant-path RT) had been difficult to merge into CY43 (after the heavy obs operator re-coding for OOPS).

7. ALADIN comments

Piet reminded that Aladin plan to devote manpower to the adaptation of the DFI code to OOPS. Daan Degrauwe (RMI) and Martina Tudor (Croatia) had started to look at this aspect. However, this action needs to be resumed after the IFS re-factoring has progressed more.

Aladin will be involved in the Workpackages of ESCAPE, for developing dwarf models. At RMI, they had started to install and study the ATLAS library, and they noticed that a technical documentation about the content and use of ATLAS would be helpful. Deborah confirmed that a users oriented note was in preparation by Willem De Coninck, and EC will send it to the partners as soon as it is ready.

Action on EC: send the ATLAS technical documentation as soon as ready.

8. Specific issues:

8.1. ODB and COPE (Peter)

Peter presented the progress and plans of COPE, and the evolutions of ODB. An important step for COPE was to enable to initialize the IFS from the ODB_server (new name of the former HUB_ODB function). The IFS code will progressively be modified in order to use the “ifsobs” interfaces, an abstraction layer enabling to then call either ODB-2 or ODB-1 functions. This approach will enable to move to the COPE/ODB_server while preserving upward compatibility for those who won't switch to ODB-2 for instance. MF indicated that they had no firm plans to move to ODB-2; the size of the ODB-2 databases was one of the problems before considering such a switch. Another item discussed was the parallelism and cost of the Screening step. In the IFS, the Screening was now found to be very scalable actually, and its cost within the overall 4D-VAR multi-incremental assimilation was now becoming marginal. This breaks earlier beliefs that Screening was not very scalable and one of the costly steps of the assimilation critical path.

Action on EC (Peter): to send MF Peter's technical note about the evaluation of the performance and cost of the IFS Screening.

8.2. Broadwell migration and optimisation (Deborah)

Deborah presented the results and the time table of the IFS migration to CRAY Broadwell processing units. The migration came along with an upgrade of the CRAY compiler, and some increase of performance had been noticed. Several bugs in the code also were found, which will be reported on the newly defined Confluence page. EC further indicated that they will have a small Xeon-Phi cluster installed in the autumn, which would allow testing hybrid architectures.

Action (Deborah): to describe the IFS bugfixes found while porting the codes to the Cray Broadwell PE cluster, on the IFS-Confluence page.

8.3. Full-POS evolution towards OOPS (Ryad)

Ryad gave a talk about the evolution of the Full-POS software (FP) for the coming cycles. The code changes are foreseen to enable to interface FP with the OOPS objects (post-processing, and later the change of geometry). In addition, FP shall be extended to enable model file transformations especially from the IFS/GRIB-2 to the Arpège/FA format, and vice versa (configuration 903).

As first steps, it was expected that FP/configuration 903 without interpolations, shall be ready in CY44. Any further progress for FP used as post-processing code presumably shall be targeted for CY44T1 (spring 2017). FP used within 4D-VAR/Arpège shall probably be assessed to the end of this evolution (link with OOPS). Progress about these changes shall be regularly given at the technical video-conferences.

8.4. Coordination steps for the IFS Fortran re-factoring for OOPS, stage 2 and stage 3

EC have now a branch on top of CY43, named CY43_OOPS_V2, which contains the finalization of the obs operator re-factoring, and additional re-factoring (Jb, interfaces). With this code, a 3D-VAR IFS minimization can be run with all observations except All-sky radiances, no LTOVSCV, no LJC, no LVARBC. CY43_OOPS_V2 had been sent to MF, and Etienne reported that after about two weeks of technical adaptations (to Arpège), the Arpège 3D-Var minimization had been run with AMSU-A and aircraft obs.

Yannick has written a short note explaining the minimal requirements for the next Fortran re-factoring steps, in order to make a simple (single-resolution) 4D-VAR minimization run. In short:

1. make 3D-FGAT work (re-factor handling of time in IFS and interface with time in OOPS)
2. trajectory handling and validation of TL/AD models
3. 4D-VAR minimization (STEPO_OOPS for TL/AD, re-factoring of Fields (GMV/GFL+Surface) structures for handling the INCREMENT object in grid-point)

The necessary IFS code changes are due to eventually enter CY44. EC explained that they will split the GMV/GFL re-factoring into two steps (NL code, then TL/AD) as was done with the obs operators. The specs for this re-factoring shall be sent to MF for evaluation, and be discussed at a forthcoming technical video-conference. EC suggested that, if feasible, the GMV/GFL work could be shared in order to make quicker progress. The re-factoring will continuously remain based on CY43_main, in order to ease code exchanges and cross-testing. A technical phasing step in preparation of CY44 will be done, with a timing to be defined when relevant.

MF have asked some precisions about the expected progress and implementation plans:

- the new trajectory code should be evaluated at GMAP. EC intend to send it with their other re-factoring items, as progress is made.
- would the GMF/GFL re-factoring possibly enable to make the parallelization of the physics or the SL origin point calculation easier ? => this aspect was not especially taken into consideration.
- Overall time schedule for completion of the OOPS project ? => probably to be discussed at a forthcoming OOPS Board meeting.
- Will EC first implement OOPS for reproducing the IFS 4D-VAR of that time, or implement in parallel other new algorithms for DA ? => IFS 4D-VAR will be implemented first and then improved or new DA ingredients will be tested using OOPS
- Link with the ensemble data assimilation system ?
- Was there a plan to port the surface analysis to OOPS ? => no firm plans yet
- Would COPE and ifsobs become operational at about the same time as OOPS => probably yes, about 2018. The old obs data access should however continued to be maintained.

- would OOPS become operational before ATLAS ? => yes.

Action : EC to send the specs and code (in CPG_DRV tree) of the re-factored GMV/GFL structure to MF ; for MF to evaluate them and provide feedback asap. This action could take place over July/August.

8.5 Open discussion about future challenges of the common code management

Deborah (IFS support) and Claude (Arpège and Arome support) presented the increasing number of dependencies with various “external” libraries, which eventually are required in order to build an IFS or an Arpège/Arome executable file. The dependencies can be of source code and interface type (i.e. a specific well-identified source code version is required for interfacing with IFS/Arpège), or of system-type (GRIB, math libraries, compile system versions etc.).

Claude explained the strategy for Arome and Surfex: once every about two years, a new Surfex code version is being interfaced with Arome. The Surfex code is however managed by a different team, and has its own versioning. Changes from the NWP community therefore sometimes enter the codes twice: (1) the official regular commitment is a direct commitment to the Surfex official SCR (and the scientific or technical changes are retrieved in the NWP libraries only once a new version of Surfex is being interfaced with Arome), but (2) some quick improvements might enter earlier as a direct contribution to the Arome/Surfex code version (in which case the contribution actually will be committed twice). Claude expected that such coordination aspects might occur for other libraries in the coming years, like Atlas or COPE.

Deborah explained that for the IFS/Arpège coordination, the important point was to well prepare and define the list of code/lib versions tested and necessary for building a full IFS executable file. These code versions could then be retrieved one by one from each SCR (Note: at EC, the SCR are Perforce for the IFS – this code is sent as a tar-ball to MF like usual – and GIT for upcoming projects like Atlas, OOPS and COPE).

Deborah explained that she will provide a library-link release note for CY44_main, in order to list the versions of OOPS, OOPS_IFS, Atlas, grib_api (now Eccodes) etc. that should go with IFS CY44.

9. Content and timing of cycles

Joint cycle	ECMWF	MF	Start of phasing	Declaration	Misc. / Oper plans
CY42				June 2015	Declared 17 June
	CY42R1		end of June 2015	July 2015	Could be implemented with resolution upgrade but not essential

	CY42R2		September 2015		
		CY42T1		<i>Cancelled in order to prepare for CY43 which was rescheduled after the last coord meeting</i>	<i>Dropped</i>
	CY42R3				Will contain refactoring on top of R2 (only)
CY43			September 2015	February 2016	Declared 25 Feb.
	CY43R1		March 2016	June 2016	Scientific changes
	CY43R2		September 2016	November 2016	Re-factoring for OOPS
	CY43R3 ?		?	?	Model, DA changes ?
		CY43T1	April – June 2016	June 2016	Including Aladin and Hirlam
CY44			mid-November 2016	End of February 2017	The build process of this cycle might be in multiple steps to accommodate necessary input for OOPS in IFS. Tbd in forthcoming videoconferences.
	CY44R1		March 2017	June 2017	
		CY44T1	April 2017 (start about 18/04/17 tbc)	June 2017	
CY45			Beginning of October 2017	December 2017	Timing to be confirmed

10. AOB

The presentations will be made available to all participants, and uploaded on the pwd-protected area of the ALADIN consortium's website (Claude with Patricia Pottier).

11. Next meetings

Next technical video-conferences:

- Thursday 1 September, 14h30 CET / 1.30pm UK

Next Coordination video conferences:

- Tuesday 18 October, 14h30 CET / 1.30pm UK
- Tuesday 21 February 2017, 14h30 CET / 1.30pm UK

Next physical Coordination Meeting:

Monday 12 June 2017, meeting to take place in Reading

List of actions

1. Action on Deborah: provide an initial proposal of F2008 suggested features for IFS-Arpège.
2. Prototype of a new Confluence page to share information about IFS-Arpège cycles (bugs or fixes). Action on Deborah: propose a reviewed list of descriptive elements for the Confluence page, based on specific examples of recent fixes.
3. Action on MF: provide EC with the source code of CY43T1 asap, possibly based on the forthcoming pre-release version 4 (Stéphane, Claude, to Deborah).
4. Action on EC: send the ATLAS technical documentation as soon as ready.
5. Action : EC to send the specs and code (in CPG_DRV tree) of the re-factored GMV/GFL structure to MF ; for MF to evaluate them and provide feedback asap. This action could take place over July/August.
6. Action on EC (Peter): to send MF Peter's technical note about the evaluation of the performance and cost of the IFS Screening.
7. Action (Deborah): to describe the IFS bugfixes found while porting the codes to the Cray Broadwell PE cluster, on the IFS-Confluence page.
8. Deborah will provide a library-link release note for CY44_main, in order to list the versions of OOPS, Atlas etc. that should go with IFS CY44.