

# 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:** RD17-xxx

**Subject:** Minutes of the IFS/Arpège coordination video-conference held on 20 April 2017.

## **Participants:**

**Météo-France:** François Bouyssel, Claude Fischer, Stéphane Martinez, Alexandre Mary

**ECMWF:** Stephen English, Deborah Salmond, Olivier Marsden,

**ALADIN:** Piet Termonia (partially only, due to connexion issues)

**HIRLAM:** Daniel Santos-Muñoz (not attending)

## **1. Adoption of Agenda**

adopted

## **2. Approval of Minutes of meeting of 21 February 2017**

Claude will circulate the final version of these minutes, for approval.

Note: minutes from the 16 March technical video-conferences also are available, and can be obtained from Claude.

## **3. Review of list of actions from last meeting**

1. Deborah will start listing F2008 items that could be accepted (mostly improvements of F2003 features). In addition, it seemed useful to also specifically list those features that we should NOT accept, like COARRAYS. => *Deborah will write an initial list of suggested blacklisted features, to circulate within MF and Aladin/Hirlam partners. Action for after CY45. OPEN.*

2. Steve and Claude to liaise in order to test the “Known Issues and Bug Fixes” Confluence page hosted at EC. => *Several MF staff now have access to the R&D Confluence pages and JIRA/GIT branch descriptions at EC (Claude, Ryad, Alexandre, Etienne). Olivier explained that ECMWF could extend this list, but only to staff having an authorized pin-code access to EC’s computer systems. To have access to the information of the JIRA pages was found useful as it provides an additional information with respect to the e-mails and meetings, or technical documentation like FLUBs. For the time being, MF have not been considering or investigating a similar sort of tool for Toulouse. CLOSED.*
3. Action on Sylvie: send the technical and scientific note about the results with the mass-preserving option in IFS to MF, when ready. => *Deborah sent a preliminary note to MF, and a final version is expected for later. EC will send this version as well. OPEN.*
4. Action on Claude: to provide EC a description of MF’s tests and results with LSPRT in assimilation. => *Gérald and Loïk are completing this note, and it should be ready for dissemination by one or two weeks time. There also was a question whether Etienne could send some of the OOPS-Arpège related code changes to EC, so that they could be included in CY45. Claude will check with him. OPEN.*
5. Action on Steve: to provide MF with a feedback, possibly a workplan description, about the “alpha control vector” work planned at EC. => *Sébastien Massart will visit CERFACS in May, and he intends to also visit GMAP on this occasion. Gérald will check with him how to arrange a discussion about the plans on hybrid data assimilation (date is 12 May). We expect some feedback from this visit, and a follow-on discussion at the forthcoming physical coordination meeting (12 June). OPEN.*

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

François gave an update of MF’s progress with implementing the CY42\_op2 e-suite (Arpège with new convection scheme PCMT and SURFEX surface scheme). The full e-suite configurations are now installed in the operations department. The subjective and objective evaluation of the e-suite continues. The decision for the operational switch will be addressed in the first half of May. The plan so far is to switch to operations in June (thus, still pending to an approval by Operations).

In parallel, evaluation of LBC coupling files by Aladin partners has started.

The next e-suite (higher resolution Arpège) would start in the autumn 2017, with a switch to operations in spring 2018. The base cycle version still needs to be decided (CY43T2 or CY44). This decision presumably will be taken around end of May 2017.

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

The switch to operations of CY43R3 remains expected for June 2017 (see minutes of 21 Feb).

The next e-suite will be on CY45R1, whose build would start around end of May. The operational switch was first expected for end of 2017, yet more likely would happen in January 2018. Careful attention is presently being paid to the additional numerical cost that comes with the ocean/atmosphere coupling in the HRES model. Cost reduction is being sought elsewhere in the IFS forecast in order to compensate.

The expected (yet not finally approved) content of a scientific suite can be found on the JIRA pages for those having access to EC's Confluence pages.

## **6. Updated status of build of CY45; validation of assimilation at MF in CY43 and CY44**

SPAMing based on CY44 is now almost completed at ECMWF. A pre-CY45 version exists now, which enables bit-reproducible (and cost equal) IFS 4D-VAR testing. Olivier and Deborah explained that after SPAMing (Python script), quite a number of manual interventions had been necessary in order to make the code compile. In addition to SPAMing, several other re-factoring items had been included: Full-POS interfacing for OOPS (Ryad), VarBC (Roel), trajectory for simplified physics (Deborah), FIELDS for increments and multiple resolution 4D-VAR (Mats). Over the last two weeks, a number of bug-fixes also had been found. However, the present pre-CY45 is not yet working for OOPS-IFS, so more fixes are required for making sure the OOPS binaries can run with CY45.

At MF, a very preliminary version of pre-CY45 from about three weeks ago was used to start SPAMing the LAM codes, and implementing the backward consequences on IFS/Arpège global codes (impact on CALL sequences and upward propagation of modified interfaces). This work was done primarily with the Aladin phasing visitor (Wafa Khalfaoui from Tunisia). For the continuation of the LAM code phasing, and for starting to test Arpège and Arome, MF will need a stable version of pre-CY45 ideally with IFS technically validated.

EC suggested that the pre-CY45 code should be as much as possible made ready for testing the simple OOPS-IFS 4D-VAR including a sound MODEL object implementation. This will require to spend some more time on fixing the remaining bugs and a specific re-factoring of YGFL needs to be done (to avoid passing the MODEL object in places where it was not meaningful per se). MF commented that extra re-factoring and testing would very likely mean that the declaration of CY45 will be quite a bit later than planned (note: end of April). That possibility was eventually found acceptable during the meeting, and a deadline of declaration as late as around mid-June was considered.

In order to try not to postpone too much this declaration, a parallel work between EC and MF was decided, and the final stages of build of CY45 have been agreed as follows:

1. EC to send MF the stable version of pre-CY45 including the YGFL re-factoring, the XFU/CFU one (move to FIELDS object), move the TE0LBCB component of LAM/LBC into the MODEL object structure, any further fix for OOPS-IFS, revert back the SRTM change (by MF) to the code of CY43 (Note: action on MF to provide info about the trace-back). Note: "stable" here means at least to compile and run a low resolution IFS 4D-Var

and forecast which is bit-reproducible with CY44. This pre-CY45 would then be a common ancestor version for any further GIT branch, bug-fix and code exchange between EC and MF (Olivier, Deborah, Alexandre, Stéphane).

2. MF to update the LAM code SPAMing and IFS/Arpège phasing for LAM (Wafa's codes ported to pre-CY45 - Alexandre). In parallel, assess compilation and build first pre-CY45 official binaries at MF (Stéphane).
3. MF will test Arpège and Arome forecasts and Full-POS. Declaration of CY45 should occur only after these tests are satisfactory. MF will not test OOPS prototypes on this cycle immediately. EC will send any bug-fix for IFS or OOPS-IFS to MF.
4. A technical video-conference for a progress report is planned for Tuesday 16 May afternoon.
5. Declaration of CY45 probably could happen in MF, after agreement with EC.

## **7. HIRLAM comments**

----

## **8. ALADIN comments**

----

## **9. Specific issues:**

### **9.1. OOPS Progress**

MF has ported the Arpège OOPS 3D-VAR prototype to CY43++ (Etienne). Work is ongoing to also test the LAM 3D-VAR prototype (Thibaut). These updated versions will then be used for further EnVar development at MF. MF will resume the Full-POS interface re-factoring (Ryad). Furthermore, MF would check the DDH codes with respect to OOPS testing, to be further discussed according to requests.

### **9.2. Any other item suggested ?**

None.

## **10. 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		
		<i>CY42T1</i>		<i>Cancelled in order to prepare for CY43 which was rescheduled after the last coord meeting</i>	<i>Dropped</i>
		CY42_op1 / op2	March 2016	March 2017	MF E-suite version expected for operations by June 2017
	CY42R3				Contains re-factoring on top of R2 (only)
CY43			September 2015	February 2016	Declared 25 Feb.
	CY43R1		March 2016	June 2016	Scientific changes
	CY43R2		May 2016	?	Re-factoring for OOPS
	CY43R3		October 2016	November 2016	Model + DA
		CY43T1	April 2016	June 2016	Including Aladin and Hirlam
		CY43T2	October 2016	mid-November	Wrap-up of bugfixes from [CY40-CY42], as well as MF E-suite changes from CY42_op1/op2
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 video-conferences.
	<i>CY44R1</i>				<i>Dropped</i>
		<i>CY44T1</i>		<i>Cancelled in order to build the technical</i>	<i>Dropped</i>

				<i>OOPS cycle CY45</i>	
CY45			March 2017	End of May or mid-June 2017	MODEL object re- factoring
		CY45T1	September or October 2017	November 2017	Including Aladin and Hirlam
	CY45R1		May 2017 ?	June 2017 ?	Science tbc
	CY45R2		July 2017	September 2017	12h overlapping DA
CY46			End of November 2017	End of February 2018	

Claude provided a first possible list of content of MF R&D code changes for CY45T1 (See Appendix). Among those, there is a proposal to implement a specific background error variance coefficient for specific humidity Q (REDNMC\_Q). Steve suggested that Elias Holm should be made aware of this change. Action on MF (Claude and Yann Michel) to contact Elias.

## 11. AOB

none.

## 12. Next meetings

### Next technical video-conferences:

- Tuesday 16 May, 14h30 CET / 1.30pm UK

### Next Coordination video conferences:

- Thursday YY, 14h30 CET / 1.30pm UK => after the 12 June physical meeting !

### Next physical Coordination Meeting:

Monday 12 June 2017, meeting to take place in Reading. Steve mentioned that EC will start evaluating the consequences for R&D and e-suite preparations, due to the move of the HPC department from Reading to Bologna. He might provide feedback about this planning.

Note: followed by OOPS Board meeting on 13 June, in Reading as well.

## **List of actions**

1. Deborah to start listing those features from FORTRAN 2008 that should stay out of the IFS/Arpège codes (blacklist approach), after CY45. Then circulate this list in MF and with Aladin/Hirlam.
2. Action on Sylvie or Deborah: send the technical and scientific note about the results with the mass-preserving option in IFS to MF, when ready.
3. Action on Claude: to provide EC a description of MF's tests and results with LSPRT in assimilation. Further check with Etienne and other MF assimilation staff which fixes from testing Arpège/Arome VAR could enter CY45 (in Toulouse or via EC/Deborah).
4. Action on Steve: to provide MF with a feedback, possibly a work plan description, about the "alpha control vector" work planned at EC. Note: there was a visit by Sébastien Massart to Toulouse in May.
5. MF to provide EC trace-back information about the SRTM problem/crash encountered in some Arpège PEARP members (this is under investigation in GMAP)
6. MF (Claude and Yann Michel) to contact Elias Holm for informing about the suggested implementation of a specific REDNMC\_Q namelist coefficient in CY45T1.

Appendix (by Claude) ; very provisional possible content of CY45T1 planned for Sept-Nov 2017 (precise dates yet to be confirmed)

Provisional input:

- System aspects:
  - PREP with FA file formats, deactivate default use of LFI format (Ph. Marguinaud)
  - FA file format support in FESTAT (R. El Khatib)
  - fixes for LAM+SURFEX and MPI in order to enable MPI tasks running in E-zone regions only (REK)
  - optimizations for Full-POS; important updates for Full-POS in OOPS (configuration 903 for Arpège and Arome, and PostProcessor object in OOPS) (REK)
  - alternative MPI communicator in DrHOOK (REK, following S. Faroux)
  - pruning of FEMARS in CNT3/IFS code (REK)
  - enable NPROMA loops beyond the minimum length of MPI slices; code changes to alleviate reproducibility problems with Intel compiler version 17; miscellaneous other code optimizations for Arome (REK)
- Arpège and Arome model dynamics:
  - first codes for implementing the Quasi-Elastic NH equations in global and LAM (for finite differences at least) (K. Yessad, F. Voitus)
  - vertically variable SITRA in SI operator (K. Yessad)
  - more flexible filtering of orography for PGD files (KY)
  - simplifications in the code of LASCAW when interpolating half-level fields (KY)
  - if ready: enable to only switch on higher-order interpolations in the last iteration of P/C scheme (could be numerically cost-effective when LPC\_FULL, KY)
- Arome physics:
  - add a term of deposition for the microphysics (Y. Seity)
  - a significant rewrite of the ICE3 microphysics code in order to reduce the dependency upon the time step value (Note: some bugs fixed while rewriting) (S. Riette)
  - add surface fields to DDH diagnostics (Y. Seity)
  - recent updates for computing gust winds, from the CY42 e-suite (enable to compute gust winds over a different time range than the forecast range of the output file) (Y. Seity)
  - *implement SURFEX V8.1 ? Tbc* (Y. Seity)
- Assimilation methods:
  - updates for Ensemble Data Assimilation (EDA) and for using grid point  $\sigma$ 's in AROME. This contribution includes a significant rewrite of LSPFCE=.FALSE. For LAM (Y. Michel)
  - enable to diagnose the content of one column of B; enable a specific REDNMC value for Q (specific humidity); implement a tuning  $\sigma_0$  coefficient for GPSSOL in Bator (Y. Michel)
  - optimization of code for filtering B matrix structures and for computing the inflation factor for AROME EDA (previous codes already in CY43T1) (Y. Michel)
- Observations:
  - enable monitoring of data from the MTVZAGY microwave radiometer on board METEOR (Russia) (Ph. Chambon, F. Suzat)
  - enable monitoring, possibly assimilation, of data from the AMSR2 microwave



- radiometer on board GCOM-W1 (Japan) (P. Chambon, F. Suzat)
- implement monthly varying versions of microwave surface emission atlases (F. Suzat)
- ALADIN, HIRLAM: Tbd ...
- OOPS re-factoring:
  - further reorganization, encapsulation and passing-by-arguments of the LBC code for LAMs (B. Bochenek, A. Mary, K. Yessad)
  - finalize the adaptation of Arpège options to the re-factored observation operator codes of phase 2: APACHE, ACHMTTL/AD (MF/ OBS team)