

# 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) Ulf Andræ

**File:** RD14-xxx

**Subject:** Minutes of the IFS/Arpège coordination video-conference – in view of Cycle 41 - held on 18 March 2014.

## **Participants:**

**Météo-France:** Alain Joly, Claude Fischer, Ryad El Khatib, Karim Yessad, Stéphane Martinez

**ECMWF:** Jean-Noël Thépaut, Deborah Salmond, Peter Lean

**ALADIN:** (absent)

**HIRLAM:** Ulf Andrae

## **0. Adoption of Agenda**

The agenda was adopted.

## **1. Approval of Minutes of meeting of 9 December 2013**

Approved.

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

### *1. about COPE:*

- 1. MF will try to run COPE and provide feedback to EC.*
- 2. Meteo-France/HIRLAM/ECMWF to make an extensive and detailed list of all the COPE filters we need to implement. The list must be available on COPE JIRA*

at <https://software.ecmwf.int/wiki/display/COPE/COPE+filters> => MF has sent its contribution. Hirlam input is expected to complete MF's. ECMWF contribution remains to be sent. MF had expressed interest on receiving simple examples of C++ filter programs (as templates) from ECMWF.

3. EC and MF coordination contacts will approach their COPE teams, and ask that a status report + list of action is provided for the forthcoming COPE video-conferences.

=> The above actions are now closed. ECMWF had sent a Project management document to MF and Hirlam, as COPE is now managed by the Forecasting Department (note: Jean-Noël informed that Drasko has moved from RD to FD). Drasko Vasiljevic is in charge of the relationship with external partners. Claude insisted that the partners were very interested to resume the discussions about the concrete developments and collaboration on technical specifications and codes. New actions have been decided: (1) MF and Hirlam to send feedback to EC/FD about the Project Initiation Document; (2) EC, MF and Hirlam COPE contacts to agree on arranging a technical video-conference before the next IFS/Arpège coordination meeting (June 2).

2. ECMWF porting to CRAY: Deborah will send MF and Hirlam the list of trouble-making pieces of code, and the workarounds that were done. => Closed. Deborah mentioned that low-level allocations via "malloc" were to be avoided on Cray, as they appear to be the cause of intermittent SEGV failures.
3. Plans for numerics at ECMWF: find a suitable date and plan the visit by Piotr S. And Christian Kühnlein to MF, presumably in February or March (one or two days visit). Claude shall inform Piet Termonia for a possible participation of Aladin staff. => Action closed (visit took place on March 5). Alain explained that the visit was making clearer the fact that Panta Rhei was aiming at developing *new* code for an alternative dynamical kernel, but yet, the discussions had raised new questions and matters of worry for the partners. About the system of equations, the way moisture processes and open system features (exchange of mass/heat falling out or evaporating within an air parcel) would be included was still totally open. These aspects however could become a matter of concern as MF and the LAM partners had been having a number of discussions on these aspects in recent past. The question of how to possibly extend the Panta Rhei dynamics to ideas tackled at MF or by partners also could be of interest for the future of the collaboration. Eventually, nothing still is known about the implementation plan of an alternative dynamics kernel in the IFS, although some work seemed to have started (Mats Hamrud and Willem De Coninck). Jean-Noël pointed out that the specifications for "Panta Rhei for the IFS" would be addressed within the plans and progress to be discussed within the Scalability Project, and much of them still was indeed very open. The Scalability workshop in Reading in April was recalled (note: MF will participate with four staff, Alain Joly, Philippe Marguinaud, Fabrice Voitus, Ryad El Khatib).
4. Model object re-factoring (Python script, ASSOCIATE): (a) EC will send a preliminary list of IFS routines and modules that would be affected by the re-factoring, (b) MF and LAM partners will complete it with their own list, (c) wrap-up at the next video-conference (Jan 27), (d) ECMWF will develop the Python script

*in January, (e) application of the script on local versions, tests of compilation and model execution including performance, (f) wrap-up (Feb 20). A firm decision for implementation is expected at the next coordination video-conference (March 18).*  
=> Actions closed. For more details and continuation, see Item 7 below.

### **3. Progress with CY40R2 at ECMWF, with CY40T1 at MF, and detailed steps towards CY41**

MF have declared CY40T1 on March 11, after including last fixes by GMAP and Hirlam. All major model forecast configurations were validated (Arpège, Arome, Aladin, Alaro), as well as Full-POS/(e)e927 and CANARI/OI. Variational assimilation was still to be validated (Arpège 4D-Var and Arome 3D-Var).

EC have progressed well with building CY40R2. Most of the expected technical features were now in the pre-cycle (trajectory for OOPS, TJK branch + Karim and Alexandre's fixes, encapsulation of 4 modules for geometry, RTTOV-11, Cray porting, etc.). Validation of IFS (T511 forecast and 4D-Var) was ongoing. Deborah mentioned she will still include two more contributions: some more cleaning of GPHPRE in ec\_phys, code clean-up for VarBC (enables bit-reproducible results in OpenMP context). One technical feature originally expected to enter (single call to COBSALL) will not be ready in time.

Specific steps for building CY41 have been agreed:

- EC to send final CY40R2 to MF: March 24 or 25
- merge R2 and T1 in Toulouse: April-May, with the support of LAM phasers (Bogdan Bochenek – Poland -, Mohamed Jidane – Morocco -, Toon Moene – KNMI -, Olda Spaniel – Slovakia -, Boryana Tsenova – Bulgaria)
- MF to send pre-CY41 back to EC: end of May
- in parallel: agree on strategy for encapsulating model variables; implement this encapsulation in June; EC to send pre-CY41 Version 2 back to MF still in June
- MF to perform some further checks and validation. Declaration of CY41 by end of June (EC and MF )

### **4. Other Progress and plans reporting (EC, MF)**

MF was now in the Acceptance Test period of their 2nd BULL cluster (at Clément Ader computing centre), the one that will host MF's operational suites. In parallel, a short-duration technical E-suite was planned in April for implementing the I/O server and adjusting the use of observations in the production runs at the level of the assimilation runs.

For the mid-term, efforts are focussed on the preparation of the high-resolution E-suites, that are planned for evaluation in a pre-operational context for September, with a switch to operations probably in the first quarter of 2015.

ECMWF mentioned that the Acceptance Test period of their Cray was ongoing.

For memory, below is the up-to-date timetable of new cycles. The table shall be discussed in more details at the next physical coordination meeting (June 2 in Toulouse).

Joint cycle	ECMWF	MF	Start pre-φ	Declaration	Misc. / Oper plans
CY40			March 2013	End of June 2013 at the latest	
	CY40R1			Oct 2013	Oper in Feb 2014
	CY40R2			Feb 2014	Technical cycle including many OOPS & refactoring features
		CY40T1	Dec 2013	Feb 2014	
	CY40R3			May 2014 (RD)	Handover to OD/FD in May 2014
CY41			Between March 17 and April 3 2014	June 2014	Merge of CY40T1 and CY40R2
	CY41R1		Includes merge of CY40R3	Sept 2014 (RD)	Handover to OD/FD in Dec 2014; migration to COPE
		CY41T1	Dec 2014 ?		
CY42				April 2015 ? (1)	
	CY42R1				Implement OOPS

(1) MF has suggested a back-up scenario with a fairly late declaration by July 2015 to take into account the period of one single BULL – C2 – cluster available. This schedule should be further addressed in future coord meetings.

## 5. HIRLAM comments

Ulf mentioned Toon Moene's involvement in the phasing for CY41. Hirlam also had a wish to join the phasing of specific LAM aspects in CY41, most importantly Geometry object features. They have installed CY40T1 and tested the model configurations. Surface analysis was still problematic (crashes).

Ulf asked about an up-to-date version of the norm checker. After discussion, it was suggested that EC's version should be upgraded in order to include F2008 key features as well as

Hirlam changes. Action decided: (1) Ulf to send Hirlam changes to EC (Paul Burton and Deborah); (2) EC to upgrade their norm checker version for F2008 + Hirlam (Paul), and send new version to MF (Ryad, Stéphane) and Hirlam (Ulf).

Deborah asked whether Hirlam had discussed potential proposals for improving the VarBC code (note: this was an item of past technical video-conferences). Ulf explained that for the time being, Hirlam had no further request to submit. Claude mentioned that MF had implemented some simple VarBC for GPS (constant predictor) in CY40T1, in coordination with Hirlam contacts (Roger Randriamampianina). It was likely that more coordination would be needed later, when the VarBC for GPS will be further improved with extra predictors. Then, probably, MF, EC and Hirlam contacts should resume a technical discussion for making the code flexible enough to fit each groups requirements.

## 6. ALADIN comments

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## 7. MF feedback about actions around OOPS: encapsulation, Arpège prototypes

The Arpège 3D-Var prototype is running on BULL based on CY40, using all conventional observation types (i.e. all obs types but satellite). Wavelet functions in Jb were not activated; standard experiment is with spectral B structure functions and uniform  $\sigma_b$ 's (maps of gridpoint  $\sigma_b$ 's were tested and worked except for humidity).

The Arpège forecast was run with reasonable results with CY40R1 and L\_OOPS=.TRUE. (from Fortran still). A test from C++ was working technically with an old version of the TJK branch, but crashed with the recent versions. These tests will be resumed after CY41 is completed (i.e. not before July ?).

Tests with the Python script for encapsulating model variables have been performed at MF. Etienne Arbogast has suggested some modifications in Tomas' original script. Furthermore, several issues have been raised and performance on BULL was assessed:

- on BULL, variables that have the ALLOCATABLE attribute cannot be ASSOCIATE-d. Indeed, even if an allocatable derived-type variable (YSTRUCT%VAR say) is allocated, the ASSOCIATE-d local variable (ASSOCIATE VAR => YSTRUCT %VAR) is not itself allocated, which causes a run-time error (Note: no error at compile time). This behaviour seems different from CRAY.
- The strategy for encapsulating namelist variables should be further discussed between EC and MF.

- In SUOBSCOR, a compile error occurred on the function COUNT when the ASSOCIATE block was present. We therefore removed the ASSOCIATE block completely from that routine.
- MF (Etienne) implemented an encapsulation of YOMGEM, YOMDIM(V), YOMMP, YOMDYN, YOMPHY[-,1,2,3] and ran a T798C2.2L70 Arpège forecast of 102 hours on BULL. Results were found bit-reproducible and elapse time was comparable with the original, non-encapsulated code.

Actions decided: (1) MF to send code examples and Python script to EC (Etienne Arbogast); (2) EC to provide feedback about MF's suggested adaptations for encapsulation (Allocates, Namelists); (3) by the May 13 video-conference, agree on strategy and Python script; (4) at the May 13 video-conference, agree on list of modules to encapsulate.

## **8. AOB**

Jean-Noël mentioned that the new Head of the Computing Department started at EC at the beginning of March. This is Adrian Wander (coming from UK Government research organizations about chemistry and scientific computing). Peter Lean now is full time on ODB, and therefore becomes available for ODB contacts at MF (Dominique Puech) and Aladin/Hirlam (Alena Trojakova, Mats Dahlbom, Eoin Whelan). He will also be involved in the ODB-related work for COPE. ECMWF is now starting negotiations with the EU commission for implementing Copernicus Services (atmosphere component, climate component).

Deborah mentioned that EC had almost completed their testing of Full-POS for the initialization of IFS via "inidata". There was a pending issue about the spectral filtering of fields, for which EC will check how to best implement a flexible control (contact at MF is Ryad).

## **9. Date and Place of Next Meetings**

### **Next technical video-conferences:**

- May 13 (1.30 UK, 14h30 CET), for an update on progress with phasing of CY41 + final agreement on strategy for encapsulation and list of modules.

### **Next Coordination video conferences:**

- to be discussed at the June coordination meeting in Toulouse

**Next Coordination Meeting in Toulouse:** 2 June, followed by an OOPS/SC on 3 June (also in Toulouse)

## **10. List of Actions**

- 1 about COPE: (1) MF and Hirlam to send feedback to EC/FD about the Project Initiation Document; (2) EC, MF and Hirlam COPE contacts to agree on arranging a technical video-conference before the next IFS/Arpège coordination meeting (June 2).*
- 2 about model variables encapsulation in CY41: (1) MF to send code examples and Python script to EC (Etienne Arbogast); (2) EC to provide feedback about MF's suggested adaptations for encapsulation (Allocates, Namelists); (3) by the May 13 video-conference, agree on strategy and Python script; (4) at the May 13 video-conference, agree on list of modules to encapsulate.*
- 3 about norm checker: (1) Ulf to send Hirlam changes to EC (Paul Burton and Deborah); (2) EC to upgrade their norm checker version for F2008 + Hirlam (Paul), and send new version to MF (Ryad, Stéphane) and Hirlam (Ulf).*