

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 Andrae

File: RD14-xxx

Subject: Minutes of the IFS/Arpège coordination meeting – in view of Cycle 42 - held by video-conference on 13 November 2014.

Participants:

Météo-France: François Bouyssel, Claude Fischer, Ryad El Khatib, Karim Yessad

ECMWF: Steve English, Deborah Salmond, Peter Lean

ALADIN: Piet Termonia, Daan Degrauwe

HIRLAM: Ulf Andrae

Note: There had been a coordination meeting in Toulouse about COPE (beg of June), the Scalability-related H2020 ESCAPE proposal has been finalized with participation of MF, Aladin and Hirlam (Sept/Oct), and two technical IFS/OOPS video-conferences have been held (26/08 and 16/10).

1. Adoption of Agenda

The agenda was adopted.

2. Approval of Minutes of meeting of 2 June 2014

Approved.

3. Review of list of actions from last meeting

1. *update of norm_checker (based on Hirlam input): the technical specifications will require more liaison between contact persons, as it is felt more attention should be paid to cases where the norm_checker is being used while embedded in a host system, like the compile system (GMKPACK, etc.). It is decided that (1) MF and Hirlam will liaise and agree on a common update, then (2) updated norm_checker is sent to EC. Action on MF (Ryad), Hirlam (Ulf & Rymvidas), later EC (Deborah and Paul Burton). => Ryad, Ulf and Rimvydas have liaised first for checking the proposed modified version of the norm checker, and this version then was sent to Paul and Deborah. Paul still needs to check and confirm the new version is fine for EC. The coordination action is closed, but a feedback by Paul is welcome.*
2. *EC to send information about the Varbc re-factoring to MF, ALADIN and HIRLAM. If required, plan an item for discussion on Varbc recoding or extension of flexibility at a forthcoming technical video-conference. => This action has a pendant in the technical video-conferences. It is decided to keep the action open for those meetings, and remove it from the list of action of the coordination discussion.*
3. *EC to send information about the changes in the SL trajectory computation, in link with noise seen in the model's stratosphere. => Done; action closed.*
4. *About code normalization features implemented in CY41 (via CY40T1): Ulf to liaise with Deborah, and Ryad in copy, and send information about Rimvydas' changes (precise list, documentation and explanation about the technical motivation). => This item is about some of the include files implemented by Hirlam in CY41, and which EC wishes to take out again of the IFS. The action is still to be firmly decided, and Deborah will send Ulf the list of routines of concern. Pruning could take place in CY41R2, which means by February 2015, so this action is moved to the technical video-conferences for decision.*
5. *ODB:*
 1. *Peter to check about the status of OBSTAT and ODB (ODB-1 or ODB-API) and potential plans for porting OBSTAT to ODB-API. => Peter confirmed that both ODB1 and ODB2 work with OBSTAT and are being maintained. ODB-API also already had been ported to OBSTAT. Closed.*
 2. *Ulf to check and provide the names of the ODB contact persons for HIRLAM (2). => Hirlam has nominated Eoin Whelan (eoin.whelan@met.ie) as ODB contact. Eoin also is a contact for COPE. For remainder, Dominique Puech is the MF contact and Alena Trojakova (alena.trojakova@chmi.cz) is the Aladin one. Closed.*

6. *F2003/C++: HIRLAM (Ulf) to send the F2003/SURFEX proposed feature to others (MF, EC), MF (Philippe/Ryad) to send the example of POINTER to FUNCTION to others. For all: check proposals (including all LAM partners) before decision-making w/r to the list of IFS/Arpège/LAM permitted F2003 features. => Ulf had sent the Hirlam examples; (post-meeting:) MF had sent their example. Shame on us, we did not really follow this action ... Ulf and Claude resent the respective examples to all participants after this meeting. We now need to check them at EC and MF, but also with Aladin and Hirlam teams. Piet indicated that for Aladin, a specific inquiry shall be arranged by the network coordinator (Note from Claude: this is a "she" from Slovakia, Maria Derkova). In addition, Deborah will update the list of already agreed F2003 features (ASSOCIATE) and simple code examples. If accepted, the two new features to be evaluated would be added as well. Action left open but moved to the technical video-conference of January. Action for coordination meeting closed.*
7. *Update the recommendations about Fortran/C++/Boost standards for benchmarking and call for tender specifications => Deborah and Claude. => Action is open. Claude suggested that the updated list of F2003 features and the Fortran/C++/Boost standards are being presented to the Aladin teams, at their next Aladin coordination meeting to be held in mid-April 2015. The issue behind is portability of new code versions on the various HPC systems across Aladin.*
8. *EC (Deborah) to send information about the principle of the cubic grid approach, along with performance figures on CRAY. => Done, action closed. Karim mentioned he had done a few tests with Arome-500m in quadratic and cubic grids, which suggest that the NH solution might produce some numerical noise not present in the hydrostatic versions. Karim further mentioned that to further test the cubic grid would first require to reassess the quadratic grid solution especially in NH. For Arpège, he believes that truncations larger than T1200 should be tried, and the future Arpège+Surfex configuration should be considered as this will have an impact on how orography is computed and filtered. Also, orography is not filtered the same way in Arpège than in the IFS. CY41T1 should be a mandatory base code version to resume the tests. Eventually, Karim's guess is that the cubic grid solution for Arpège or the LAM NH models would require work expanding over the next two years or so. EC is performing ongoing testing in the IFS, in order to evaluate the cubic grid as a potential candidate for the 2015 E-suite based on CY41R2 (this is done by Nils Wedi and Sylvie Malardel). Claude suggested that the cubic grid experimentation could be a specific item of discussion for the next coordination video-conference (in March 2015).*

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

MF is finalizing the code version of the high resolution E-suite, CY40_op2. In parallel, a bugfix branch of CY41 will be updated with a few specific fixes for sanity checks (CY41_bf.02). The fixes concern LAM TL/AD, option LGWADV for Arome, CANARI safeguard with respect to LVARBC (in HOP), fix for the IO Server, fix for MF blacklist for SAPHIR. MF have started to test the Arpège 4D-VAR and the Arome 3D-VAR with CY41. For Arome, one full assimilation network time was run, with acceptable results both for screening, minimization and CANARI. For 4D-VAR, however, only CANARI and 4D-screening seem OK. In the minimization, the very first gradient is clearly totally wrong. Investigations will be going on in the coming weeks. Deborah indicated that we could exchange return listings of IFS and Arpège 4D-VARs in CY41, for comparison.

Preparations for CY41T1 have started, with the involvement of Aladin and Hirlam. The list of technical contributions is provided in Appendix A at the end of this document. Participants are invited to check and possibly send comments or questions to Claude by e-mail, after the meeting.

François reported about the progress of the operational system at MF. The IO server has been put to operations in June. In October, significant efforts had been devoted to change the format of observational input files from ASCII to BUFR (SYNOP, some Aircraft). The high resolution E-suite Arpège TL1198C2.2L105 and Arome-1.3km are now in their final stage of installation (all systems already run in the operational E-suite environment). Most of the observational changes expected will indeed be in this E-suite as well. However, the new convection scheme of Arpège, PCMT (and the associated new shallow convection scheme), did not make it into the E-suite. Tests with the new convection scheme showed improved performances in summer time, but slightly negative synoptic scores over a winter period. The expectation is to switch this E-suite to operations in February 2015.

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

EC is running CY40R2 in e-suite for implementation in Dec-Jan timeframe. The results are very positive, with strong positive impact on most forecast fields. These arise primarily from the data assimilation and physics changes, and there was also a useful contribution from improve use satellite data. This is the first scientific upgrade since November 2013, following the Cray migration during 2014. However there have been other satellite data implementations in 2014 between cycles, notably IASI on Metop-B.

EC is now planning actively for the next cycle, with a deadline for contributions for 41R2 likely to be towards the end of January 2015. Given current performance of the operational system on the Cray EC are reviewing whether to continue with the planned resolution enhancement across all systems (HRES, EDA, ENS, 4D-var) or whether to focus on delivering further optimisation first. Given this the implementation of 41R2 may be at current resolution, except perhaps for the 4D-var inner loop, with other cost-neutral scientific

changes. The resolution upgrade would then take place in 2016. However this is still under discussion. It is likely that the resolution upgrade will use a cubic grid in all configurations.

Looking further ahead a table giving some elements of possible changes in the next four years was also presented.

6. HIRLAM comments

Ulf mentioned that Hirlam will commit changes in the ODB for CY41T1, which had been agreed with EC. Furthermore, they will implement a LAM version of the de-aliasing scheme coded by Mariano Hortal (LGRADSP key). Ulf asked what was the right forum for discussing OOPS design aspects, coordination meetings or any meeting in the Scalability-included OOPS project. Deborah will ask Yannick (OOPS project manager). Claude suggested that the technical video-conferences could be used for these issues.

Action: Deborah to check with Yannick where/how OOPS design aspects can be discussed among EC/MF/LAM partners (technical video-conferences like for re-factoring ?).

7. ALADIN comments

none.

8. Specific issue: Optimization

Deborah summarized recent optimization work of the IFS on Cray:

- vectorization, in conjunction with by Ryad at MF
- I/O: EC plan to test Philippe's I/O server adapted for IFS
- Comms: EC are investigating ways to reduce the cost of MPI communications including testing of Philippe's IALLTOALLV
- ODB: Peter has implemented an optimized handling of the pool-to-proc link (way how to use the lookup tables). This drastically improves the ODB performance on Cray. The changes in the active ODB code remain limited (few changes in IOASSIGN, a few more columns in the ODB). Peter further recommends to turn off the 'pool-mask' option which was used in the past for post-processing purposes. Deborah asked about what compile options were used for the C compiler: those are presently -O0 at EC, and -O2 at MF. Action on Peter, to send information and/or ODB code about his optimizations to ODB contacts (Dominique, Eoin, Alena).

9. Content and timing of cycles

Joint cycle	ECMWF	MF	Start pre-φ	Declaration	Misc. / Oper plans
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CY40			March 2013	July 2013	
	CY40R1			Oct 2013	Oper in Feb 2014
	CY40R2			Feb 2014	Technical cycle including many OOPS & re-factoring features
		CY40T1	Dec 2013	Feb 2014	
	CY40R3			1 July 2014	Handover to OD/FD end of July 2014
CY41			End of March 2014	July 2014	Merge of CY40T1 and CY40R2
	CY41R1			Sept 2014	Merge of CY40R3 and CY41
	CY41R2		Deadline for changes: Dec 2014	Feb 2015	Scientific and OOPS technical changes incl.
		CY41T1	End of Nov 2014 = deadline for contributions	February 2015	Build this cycle (phasing) over Dec 2014 – February 2015
CY42				March-June 2015	
	CY42R1				Implement OOPS
		CY42T1		Nov-Dec 2015 ??	Dates to be confirmed
CY43				March-June 2016 ??	Dates to be confirmed

10. AOB

Ulf mentioned that Hirlam/Harmonie codes ran significantly faster on the Cray when using the gfortran compiler, rather than the Cray one. EC had quite the opposite experience with the IFS. Deborah will send Ulf details about EC's use of the Cray compiler. Ryad mentioned he had checked the Cray and Intel compilers (on Cray), and reached about a 7-8% increase of performance of Cray w/r to Intel, after several code optimizations.

11. Next meetings

Next technical video-conferences:

- Tuesday 22 January 2015, 1.30pm UK / 14h30 MEST

Next Coordination video conferences:

- Tuesday 17 March 2015, 1.30pm UK / 14h30 MEST. Specific topics: feedback about tests with the cubic grid (by EC); feedback of code evaluation and pre-phasing of CY41R2 (MF) and detailed timing of technical steps for building CY42 (EC and MF)

Next Coordination Meeting in Reading: Monday 15 June 2015 in Reading (EC)

List of actions

- 1 Update the recommendations about Fortran/C++/Boost standards for benchmarking and call for tender specifications => Deborah and Claude.*
- 2 Deborah to check with Yannick where/how OOPS design aspects can be discussed among EC/MF/LAM partners (technical video-conferences like for re-factoring ?).*
- 3 Peter, to send information and/or ODB code about his optimizations to ODB contacts (Dominique, Eoin, Alena).*

Appendix A: list of content of CY41T1

CY41T1: deadline of contribution end of November 2014. Build to take place over December 2014 – February 2015. Declaration in February 2015.

Provisional content:

- Bugfixes from CY40T1_bf, *to be reported on the responsibility of scientists and groups*
- Reports from MF's pre-operational suite (CY40_op1.04 and beyond, CY40_op2), *ibid. among them: AMV update (C. Payan)*
- Bugfixes from CY41_bf, *bf.01 should be a basis for T1, bf.02 should be merged by GCO*
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- System:
 - PREP version using Full-POS software (Philippe Marguinaud – PM -)
 - Possibility to encode fields with missing values in FA (PM)
 - Modset for PROGRID: bitmap, enable masks (PM)
 - Enable possibility to read fields in random order in the Arpège I/O; optimisation of I/O server; optimisation of SPREORD (PM)
 - Reading of LBC files from the I/O server (PM)
 - Fixes for Surfex I/O and Open-MP, for LFPPACKING; disabled intermediate compacting of model fields before post-treatment (PM)
 - *Enable GRIB2 in FA (PM)*
 - Enable possibility to directly write out GRIB1 fields in the FA-file software, for a potential use for MF's BDAP model output operational database (PM)
 - Pruning of code residuals for the obsolete Full-POS conf 927/928 (R. El Khatib – REK -)
 - Adaptation of the spectral data handling requested in configurations 901 and (e)923, in preparation of the total removal of the old SPA3/SPA2 array handling in the IFS (planned for CY42) (REK)

- Parallel version of “festat” code for Arpège (REK)
- Assimilation and use of observations:
 - Extension of VarBC code for multiple predictors for GPS/GNSS data (P. Moll, in consultation with R. Randriamampianina and M. Lindskog)
 - Code enabling the diagnosis of local correlation tensors in Arpège, used for instance for evaluating horizontal lengthscales of a wavelet Jb (Y. Michel)
 - Code for evaluating dispersion variances without in-core memory storage of all ensemble members (useful for large ensembles) (Y. Michel)
 - Code for assessing the optimal cut-off truncation of filtering (Y. Michel, following the work by B. Ménétrier)
 - CANARI code improvements linked with the use of SURFEX surface fields (F. Taillefer)
 - Fixes for LAM BGVECS (L. Raynaud)
 - Updates for Forecast Sensitivity to Observations FSO with Arpège (N. Boullot, A. Doerenbecher)
- Arpège forecast model:
 - encapsulation of Arpège-specific physics variables and modules into derived types, in parallel to what ECMWF will do for IFS (Y. Bouteloup, PROC team, E. Arbogast)
 - various local code improvements for specific dynamics options (K. Yessad)
 - code for calling SRTM (EC short wave radiation scheme) (M. Benamara, Y. Bouteloup)
- Arome forecast model:
 - Upgrade of the 1D surface ocean model CMO in view of an operational use in MF’s Arome systems like Overseas (G. Faure, F. Taillefer, Y. Seity, CRC/La Réunion team)
- HIRLAM (preliminary list, *to be confirmed*):
 - Upper air assimilation:
 - GNSS handling, pregpssol (Jana Sanches AEMET);

- Radar treatment (Martin Ridal, SMHI);
 - Humidity adjustment by MSG information (Sibbo Van der Veen KNMI);
 - Arome 4DVAR updates (Magnus Lindskog SMHI)
- Surface assimilation:
 - Bugfixes to CANARI (Trygve Aspelien MET Norway);
 - Interface to SODA from CANARI (Trygve Aspelien MET Norway);
 - SODA EKF updates (Trygve Aspelien MET Norway)
- UA Physics:
 - Radiation output changes (Laura Rontu FMI, Kristian Pagh Nielsen, DMI) ;
 - Unification of radiation schemes (Laura Rontu FMI, Jan Masek, CHMI);
 - Treatment of mixed phase clouds (Karl-Ivar IVarsson, FMI)
- SURFEX: ALARO-SURFEX interface fixes
- EPS:
 - Perturbation of observations (Roger R MET Norway);
 - Two new main programs, mten and pertcma #13038.
- Numerics:
 - Treatment of boundaries in spectral space (Mariano Hortal, AEMET);
 - De-aliasing of vorticity (Mariano Hortal, AEMET);
 - Davies-Kållberg relaxation at the upper boundary (Mariano Hortal, AEMET);
 - VFE NH updates (Mariano Hortal SMHI, Petra Smolikova CHMI)
- Technical: Rename of stat.F90 to festat.F90 (Ulf Andrae SMHI); Compiling and norm violations(Ulf Andrae SMHI)
- ALADIN/ALARO:

- Encapsulation “à la OOPS” of LAM/LBC coupling code (B. Bochenek, following a technical proposal by Karim)
- Some miscellaneous post-phasing cleaning in CY41 (B. Bochenek)
- ALARO-1 physics upgrade (R. Brozkova)