

IFS/Arpège Memorandum

From: Stephen English and Olivier Marsden

To: (ECMWF) DR & RD Section Heads

To: (Météo-France) Arpège diffusion list

To: (ALADIN) Piet Termonia, Daan Degrauwe

To: (HIRLAM) Daniel Santos-Muñoz

File: RD19-xxx

Subject: Minutes of the IFS/Arpège coordination meeting of 8 March 2019.

Participants:

Météo-France: François Bouyssel, Claude Fischer, Ryad El Khatib, Jean-François Mahfouf by videoconf

ECMWF: Stephen English, Michael Sleigh, Olivier Marsden, Peter Lean, Nils Wedi

ALADIN: Daan Degrauwe by videoconf

HIRLAM: Daniel Santos-Muñoz by videoconf

1. Adoption of Agenda

The agenda was agreed, albeit the order of some items was changed to accommodate when people were available. In these minutes the order of the original agenda is retained.

2. Approval of Minutes of meeting of 29 January 2019

Claude reported he received comments on the draft minutes from Olivier, Deborah and Steve, as well as comments from Michael that were for information but did not require a change in the minutes. The proposed changes have been made and revised minutes made available. The revised minutes were agreed.

3. Review of list of actions from last meeting

Both actions were closed.

4. MF information about progress and plans of E-suites and cycles (François, Claude)

François described the plans for the 43T2 e-suite at MF. This is intended to go operational in June 2019. Highlights include TL1798L105 Arpege configuration, use of Vortex python library, move to GRIB2, new diagnostics and new observations.

Claude then presented cycle planning and other items. Of particular interest is IFS/Arpege post-OOPS re-factoring coding training days in 2nd week of September. This links to ECMWF efforts to provide similar training in the new IFS training that will be first run in May. The 46T1 cycle will be ported to the new HPC. The level of testing needed for 46T1 delayed slightly MF delivery of Cy47. Alexandre Mary is leading the development of new testing tools for this. It was suggested that the MF testing tools should be presented to next VC meeting.

ACTION-1: MF to provide presentation of testing tools to next VC.

It was noted that the retirement of Karim inevitably makes the testing of Cy47 slower as the working practices in MF will have to evolve and new staff will be trained to join technical activities on the code system. The goal remains to deliver by end March and declare in May.

The porting of MF's applications to their next supercomputer has timing uncertainty similar to EC uncertainties in next HPC, having a similar 6 month flexibility. A decision will be made public in July. This means there is some flexibility of the timing of Cy48. Early and late Cy48 options were presented. The strong preference of both EC and MF is for the early Cy48 option. However this may have to be revisited, depending on the respective timetables for new HPC. Therefore late Cy48 option remains plan B. Assuming the early Cy48 option proceeds there will be either a very quick and limited 47T1, or actually no 47T1 at all, as there is insufficient time for an ambitious scientific cycle in this option.

François also presented an overview of contents of the next E-suite, to be based on 46T1. Headlines include snow analysis work, tuning of the obs operator std deviations, assimilation of many new observations, new model output (CAT index, ice crystals index), and changes to Arome (coupling of EDA and 3DVar, possible switch to Ecrad, new coupling procedure for Arome-IFS and overseas models). Regarding new model output, Olivier Jaron should talk to Peter Bechtold who has done recent work on these questions.

ACTION-2: MF and EC to exchange on development and implementation of aviation devoted model outputs (CAT, ice crystals) (O. Jaron/Y. Bouteloup, P. Bechtold)

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

Michael presented EC cycle plans. Plans for 46r1 are proceeding as previously described. The e-suite is about to start. The process has been complicated because of FDB4 to FDB5 transition, new build system and complicated script changes (continuous DA) and the e-suite is now on the critical path for a June implementation, so there is no slack now in the timetable. However at this moment the plan remains for June implementation.

As is the case for MF there is uncertainty over the timing of the HPC move, because vendors have 6 months flexibility. Therefore EC are also having to plan flexibly. Cycle 47r1 is being build, and it is anticipated that it is most likely it will go operational. However the timetable is tight and it will be an unambitious low risk cycle, and there may be insufficient time to include all changes proposed. Therefore changes are being prioritised. There remains a possibility there will be insufficient time for it to operational, so there remains a plan B to build the cycle without making it operational. However plan A is now for it to go operational.

There will then be a porting cycle for the new HPC, containing only those changes needed to run on the new HPC. The next scientific cycle will be built in 2021, with the precise timing uncertain for the reasons noted above, but implementation will be in 2022.

The decision on the new HPC at EC will be taken at an Extraordinary Council in September. However for IFS-Arpege planning it may be clearer earlier what the timescale is, even if details on the HPC procurement can't yet be revealed.

6. Technical status on CY46T1, CY46R1 and merge of CY47 (Michael, Claude)

Much of the discussion here had already taken place. However it was noted there was a need to share test cases. Information about this will be presented at the next VC.

ACTION-3: EC and MF to share information on test cases to inform and discuss on sharing at the next VC.

7. Specific topics

7.1. Continuous DA + COPE (Peter)

Peter presented the latest status on Continuous DA and COPE. In particular he noted that the case for COPE is now much stronger and it is needed to simplify the Continuous DA configuration, as the DA will be able to use whatever observations are available on the ODB store when the DA minimisation begins. This is particularly significant for the OOPS configuration where all minimisations are run in a single executable.

7.2. OOPS Progress (Steve)

EC are encountering some difficulties in delivering a working OOPS suite with 46r1. This means items on the OOPS close out report list are awaiting a working 46r1 version. The reasons for the 46r1 difficulties are under investigation and EC will keep MF informed of progress.

7.3. Model science (EC & MF)

- (a) Full-Pos ability and needs (e.g. interpolation with steep orography; IFS-FVM initial data preparation, new features) (Nils, Ryad)

Major Full-Pos design changes were needed for OOPS, with deep refactoring. This has led to significant benefits, and a speed up. The refactoring for the I/O server is not yet complete. This will be fully available in Cy47. It will be tested at EC as part of 47r1 testing and any issues reported back to MF.

The question of Boundary Layer interpolation in complex terrains was briefly discussed. . There was also a discussion on FVM-appropriate orography, and how to provide it to Full-Pos: Full-Pos should have the required features already, and these will be tested at ECMWF with CY47R1.

- (b) ECMWF model development (Nils)

Nils presented EC model development plans. Nils also described Mats' work with field containers. This methodology will be particularly useful for atmospheric composition, because aspects such as ozone chemistry can be run at lower resolution, taking weather fields from the high resolution run. This can allow cost-effective chemistry. The rationale behind the implementation of Atlas fields in the IFS was presented.

EC are currently assessing how to efficiently implement FVM features into the IFS general code structure. This topic is related to re-factoring the model state (and model fields arrays) for

progressively preparing the codes for new architectures. This is where Mats' proposals for extending the FIELD_CONTAINER concept on the one hand, and including features from ATLAS on the other hand, come into play. However, the exact strategy how to proceed should take into account the spec not to disrupt the current IFS model core. For instance, running the IFS with its current dynamical core without ATLAS should remain possible (when run on CPU/X86). Conversely, running IFS-FVM or running IFS on GPU will probably require to use elements from ATLAS.

These items are important cross-cutting issues for the coming years of collaboration (and upcoming cycles eventually). It was suggested to have a dedicated discussion on the implementation of FVM in the IFS in the 1st half of 2020. Details should be decided in the autumn (see also item 7.6 below).

(c) MeteoFrance model development, including details of the special projects proposed at WGNE (François)

Philippe Marginaud is looking at GPU aspects for Arpege and Arome forecasts. He will make contact with similar activities at EC via Olivier.

7.4. Assimilation and observation science (EC & MF)

a) ECMWF DA / Obs developments (Coupled assimilation, interface obs - ocean skin temperature -, Aeolus, All-sky strategy, Reconstructed radiances, PCs or just more radiances, FY-3 evaluation)

Steve gave a presentation of science development areas, both in the context of 47r1 and longer term.

b) MeteoFrance DA / Obs developments (...) (François)

An issue arising from François' presentations included the MHS all-sky assimilation at MF, that is tropics only. MF find main benefit of all-sky MHS is in the tropics and would be interested to know if this is also the case at EC.

ACTION-4: SE to discuss with Alan Geer and Niels Bormann the relative impact of MHS all-sky in tropics and extra-tropics and feedback to MF.

7.5. Single precision applications (EC & MF)

Nils Wedi showed the plans to make single precision IFS available for testing, which is now available with 46r1. He noted that the TL/AD code remains double precision, and this means OOPS runs everything double precision. So in testing it is only the forecast integration that is single precision, running from the 4D-Var analysis created running under double precision. A SP FAQ is being made available by Michail and Peter D. to answer questions about the SP configuration.

ACTION-5 : EC to provide access to SP/FAQ in Confluence to MF (Philippe Marginaud)

7.6. Views about adapting the codes to new HPC architectures (EC & MF)

Nils mentioned the Scalability paper being developed for EC SAC. MF will be given early sight of a draft to comment on coordination aspects, probably in July.

ACTION-6 : Nils to discuss with Peter Bauer if it will be possible to provide an early draft (July timeframe) to MF for comments.

8. Comments by LAM partners

No additional comments/

9. Content and timing of cycles

Below is an updated version of the overview Table of Cycles, after discussion.

The possibility for two scenarios was kept at this meeting, with a preference for the “early-CY48” case. The timing will have to be re-assessed at the next coordination videoconference (4 July 2019):

1. an “early CY48” scenario with a build of CY48 in December 2019 – February 2020. This scenario would enable to make a joint cycle just before migrating to the next HPCs (+Bologna for EC) in the case where these migrations would have to start in the Q1/Q2 of 2020. In this scenario, MF and the Aladin/Hirlam partners would evaluate whether they can build a scientifically limited, mostly technically oriented “quick” cycle CY47T1 (wrap-up of missing features from CY46T1, OOPS aspects for Arpege or Arome, optimization or porting items). There will be a risk of totally dismissing CY47T1, if any additional time constraint appears..
2. a “one-year interval” scenario with CY48 built in the period [February – May 2020] (thus about one full year between CY47 and CY48). In this scenario, MF and the LAM partners would build a scientific/technical CY47T1.

Joint cycle	ECMWF	MF	Start of phasing	Declaration	Misc. / Oper plans
CY45			March 2017	28 June 2017	MODEL object re-factoring
		CY45T1	2nd October 2017	24 January 2018	Including Aladin and Hirlam
	CY45R1		May 31 st 2017	August 2017	Operational June 2018
	CY45R2		Mar 31 st 2018		Technical cycle for introduction of ecBuild
CY46			Start Jan 15 th , 2018	10 April 2018	<i>OOPS aspects added as extra branch on CY45R1 for CY46</i>
		CY46T1	Oct-Dec 2018	March 2019	Technical update for fixes (assimilation) plus some science
	CY46R1		31 May 2018	Feb 2019	OOPS updates + science
	CY46R2			<i>cancelled</i>	Research section version only if CY46R1 is frozen

					for operations before Bologna
CY47			Mid-February 2019	May 2019	Target joint cycle for baseline OOPS in Research mode
		CY47T1	Autumn 2019	<i>Note: risk that this CY47T1 is dismissed if additional time constraints appear!</i>	Missing features from CY46T1, OOPS updates for Arpege or Arome, optimization or porting items. New science only if CY48 is late!
	CY47R1		April 2019	July 2019	This R1 will be built from several parallel RD branches, plus a CY47 branch
CY48 -early option -late option			- Dec 2019 - early spring 2020	- end of Feb 2020 - late Spring 2020	Early preferred, subject to procurement timelines

10. AOB

Steve asked whether MF were considering to assimilate drone data (answer: no). Some additional short discussion about NetAtmo data especially around complex coastal lines (Nils, referring to work going on at Met.no).

EC confirmed that MF's proposal for handling array bound violation without causing runtime stops in forecast model interfaces was accepted. Ryad will then implement the feature in CY47.

11. Next meetings

Next technical video conferences:

- ⇒ To be confirmed: in the week 11-14 June (Claude to check with everybody)
- ⇒ after the meeting, this date was set to Wednesday 12 June, 14h30 (CET) / 1.30pm (UK)

Next Coordination video conferences:

- ⇒ Thursday 4 July 2019, 14h30 (CET) / 1.30pm (UK)

Next physical Coordination Meeting:

- ⇒ March 2020, Toulouse. TBC.

List of actions decided:

1. MF to provide presentation of testing tools to next VC.

2. EC and MF to share information on test cases to inform and discuss on sharing at the next VC.
3. MF and EC to exchange on development and implementation of aviation devoted model outputs (CAT, ice crystals) (O. Jaron/Y. Bouteloup, P. Bechtold)
4. SE to discuss with Alan Geer and Niels Bormann the relative impact of MHS all-sky in tropics and extra-tropics and feedback to MF.
5. EC to provide access to SP/FAQ in Confluence to MF (Philippe Marguinaud)
6. Nils to discuss with Peter Bauer if it will be possible to provide an early draft of the SAC paper (July time frame) to MF for comments.