

IFS/Arpège Memorandum

From: Claude Fischer

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 videoconf meeting of 4 July 2019.

Participants:

Météo-France: Claude Fischer, Ryad El Khatib, Jean-François Mahfouf, Stéphane Martinez, Harold Petithomme
François Bouyssel excused

ECMWF: Stephen English, Michael Sleight, Olivier Marsden, Nils Wedi, Tomas Wilhelmsson, Peter Lean

ALADIN: Daan Degrauwe excused

HIRLAM: Daniel Santos-Muñoz excused

Note: slides of the talks by Claude, Michael, Steve and Nils can be obtained from either Claude or authors, on request. Claude will make the presentations available internally for the GMAP Section in MF.

1. Adoption of Agenda

agreed. Item 9 was discussed with item 6 (timing of cycles / status of CY47 resp.).

2. Approval of Minutes of meeting of 8 March 2019

agreed

3. Review of list of actions from last meeting

1. MF to provide presentation of testing tools to next VC. *Alexandre Mary presented the ideas and tools for revisiting the work practices for code validation in MF, at the technical videoconf of 3 July. Action closed.*

2. EC and MF to share information on test cases to inform and discuss on sharing at the next VC. *Discussed also at the 3 July tech'VC. As a start, we intend to share low truncation IFS and Arpège forecasts. Action closed.*
3. MF and EC to exchange on development and implementation of aviation devoted model outputs (CAT, ice crystals) (O. Jaron/Y. Bouteloup, P. Bechtold). *Olivier J. and Peter had been in touch with one another. Action closed.*
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. *Philippe Chambon and Alan Geer have been discussing the impact of microwave all-sky radiances in a specific VC. They decided to run and compare OSE experiments for cloudy microwave, with a focus on the relative impact of data in the Tropics on the forecast performance in the mid-latitudes. Action closed.*
5. EC to provide access to SP/FAQ in Confluence to MF (Philippe Marguinaud). *Michael Diamantakis provided the Confluence access to Philippe Marguinaud. Action closed.*
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. *The draft paper is still in the redaction process with Peter Bauer. It is expected to be ready in end of July. Nils will send the final draft to Claude, for circulation in GMAP. Action open (reformulated).*

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

Claude gave an update about the very recent switch to operations of CY43T2, which is a major NWP achievement for 2019 in many aspects: very general positive scores, specific positive feedback of the subjective evaluation, important (and complex) technical modernization of the operational scripting system (Vortex in all NWP applications, GRIB2 encoding of post-processing and Arpège historical files) etc.

Unlike expected (hoped) at the time of the 8 March coordination meeting, MF will not be able to implement a comprehensive CY46T1 e-suite in the autumn 2019. On the side of Research, CY46T1, though very close to full validation for Arpège 4D-VAR and Arome 3D-VAR, still misses a few ingredients from the CY43T2 suite, and a number of applications remain to be tested (ensembles, ...). On the side of Operations, the timing for freezing the operational suites before migrating to the next HPC remains very tight (no later than about February 2020), and implementing a new e-suite should be entirely ready by the end of September 2019 (this now seems fairly out of range for CY46T1 *plus* scientific changes being fully tested). An additional constraint is that operational teams in charge of the o/e-suite monitoring and evolution will suffer temporarily from reduced staffing, while several other operational suites (besides NWP) also will require updates this autumn. For NWP, the plan therefore would be to implement a reduced e-suite focusing on some Arome improvements (snow analysis, grid point horizontal diffusion tuning) along with on-the-fly changes for observations, all these changes in CY43T2. Some specific post-processing for aviation might be ported unto CY46T1 in order to enable new outputs.

Claude introduced an updated view on the roadmap for migration and the evolution of operational suites in 2020-2021, and somehow beyond (until 2024). A critical information for the planning of 2020 remains the public announcement of MF's choice for the next HPC, and the timing for installation and validation/porting. This important decision would become public by about end of July.

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

Michael reminded the operational implementation of CY46R1 on 11 June, which was a major new operational cycle providing significant improvements in EC's forecasting systems (note: there had been several webinars about CY46R1 organized by the Forecast Dept. for member states). The scientific and technical content of CY46R1 has been described in the 8 March meeting (refer to minutes and slides of presentations).

CY47R1 will be the next scientific interim cycle in Reading. Scientists are being asked to provide their contributions ready for 15 July, so that the integration phase can start. Declaration is scheduled for end of October, with an aim for an operational implementation in the 2nd quarter of 2020. The increased scientific and operational target for CY47R1 is now possible because of the slight shift of calendar of the HPC move to Bologna (by about 3 months). The contract signature of the next HPC for EC is expected at the December 2019 Council meeting. Much of 2020 would then be devoted to installation and Acceptance test process of the next HPC, in parallel to moving the Data Center (DC) to Italy. The operational declaration of DC+new HPC is expected for beginning of 2021.

After CY47R1, which would be the operational migration cycle, EC expect to work on CY48R1 which would be the first e-suite cycle in Bologna. The e-suite handover to Operations is planned for the 4th quarter of 2020. EC expect that IFS forecasts in single precision (SP) will be made ready for that target, with an aim to use SP in the ENS runs. Other scientific ingredients include an update of the ENS configuration, consistent moist physics framework, multi-layer snow scheme.

About SP, Claude confirmed Philippe Marguinaud is now coordinating efforts in GMAP in order to assess SP in Arpège and Arome.

CY49R1 is tentatively scheduled for end of 2021 (e-suite handover) for operational declaration in 2022, and would include OOPS for 4D-VAR/IFS. The draft scientific content of this suite includes OOPS operational implementation, NEMO-4 (ocean), SI-3 (sea ice), multi-layer surface variables in IFS, multi-layer soil scheme.

6. Technical status on merge & validation of CY47 (Michael/Olivier, Claude)

note: some technical status (as compiled by Claude on 26 June) is listed in the Appendix 1, for general information.

Since 26 June, we do have a v04 of pre-CY47 available in the MF GIT-repository. For that version, MF has run the “mitraille” technical test bench with accepted results (this covers global and LAM models, adiabatic and with physics, TL/AD, fullpos and a few ancillary configurations – data assimilation is missing).

Since May and v03, the pre-CY47 is shared with EC, and Olivier has started to test IFS forecast and 4D-VAR. The present status is that there seem to be two remaining issues: (1) minimization sometimes crashes (Olivier and Gabor investigate this problem), (2) the IO-server crashes in the CRAY environment (but works with Gfortran and INTEL – Olivier has been asking and obtained support from the Forecast Dept. on this problem). Olivier and Claude will continue to liaise about the details of technical validation in the next two weeks (Action). Item (1) was very desirable for cycle declaration (if feasible, before mid-July), while item (2) could be dismissed for initial declaration (and added later as a bug fix). There was a consensus that cycle declaration should occur at the latest in the 2nd half of August, so that MF and LAM partners could start creating branches in view of CY47T1.

In the continuation of this discussion, the timing of cycles CY47R1, CY47T1 and CY48 were addressed, and the so-called “early CY48 scenario” has been adopted. This decision is reflected in the Cycles Timing Table of Section 9 below. The outlook until CY49 has been added as well.

7. Specific topics

7.1. OOPS Progress (Steve – Olivier)

Olivier gave a brief update about recent tests and progress with the OOPS binaries. A few specific options of 4D-VAR still are under investigation (Jc-DFI – Sébastien Massart; weak constraint to be checked), otherwise the 4D-VAR minimization and the outer loop sequence in one binary, including trajectory, are OK with CY46R1. Additional fixes are required in order to run screening (Peter) on top of CY46R1/CY47. Those will enter CY47R1. Continuous data assimilation is ready in OOPS/C++, but work remains to be done in the ODB layer for completion. Olivier confirmed that the only new features for OOPS-IFS, not yet provided in the CY46R1+OOPS that is shared with MF for CY47, are for running screening in the first trajectory.

Steve explained that discussions with the Operations at EC would start soon in order to check the operational requests for OOPS-IFS.

Steve explained that whilst the technical developments for OOPS are close to completion, including integration of new developments such as Continuous DA, there are outstanding issues that need to be resolved before operationally switching to OOPS. In particular the documentation, the training of RD developers and the details of the operational configuration. Also testing in full mode, including EDA. Therefore it is not realistic or sensible to implement before the new HPC, and implementation is likely to be in Cycle 49R1 at Bologna, in 2022, as noted above.

Claude confirmed MF had been running several OOPS prototype unit tests with CY46T1 (Etienne): obs operator tests, low truncation T21 Arpège forecasts (with some TL/AD), a “three-obs” 3D-VAR minimization in T149. Among specific issues, work remains to be done in order to fully test the Arpège simplified physics in TL/AD (some trajectory handling in the Fortran code has to be checked and adapted). EnVar scientific work based on OOPS is still being done in CY43.

The question of how to share a CY47-based code version for cross-OOPS testing in EC and MF was addressed. Olivier confirmed he intends to port all OOPS devs not present in CY47 (i.e. those in CY46R1+OOPS) unto a specific CY47_OOPS branch. In addition, the appropriate C++ OOPS version will have to be decided and shared. Olivier, Claude and Etienne will liaise for this coordination in due time. (Action)

MF asked about any plans to re-factor the IO-server code for OOPS, as the server wasn’t yet tested. EC explained that there was probably no re-factoring needed in the core of the IO-server code. Only the high-level management of MPI communicators will have to be ported in the C++ layer.

7.2. Model developments update (Nils Wedi)

Nils recalled the successful scientific visit by Jozef Vivoda, which enabled to define a much more robust setting of vertical finite elements for both hydrostatic and NH IFS configurations. Work has been done at EC in order to use Full-POS for initializing FVM from IFS. The most suitable combination is with using vertical profiles cast with $\text{Log}(p)$ (instead of p) before interpolating unto a Z-coordinate (otherwise the height of the lowest model level might be diagnosed below the

ground). Coupling of IFS physics with FVM is progressing, at present work focuses on radiation and surface scheme (note : large scale precipitation is already done).

Nils explained the efforts now started and ongoing, for developing DSL-type of approaches for the IFS codes. The aim is to define a simple scientific code version suitable for R&D, however likely not optimized for most present or future HPC architectures. The scientific codes will then have to be converted into machine-specific, highly optimized codes which will differ from one target platform to another. Other NWP centers in Europe are engaged in such efforts (e.g. Met Office Psyclone project or Meteo-Swiss, which already is a partner of EC). The specific case of the physics code was mentioned, where EC will try out a purely 1D-column model layout (for the scientific code), with the horizontal dimension being handled by a specific DSL-tool at the creation of the optimized code (add-on NPROMA or KIDIA:KFDIA sort of indices in the local arrays).

Nils confirmed that the EC paper about porting the IFS codes to future HPC, aimed for the upcoming autumn SAC meeting, is still in the redaction phase (PI is Peter Bauer), and will be sent to MF for an early scrutiny as soon as ready (expected to send the paper by end of July). (Action)

7.3 Machine Learning and Artificial Intelligence perspectives as seen at ECMWF (Steve)

Steve introduced a recent paper about Machine Learning (ML) techniques and their exploration at EC. The paper presents a number of views about potential benefits of ML and suggestions for applications and project proposals. EC would be interested to get MF's views about ML, the potential implications of ML-techniques in areas of the IFS/Arpège collaboration, or suggestion by MF on topics of high priority. Steve explained that EC was aiming at submitting proposals on ML to the upcoming Calls of H2020. A collaboration with Marc Bocquet (ENPC/IPSL) has been started on ML and parameter estimation. In modelling, exploration of ML approaches for radiation computations has been considered.

Action on MF to provide feedback about the ML paper to EC, until the next coordination VC.

7.4. Other various items around the IFS/Arpège collaboration (Steve)

Steve listed a number of areas of ongoing collaborations by EC with various partners :

- joint OSEs for cloudy microwave radiances : EC & MF (A. Geer and P. Chambon involved) (see action above);
- new satellite observations – in particular joint efforts with Met Office and EUMETSAT on FY-3D and FY-4A and raised the question of Météo-France's readiness to collaborate in a Tiger Team or similar framework for the forthcoming Early Morning orbit FY-3E satellite, where CMA have asked for fast feedback to determine if they will continue to own the E-AM orbit slot. He also highlighted the very encouraging progress with Aeolus, where it remains the goal to use Aeolus operationally at ECMWF before end 2019, given a successful switch to the B laser;
- OOPS links with JEDI : JCSDA is implementing an OOPS version in the JEDI data assimilation platform. EC and JCSDA will continue to collaborate on OOPS but will not share a common repository. The strategy is to keep two separate repositories (OOPS-JEDI at JCSDA, OOPS-IFS at EC) and ensure that relevant developments can be phased from the one to the other. There is a risk that the two versions eventually diverge with “no return” possible, which is at present an accepted scenario at EC. However without compromising

operational requirements at EC we will aim to be as closely aligned as possible for as long as possible;

For the IFS codes, it was noticed that the developments of continuous DA (EC), all-sky microwave retrieval and assimilation (MF), along with the last re-factoring for OOPS (EC) have made the phasing of the OBS codes for CY47 more complex than expected (especially around GOMs). Some earlier exchange of information could be useful here. The next coordination meeting should discuss potential changes to GOMs handling / all-sky aspects, both scientific & technical (Alan Geer and Philippe Chambon should be invited then). (Action)

However it was also noted that there was a particularly large effort on the GOMS to prepare for OOPS, and it was these changes that were an issue for MF. There is no particular reason to conclude that issues in future will arise in this area. Therefore the point is much broader than the recent experience of Alan Geer and Philippe Chambon, and relates to MF developing code on a version of IFS, which can then prove difficult to merge to latest version if major restructuring has in the mean time taken place. So even more generally, time seemed ripe to make an overhaul of upcoming and recent major code changes, for the next few cycles (CY48, CY49). EC probably would have the most input to provide here (eg. status of FIELDS_CONTAINER development by Mats ?). (Action)

8. Comments by LAM partners

dismissed.

9. Content and timing of cycles

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

Joint cycle	ECMWF	MF	Start of phasing	Declaration	Misc. / Oper plans
CY46			Start Jan 15 th , 2018	10 April 2018	<i>OOPS aspects added as extra branch on CY45R1 for CY46</i>
		CY46T1	October 2018	28 February 2019	Technical update for fixes (assimilation) plus some science
		<i>CY46T1_bf</i>	<i>June 2019</i>	<i>September 2019</i>	<i>This is a specific branch for wrapping up CY43T2_op2 changes on top of CY46, as a step towards CY47T1</i>
	CY46R1		31 May 2018	Feb 2019	OOPS updates + science. Operational since 11 June 2019
CY47			Mid-February	July or Aug 2019	Target joint cycle

			2019		for baseline OOPS in Research mode
		CY47T0	End August 2019	September 2019	OOPS-MF prototype & array bound check
		CY47T1	By about 10 October 2019	End of November 2019	Deadline of contribution will not be “expandable”. MF aim is to wrap-up all changes from CY43T2_op2. LAM partners will be asked to follow the same restricted specs for their contributions.
	CY47R1		July 2019	End of October 2019	Expected to become the porting cycle for Bologna
CY48			Dec 2019	End of Feb 2020	
		CY48T1	Sept 2020 ?	Nov 2020 ?	
	CY48R1		Q2/2020 ?	Q3/2020 ?	Single precision runs in ENS
CY49			Dec 2020	End of Feb 2021	tbc
		CY49T1			
	CY49R1				OOPS operational for 4D-VAR/IFS

10. AOB

None.

11. Next meetings

Next technical video conferences:

- ⇒ Wednesday 3 July, 14h30 (CET) / 1.30pm (UK) => minutes available from Claude
- ⇒ Tuesday 19 November, 14h30 (CET) / 1.30pm (UK)

Next Coordination video conferences:

- ⇒ Thursday 4 July 2019, 14h30 (CET) / 1.30pm (UK) => minutes herewith!
- ⇒ Friday 29 November, 10h00 (CET) / 9.00am (UK)

Next physical Coordination Meeting:

- ⇒ March 2020, Toulouse. TBC.

List of actions decided:

1. Nils to send Claude the draft paper about adapting and porting the IFS codes on new architectures (SAC paper).
2. Claude and Steve to exchange relevant information and material about code training planned both in MF (9-12 Sept. 2019) and EC (a bit later).
3. Olivier and Claude to liaise about the details of technical validation of pre-CY47 in July, possibly August, and agree on exact date for declaration.
4. Olivier, Claude and Etienne to liaise in due time and agree on code versions to share: CY47_OOPS Fortran branch, appropriate OOPS/C++ version from OOPS-GIT repository.
5. MF to provide feedback about the ML paper to EC, until the next coordination VC.
6. The next coordination meeting should discuss potential changes to GOMs handling / all-sky aspects, both scientific & technical (Alan Geer and Philippe Chambon should be invited then).
7. EC to prepare presentation for next meeting on significant tech changes/refactoring around CY48-CY49.

Appendix 1: overview of build of CY47 and technical status as of 26 June

(listed by Claude)

Specific milestones of the Build process EC/MF:

- MF received a pre-CY46R1 from EC for code scrutiny and test of compilation, on 21 January 2019. On the basis of this code, Karim sent a merge analysis note to GMAP (internal note from 29 Jan), as well as specific comments on changes in Setup and Dynamics to EC. Stéphane sent specific comments about problems encountered when compiling the code on MF's BULL.
- MF received the final CY46R1 code version for the merge on 21 February (compiled by GCO, compile issues from 21/01 had been taken into account by Olivier Marsden).
- Start of code merge with CY46_t1.08 (last pre-cycle version of CY46T1, extremely close to the final version of T1) on 26 February. Stéphane sent an internal note with specific difficult merge issues, for analysis and scrutiny by GMAP staff (1 March).
- CY46T1 declared as main at MF on 28 February
- [v01] first initial merge of pre-CY47 completed on 1 March (T1+R1).
- MF sent the Tech'Memo of CY46T1 (aka FLUB) to EC on 1 March (Claude to Olivier, Michael and Steve). EC sent the FLUB of CY46R1, including the technical description and the list of modified files per commit, to MF on 11 March (Michael to Claude). EC sent a second version of the CY46R1 FLUB on 27 March (tidy up of previous version).
- Actions started in GMAP (status of 13 March) :
 - refer to previous status report on PNT-mine.
- Phaser meeting summary of Tuesday 19 March:
 - refer to previous status report on PNT-mine.
- Phaser meeting summary of Thursday 28 March:
 - refer to previous status report on PNT-mine.
- MF built its local v2 of pre-CY47 (in MF GIT: CY46T1_r1.02) on 3 April with code contributions by Ryad, Fabrice, Christophe, Olda and Etienne. This code version was sent to ECMWF on 5 April. Full mitraillette testing was launched in parallel to sending the code to EC (Patrick S.). Results have been summarized and uploaded to PNT-mine on 12 April.
- Actions started and followed-up in GMAP as of 10 April (after test results of v2 became available):
 - look back on previous **major trouble shooters (i.e. should be fixed in v02)**:
 - dirty initialization code in GNH_CONV_NHVAR and SPNH_CONV_NHVAR from CY46R1 (corrupted NH state vector initialization after reading IC file)
 - SLHD code had to be fixed (complex merge)
 - specific SL new options from CY46R1 have been preventively aborted in the setup when irrelevant (eg. RK4 option for trajectory in LAM case) or not coded (eg. LAM version of WENO option in IFS)
 - the additional dimension added on snow arrays throughout the model code had to be carefully reflected into Arpège physics and Full-POS. Note: not yet sure whether something has to be done for specific CANARI snow arrays (if any ?)
 - LAM codes have been updated with respect to interface changes in IFS (so-called "monkey business")
 - assimilation and observations:
 - progressively porting the OOPS unit tests under the new testing environment tool "Davaï" (Etienne, Alexandre); status report by Etienne about his early testing of obs operators with pre-CY47/v02 => see Appendix
 - **code check for SCAT code: code scrutiny was OK (Christophe)**, awaiting a potential test of SCAT obs data with the OOPS obs operator tools (Etienne, Christophe) ?
 - **code check for CANARI** (Camille & Patrick M. contacted => **eye scrutiny of the code seems OK**). Will see later whether some of the 46R1 changes actually provoke

- undesired side effects in CANARI, for instance the additional dimension in snow arrays)
- [Etienne & Claude:] **post-merge re-phasing of CVAR2IN(AD)** for the two code solutions implemented for hybrid variational assimilation using an alpha-type of CV extension (LACV/IFS, LENSICOV/Arome) => Sébastien Massart (EC) and Yann Michel (MF) contacted for validating the proposed re-phasing => they both confirmed
 - **re-phasing of Arpège code solution for IR radiance inter-channel error correlations (SURAD)** => Vincent G. has provided a recoding in SURAD to take into account the Arpège handling of inter-channel correlations (for v03)
 - **in-line chemistry code**: this was updated in CY46T1 with a code contribution by the CNRM Climate group for Arpège-chimie, however now clashing with code updates in CY46R1 by ECMWF. Therefore, the merge was particularly difficult, and was likely to produce a not fully satisfying code. Claude contacted Romain Roehrig, Antoinette Alias and Martine Michou (GMGEC) for code check and phasing corrections (note: unfortunately, no “quick” testing possible here, at least for now). => the suggested solution is to rename one routine from 46R1, otherwise stick to either pre-CY47/v02 or to 46T1:
 - routines aplpar.F90, chem_main.F90, chem_init.F90 are kept as in v02 of pre-CY47
 - routine acchem.F90 is taken from CY46T1 for the next pre-release (v03) of CY47 (this routine will only be used by Arpège-Climate with inline chemistry)
 - routine acch_csr.F90 for pre-CY47/v03 is also taken from CY46T1 with no changes as seen in CY46R1 (this will stay as an Arpège-only routine)
 - version CY46R1 of the “same” routine acch_csr.F90 will be renamed as mocage_csr.F90 (then only for use in IFS-chem)
 - *note: precise update in GIT to be confirmed with ECMWF and MF/GCO team*
 - **ALARO mitraille run not bit-reproducible** (about 15 digits #): Olda Spaniel is investigating this test
 - **compile errors in blend.F90, blendsur.F90, check_limits.F90 fixed** (Ryad)
 - Arpège forecast mitraille results with physics:
 - very different norms (about 15 digits # at the end of integration) => plot fields, control results with the help of PROC team (Patrick S., Yves B.)
 - it is being recalled that global adiabatic runs *do not* provide bit-reproducible norms (about 5-6 digits =; perhaps because of changes in the SL code in R1, or due to changes in details of the Legendre transform code?)
 - visual **code scrutiny of APLPAR: OK (Yves)**
 - Note: adiabatic LAMs as well as Arome seem bit-reproducible w/r to CY46T1 (!)
 - **IO_server tests crash in both LAM and global runs**: to be checked with ECMWF. As of 2 May, the IO_server was crashing in IFS pre-CY47 (Olivier has sent some technical status of his tests to MF). The IO_server is OK in both CY46R1 and CY46T1.
 - **check of results of c923/e923**: OK (very small differences seen on the global field of direction of subgrid orography, not numerically significant as it scales with 10^{-16} for radians)
 - **FESTAT compile error: fixed by Ryad** (for v03)
 - **build of v03 of pre-CY47: done on Friday 10 May**. Contributions listed:
 - Ludovic: fix for GRIB2, fix for surface stress
 - Ryad: various fixes and cleaning (branch “khatib_CY46T1_r1.02%*mrg*” - see doc of GIT branch for details)
 - Vincent: MF update for IR inter-channel correlation handling (SURAD)
 - Etienne/Claude: phased CVAR2IN(AD) for IFS/Arpège hybrid control vector components
 - GCO: updated names and locations of specific IFS-CAMS and Arpège-Climate chemistry routines (following the suggestions by the MF Climate group)
 - Olda Spaniel: fix for making Alaro forecast test bit-reproducible w/r CY46T1

- Olivier Marsden (EC): several fixes for IFS (probably not affecting the MF configurations)
- Note: v03 will be compiled as a full main pack, and a debug version will be made available (possibly for use in the search of the IO_server problems)
- status of validation updated as of Thursday 23 May (Claude & Olivier M.):
 - MF status:
 - results from Olda Spaniel (from Bratislava): ALARO now bit-reproducible with v03
 - IO_server tested successfully for Arpège and Arome mitraillette runs when switching off the call to EC_MEMINFO. MF will continue to validate the codes of CY47 using the environment variable “export EC_MEMINFO=0”. This choice is for the time being also recommended for future OLIVE and pre-operational configurations.
 - In v03, several specific FP tests were fixed as well.
 - With the above, v03 provides successful mitraillette tests for all Arpège (global) and LAM forecasts, Full-POS and other tested configurations. LAM forecasts appear to be bit-reproducible w/r to CY46T1 (!).
 - issues noted by MF: poor performance of the RTTOV code.
 - EC status:
 - fixed ALLFPOS received from MF (Ryad) seems to enable running full IFS 4D-VAR
 - test of Ryad’s code updates for array bound check is ongoing (run 4D-VAR)
 - 2-3 small corrections on top of v03 (mostly in #ifdef places that don’t affect MF)
 - outstanding IO_server problem for IFS on CRAY:
 - a small toy IFS test on PC using GNU compilers was fine
 - 2 tests ongoing on CRAY: (1) with GNU compiler, (2) with INTEL compiler
 - suspicion on a specific problem with CRAY environment: open question for now
 - for v04: Olivier expects a clean fix for EC_MEMINFO (call MPI_BARRIER only on those procs that do not serve for the IOS)
- status of validation as of Thursday 20 June:
 - MF:
 - all mitraillette tests OK based on v03 + a few last fixes (see below content of v04);
 - tests of Ryad’s array bound check codes OK in Arpège and Arome tests;
 - open issue: the call to RTTOV below MF_PHYS, when computing simulated satellite images, has a dramatically increased numerical cost (about 10 times more expensive than in CY46T1, suspicion on an effect linked to the thresholds of radiative ice/liquid water content used for defining cloudiness in RTTOV) => question for EC: have there been any changes in CY46R1 that could explain this difference ? (who to contact ?)
 - EC (Olivier’s info):
 - with a few additional fixes on top of v03, 4D-VAR IFS is running with satisfactory results when using binary files compiled in debug (note: 4D-VAR is not bit reproducible w/r to CY46R1 – which however was not to be expected). 4D-VAR with optimized binary files crashes; there is a suspicion on a Cray compiler problem as several crashes were noticed by EC with recent code versions. For these technical tests, the IO-server is switched off.
 - The IO-server was tested separately on a toy model config: for now, there is a suspicion on a specific problem in the Cray environment since a parallel test with GNU-compiler was fine. An additional test using the INTEL compiler will be done as well.
 - Olivier intends to separately test IFS/4D-VAR for Ryad’s array bound check code. This evaluation will be only numerical (bit reproducibility w/r to pre-CY47 v03+ is expected). Due to time constraints, it is however unlikely that the tests can be completed before CY47 is to be declared.

- OOPS tests: recent results seem to confirm that CY46R1 works now with OOPS (the earlier pessimistic evaluation was due to problems in the test package itself, and how to analyze some specific test cases – eg. case of the so-called late 4D-VAR restart -).
- build of v04 of pre-CY47: 26 June, with a view on declaring CY47 soon after.
 - code improvements for simple precision LAM (neutral impact in double precision): EGGPACK, SUEFPG3 (Ryad)
 - some specific fixes for non-initialized variables and array bound violations, found while testing the array bound violation-proof modset (Ryad)
 - two fixes for single-precision in Arpège (Philippe M.)
 - additional updates of known bug fixes from the ALADIN community (Daan from CY46T1_bf => GCO will re-phase them directly into CY47 as they are trivial): 2 fixes from RMI (chkevo.F90)
 - GCO: delete useless LFI routines (list of 6 routines from Olivier M. & Philippe M.):
lficaq.F90
lficax.F90
lfichi.F90
lfidah.F90
lfidst.F90
lfiled.F90
 - fixes from ECMWF (code changes to be sent to MF by Olivier): ALLFPOS (actually Ryad's fix); clean fix in EC_MEMINFO (only I/O-processors can call MPI_BARRIER at this level of CNT0, not model processors); a few small fixes for IFS conf. (several corrections for screening)
- Leftover problems, and leftover code changes **for after declaration** of CY47_main:
 - Ryad: fixes and modified interfaces below CPG in order to *enable running executable files with full array bound check => pending validation in IFS, would enter CY47T0/T1 at MF*
 - further investigation of the 4D-VAR crash with optimized binary files on Cray (Olivier)
 - IO-server/MPI environment aspects on Cray (Olivier)
- post-CY47 note for MF: the proposal would be to build soon after CY47_main is declared, an interim technical cycle CY47T0 containing,
 - Ryad: fixes and modified interfaces below CPG in order to *enable running executable files with full array bound check*
 - Etienne: OOPS/C++ and OOPS-IFS/Interfaces code changes ported from CY46T1 to CY47 in order to enable unit testing of OOPS components in the MF prototype testing environment “davaï” (in coll. With Alexandre)
 - any other potential bugfix from late tests of CY47