

# IFS/Arpège Coordination Report

**From:** Claude Fischer (MF)

**To:** (ECMWF) HR, RD Division & Section Heads, List of recipients

**To:** (Météo-France) Arpège diffusion list, other MF (Arome) correspondents

**To:** (ALADIN) Piet Termonia, Daan Degrauwe, Roger Randriamampianina

**To:** (HIRLAM) Ulf Andrae

**File:**

**Subject:** Draft minutes of the IFS/Arpège coordination video-conference - Cycle 40 – held on 5th December 2012.

## **Participants:**

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

**ECMWF:** Jean-Noël Thépaut, Deborah Salmond, Anne Fouilloux

**Part time:** (none)

**ALADIN:** Daan Degrauwe

**HIRLAM:** Ulf Andrae

## **0. Adoption of Agenda (start at 14h30 Tlse / 1.30pm Rdg)**

adopted. 3 issues were listed for the technical specific aspects (F2003, EC/MF video-conference on Full-POS2 and VarBC predictor code).

## **1. Approval of Minutes of Coordination meeting of 28th June 2012**

approved.

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

1. *ECMWF will prepare C++ coding guidelines for OOPS: postponed to after the scientific review and its outcome => EC will investigate whether the guidelines can be made common to OOPS & COPE. Anne will contact the OOPS core team at EC, and later liaise with MF and LAM partners. Action kept open.*
2. *GIT: EC will keep MF informed about the progress of their internal discussions; EC will send MF Baudoin's memo once ready. => EC have sent*

Baudoin Raoult's note to MF. Discussions continue at EC between RD and OD about the requirements for GIT. EC would like to get more feedback from MF's experience with GIT, as they will move to it during 2013. Stéphane gave an overview of the "GIT-tools" wrapping layer he has developed, in order to adapt the tool to MF's usual practices (GIT-tools reproduce more or less the wrapping layer MF have for clearcase). Action closed. New action: both centres agree to keep each other informed about their progress on using GIT.

3. *Old GRIBEX interface: EC would prune all their use of the old GRIBEX interface from the IFS. The question was raised whether Arpège was still using this interface (uncertain answer at this stage). EC will send MF the full list of occurrences of GRIBEX calls, and MF will check whether it wants to prune some of them (in Arpège-type of configurations). This can be done at any time in the future, and there is no obligation to totally prune this interface. Further liaison about that is between Deborah and Claude (by email) and then if necessary in a technical video-conf. => EC and MF have agreed on the minimum set of routines where GRIBEX needs to be retained for the time being. However, MF won't have any optimization issue any more once they have moved their applications to their new HPC (BULL). Therefore, we agree that GRIBEX should stay in the code until at least CY41. Deborah will send MF a set of routines where GRIBEX has been totally pruned and replaced by equivalent GRIB\_API calls, so that they can start testing it on the new HPC asap. Action is kept open.*
4. *Fieldsets, States and LAM requirements (time info, etc ...): Action: Piet will send Daan's questions to Jean-Noël + further liaison in technical video-conf. => Action closed. More discussions should take place in the forthcoming technical video-conferences; Daan's work for LAM in the Fieldset structure is planned to enter CY40.*
5. *New GOM structure in CY39: Deborah and Claude to arrange a video-conference for Alan's talk for MF delegation. The target attendees are OBS people and beyond, as Alan would show some more general features of code cleaning using F95 features. If possible, this talk should be arranged for July 2012. => Action closed. Claude will make the video available to MF and partners (note: the file is now on MF's archive "cougar", at ["/gmap\\_coope/mrpe/mrpe722"](#), file: "Alan-Geer-Pres.m2ts", about 13.4 GB)*
6. *technical video-conference to discuss (especially) the work about disentangling of the Setup routines: in late September or beginning of October. From ALADIN, Daan Degrauwe should be involved directly in this video-conference, either by physically visiting ECMWF (or MF ?) or by calling in the conference. => Action closed.*

### **3. Progress and Plans of ECMWF (Highlights)**

Jean-Noël presented the list of scientific targets per Division, for 2013 (slides available with Jean-Noël or Claude). About the implementation plans, for 2013:

- Upgrade of vertical resolution (high-resolution system, 4D-Var, EDA and EPS)

- Enhancement of EDA and Jb (flow-dependent unbalanced variables, reintroduce balance in the stratosphere, improved model uncertainty estimation.)
- Further development of hybrid DA and increase EDA ensemble size (to 25)
- Use of EDA based background error correlation length scales in high-resolution 4D-Var
- Implementation of 24h weak-constraint 4D-Var
- Increase inner loop resolution of 4D-Var to T399
- Use of prognostic cloud condensate as control variable in data assimilation
- Assimilation of ground-based GPS, use of ASCAT soil moisture data in SEKF
- Use of NESDIS Southern Hemisphere snow cover product
- Coupling of ozone with radiation and dynamics

For 2014:

- Increased horizontal resolution of EDA
- Real time LAI through data assimilation of LAI
- First implementation of 4D-Var using IFS within the OOPS framework
- Implementation of a Continuous Observation Processing Environment (COPE)
- Use of flow-dependent background error covariances in high-resolution 4D-Var
- First representation of random component of model error in weak constraint 4D-Var
- Implementation of snow analysis in the EKF
- Use PC technique to assimilate information from hyperspectral sounders
- Multivariate verification of EPS and EDA against analyses and observations
- Revision of the stochastic schemes used to represent model uncertainties in the EPS/EDA

In terms of cycles, the plans are the following:

- Cy39: common ECMWF – Météo-France cycle upgrade
- Cy38R2: increase of number of vertical levels to 137 in high-resolution forecasts and DA
- Cy39R1: EPS L92, surface properties, drizzle, lake model, balance, 24-hour DCDA, revision of EDA perturbations (unbalanced variables), ...
- Cy40: common ECMWF - Météo-France cycle upgrade (*See item 6.1. below*)
- Cy40R1: EDA covariances, new stable boundary layer formulation, humidity control variable, observation errors ...
- Throughout the year: Metop-B (IASI), NPP (CRIS), OSCAT (next week?), ground-based GPS, etc. New satellite or instruments are planned to implemented in assimilation on the fly, without changing cycle or a heavy E-suite definition.

#### **4. Progress and Plans of Météo-France (Highlights)**

MF have switched to operations a new configuration of the Arpège 00 UTC very short cut-off production (so-called PACOURT), based on a single outer loop 4D-VAR (instead of 3D-FGAT). Scores of this new version are significantly positive. In addition, a 03 UTC Arome-France production, coupled with the modified PACOURT

Arpège production, has been implemented. This version is now delivering the reference Arome products for the morning forecast activities.

MF will launch one E-suite in January 2013, with the following content:

- Code release: CY38T1\_op1 (based on CY38T1\_bf.01 + devs)
- Assimilation:
  - Implement flow-dependent cross-correlation structure functions in wavelet space (H. Varella, L. Berre, G. Desroziers): at least in the assimilation cycle of 4D-VAR (may be not in the production analysis)
- Observations:
  - RTTOV-10 including one new layer at 0.5Pa that requires extrapolation of model profiles in Arpège
  - Monitoring and/or Assimilation of NPP/ATMS, NPP/CRIS; Metop-B (IASI, AMSU-A, MHS, HIRS, ASCAT, GRAS); Ocean-SCAT; possibly Megha-Tropiques
  - More AIRS assimilated over land and in the stratosphere; more IASI water vapour channels; more GPS R.O.; assimilation of GOES radiances; NOAA-19 MHS channels 4 and 5;
  - More GPS ZTD by selection inside screening + tuning of  $\sigma_0$
  - Upon availability, assimilation of winds and radiances from MSG-3
  - switch to vertical interpolations inside RTTOV (pending on optimization issues for NEC),
  - evaluate an increased density of observations in the LAMs
  - Assimilation of GEO radiances from GOES and MTSAT
  - More SEVIRI radiances over land for AROME; sampling of AMSU-A and AMSU-B/MHS radiances at [80-100km]; AMSU-A channels 9 and 10 assimilated; X-band radar radial winds from Mont-Maurel assimilated;
- Arpège/Aladin physics:
  - new tunings for thermal inertia, albedo and roughness length over glaciers
  - removal of relaxation towards climatology of snow; strengthen the relaxation of SST towards OSTIA data
- Aladin suites only:
  - New climatological data for sand and clay (now, same as in Arome-FR)
- Arome-France physics and model:
  - switch SURFEX file format to FA;
  - SURFEX V7.2
  - Remove the reversing of vertical loops in Méso-NH physics code (optimization issue) – *to be confirmed* -
  - Remove negative specific humidity values after the analysis step
- Full-POS outputs:
  - New diagnostic of Eddy Dissipation Rate (EDR), useful for airport turbulence diagnostics
  - Optional possibility to extrapolate T in the low layers without using Ts, but using the temperature values in the two lowest model levels

instead. This option is coded under key (APACHE), and not activated for Aladin coupling file production (to partners).

- Interpolation of raw model fields in coastal areas, instead of increments w/r to climatology. This option improves the interpolated result (only active in post-processing).

This E-suite is expected to switch to operations in June 2013. Porting of applications to the new HPC will start in June/July.

MF will also start to intensively test their future high resolution Arpège and Arome configurations, on their new HPC, in summer and autumn 2013. MF expect to implement the high resolution systems in the summer 2014, but this calendar depends on the progress of the installation of the second HPC cluster in winter/spring 2013/2014.

## 5. LAM partners comments

no specific issue.

## 6. Cycles: status and content of future releases

Both EC and MF will have timing constraints in 2013 and 2014. EC wish to declare their CY39R1 around May 2013, to include changes for the vertical high resolution other scientific changes. The operational implementation of CY39R1 is scheduled for September 2013. EC will start porting to their next HPC after mid-2014.

MF will have no opportunity to work on new code releases between June and at least November 2013, because of porting to new HPC and preparations of the future high resolution systems. These constraints impose limits in the scheduling, which have been addressed and lead to the calendar summarized in the following Table:

Common cycle:	ECMWF	MF	Start pre-φ	Declaration	Misc.
		CY38T1		August 9, 2012	Oper schedule (op1) in June 2013
	CY38R1			Feb 2012	Oper. In June 2012
	CY38R2			Aug 2012 Work ongoing for future oper version	E-suite in Dec 12; oper in April 2013
CY39			End Aug. 2012	Nov. 29, 2012	
	CY39R1		March 2013	May 2013	Oper at EC in Sept 2013
		CY39T1	In Jan 2013	Early March 2013	
CY40			In late March 2013	Beginning of June 2013 at the latest	See more detailed strategy of phasing below (*)

	CY40R1		In Oct. 2013	Oper. In Feb 2014
	<i>CY40R2 ?</i>		<i>In Feb. 2014</i>	<i>Technical cycle including many OOPS &amp; refactoring features</i>
	CY40T1	Nov 2013 at the earliest	In Feb. 2014	
CY41		In March 2014	In June 2014 ?	First common cycle that MF would test only on BULL
CY42			In April 2015 ?	

(\*) specific steps towards CY40:

- EC would send a pre-release of their CY39R1 to MF, for pre-phasing to start, in March 2013
- MF would send the result of merging CY39T1 with this pre-release to EC, in May 2013
- EC would add extra scientific content and declare CY40: June 2013

## 6.1. CY40

The technical content of CY40 has been discussed, based on the pre-list shown by Deborah at the previous OOPS/Steering Committee. The features expected to enter CY40 are:

- re-organization of global variables and setup to cope with the Geometry object (Tomas, Karim, Daan, Alexandre, (+ others ?) would be contributors)
- re-organization of global variables and setup to cope with the definition of the State (Tomas, Karim, Daan, Alexandre)
- change of resolution of fields (IFS version, Tomas)
- introduction of the new Model Field Structures by Alan Geer: only for dataflow in and around the IFS radiation scheme. This item will be further discussed between EC and MF, after MF will have studied more in depth the prototype code. Otherwise, it is expected that the overhaul of the model data structure will start entering the code in CY41, in a progressive manner (no abrupt removal of GMV/GFL is planned)
- GOM cleaning – neutral winds (Alan & Giovanna)
- IFS physics cleaning (CALLPAR, Filip)
- re-arrange vertical interpolations of observation operators (split preparation phase from the core vertical interpolation code): open issue. Might enter only after CY40 (then CY41) (Deborah and Mats)
- for completion, from previous technical meetings: specific code cleaning taken from Karim's document (EC and MF); pruning of a few keys in the assimilation (MF / *note: we will probably leave LOBSTL and L131TL as is,*

*since they still are active in the screening/traj and configuration 601*); removal of command line options (MF, to be confirmed for CY40)

## **6.2. Draft contents and timings of CY41, CY42**

Other, bigger in volume, technical changes, are expected to enter CY41:

- a wider use of the new Model Field Structure by Alan
- adaptations in the model codes (NL, TL, AD):
  - STEPO (Filip and Yannick)
  - trajectory handling (Yannick and Marta)
- overhaul in the VarBC code (Alan)

It is still too early to make plans about CY42.

## **7. Specific managerial issues**

The licensing policy for the OOPS C++ code has been addressed at the last OOPS Steering Committee. EC plan to issue an APACHE-2 license, keeping the proprietary rights of the code. MF and LAM partners would sign a Contributor Transfer of ownership Agreement (CTA), and have full rights to use the code for research or operations.

The bilateral discussion about this licensing strategy is ongoing between EC and MF.

It is furthermore expected that the proprietary rights and licensing policy for the whole NWP common codes also would be discussed soon.

## **8. Specific technical issues**

- 8.1. Fortran 2003: EC have sent out a list of 5 specific F2003 features they'd like to implement for further encapsulating IFS code. *Refer to the minutes of the Dec 5 technical tele-conf and minutes (available from Deborah or Claude)*. Among those, items 2 and 5 were found OK on NEC/SX, the others (1, 3, 4) are not supported. It is agreed that the first two features can enter in CY40 code. More generally, F2003 had been discussed in the morning technical teleconference. EC and MF agreed to keep a common Table listing the available Fortran compilers along with the precise list of feature desirable for refactoring. This information is also of interest to OpenIFS. Glenn Carver has volunteered to prepare the initial version of this survey Table.
- 8.2. Full-POS2: EC (Deborah) and MF (Ryad) agree to arrange a video-conference for Ryad to introduce EC staff to the new Full-POS2 software. This presentation would probably take place after January 21.
- 8.3. VarBC predictor: Hirlam is interested in having a more flexible code for defining the VarBC predictors. It is agreed to take such spec on board of the soon-to-come analysis for an overhaul of the VarBC code (targeted for CY41)

## 9. AOB

no specific AOB.

## 10. Date and Place of Next Meeting

**Next video conference: March 19, 2013, 1.30pm (Rdg) / 14h30 (Tlse)**

**Next Technical video conf: week of January 14-18, 2013**

**Full-POS2 presentation video-conference: second half of January, after Jan. 21**

**Next Coordination Meeting in Reading: May 27, 2013 => **shifted to June 3****

**Next OOPS Steering Committee (Toulouse): May 21, 2013**

## 11. List of Actions

1. *C++ coding guidelines for OOPS*: EC will investigate whether the guidelines can be made common to OOPS & COPE. Anne will contact the OOPS core team at EC, and later liaise with MF and LAM partners.
2. *GIT*: both centres agree to keep each other informed about their progress on using GIT.
3. *Pruning of the old GRIBEX interface*: we agree that the last GRIBEX calls for Arpège should stay in the code until at least CY41. Deborah will send MF a set of routines where GRIBEX has been totally pruned and replaced by equivalent GRIB\_API calls, so that MF can start testing it on the new HPC asap.
4. *Inclusion of the new Model Field Structure for the IFS radiation scheme*: MF to study the prototype code and give feedback to EC. Decision on whether the new structure already enters for the radiation code in CY40.
5. *Ensemble data assimilation changes*: Jean-Noël to contact Massimo Bonavita, to ensure that the forthcoming scientific and technical changes in the IFS/EDA are transmitted to MF contacts (Gérald Desroziers, Loïk Berre, Laure Raynaud). Claude will liaise about the reciprocal with MF correspondents.
6. *Next technical video-conference, mostly devoted to Geometry & State for CY40*: Claude will arrange the precise dates and contact all correspondents.
7. *Presentation of Full-POS2*: EC (Deborah) and MF (Ryad) agree to arrange a video-conference for Ryad to introduce EC staff to the new Full-POS2 software.