

# IFS/Arpège Phone Call Memorandum

**From:** Claude Fischer (MF)

**To:** (ECMWF) HR, RD Division & Section Heads, Anne Fouilloux,, Tomas Wilhelmsson ,Yannick Trémolet , Nils Wedi , Mats Hamrud, Sylvie Malardel

**To:** (Météo-France) Arpège diffusion list

**To:** (ALADIN) *Observer position presently open*

**To:** (HIRLAM) Xiaohua Yang

**File:**

**Subject:** Minutes of the IFS/Arpège phone call -towards Cycle 37 - held on 3<sup>rd</sup> November 2009.

## **Participants:**

**Météo-France:** Alain Joly, Claude Fischer, Vincent Guidard, Stéphane Martinez, Guillaume Beffrey and Karim Yessad

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

**ALADIN:** ()

**HIRLAM:** ()

## **1. Adoption of Agenda**

The agenda was adopted.

## **2. Approval of Minutes of the previous coordination meeting of 25<sup>th</sup> June 2009**

Approved.

## **3. Review of list of actions from last coordination meeting**

- 1) **DS and Philippe Marguinaud to move RTTOV9 allocations to higher level in IFS.** Tomas Wilhelmsson has done the modification and liaised with Philippe for finalizing the code changes. The code is ready and will enter CY37 via CY36R2. It also will enter MF's next E-suite as a branch on top of CY35T2. Action closed.

- 2) **DS to investigate the feasibility of checking that all new releases compile on the NEC.** Deborah has got the administrative authorizations for remote connections to MF's computer system, but there remain some technical problems to be solved by I.T. People (network and connection aspects). Action closed as concerns coordination (except if technical problems persist).
- 3) **Patrick Moll, Ludovic Auger, Vincent Guidard and DS to sort out array index problem with channel number instead of channel count.** Deborah has checked the code and will provide the fix for CY37 (via the Reading contribution). Action closed.
- 4) **DS, REK, KY and Tomas Wilhelmsson to look at evolution of Arpège/IFS coding norms.** This will be discussed during Ryad's stay at ECMWF in early December (8/12). Action ongoing.
- 5) **JNT to provide paper from Tony McNally to Nadia => done**
- 6) **JNT to provide description of Elias Holm's work on humidity => done** (MF is interested by any further documentation from Elias, if/when available, as a number of GMAP staff can potentially be interested by this work)
- 7) **JNT and YT to agree date for F2003 seminar with MF. => 18/11/09**
- 8) **CF to read IPR guidelines and provide feedback before end of July.** ECMWF has sent a recent version to MF, who shall further study the document and possibly propose some adaptations in link with the IFS/Arpège collaboration. Those would mostly concern (if any) the text in § 8 & 9: MF and Aladin/Hirlam partners shouldn't have to transfer a copyright of their source code developments to ECMWF; inbound copyright for imported source code should be handled whenever relevant also by MF and Aladin/Hirlam partners. For the latter, a good awareness of ECMWF's regulations by the partners and communication with the IFS contact can perhaps be enough. Action to be continued: CF to further liaise internally and with JNT about possible comments or changes in the IPR document.
- 9) **JNT and CF to look at current agreement between MF and EC to see if it needs updating in view of HIRLAM.** CF has sent an updated version to JNT, containing the additional references to Hirlam (besides Aladin), plus some text updates and tidying up of the document. JNT will check internally with E. Kallen and D. Marbouty. Action to be continued: make a new status of this document at the next phone call.
- 10) **DS, JNT, CF: confirm timing for CY37** ECMWF is OK with sending its contribution to CY37 by early May 2010. MF may have internal constraints coming from I.T. (upgrade of the two SX9 clusters) and/or Operations Depts. Those may force MF to shift its calendar of CY36T2 (presently anticipated for March) and then also shift the preparation of CY37 (maybe by one month ?). Action to be continued, with a trial to settle the dates for CY37 in December 2009 (contact between AJ/CF and JNT/DS).
- 11) **MH, KY and REK to find a way to not split SUGAW** it is not yet clear whether Mats will provide the upgraded code (with the agreed split of SUGAW in the setup) of Karim. DS will check with MH what is the situation at ECMWF. Action to be continued (DS, MH, KY, CF).
- 12) **Deborah to hand over Karim's document to Lars Isaksen and Drasko Vasiljevic. Then wait for some possible feedback from them.** The doc is still under investigation. Action to be continued.
- 13) **Whenever needed, Deborah and/or Jean-Noël may send ECMWF's preparatory documents to Patricia Pottier who's acting as webmaster.**

**She would upload the files on the site.** Whenever relevant material is available, DS shall send that to CF who will include it in the partners-only protected web site with the help of Patricia. Action closed.

#### **4. MF progress and plans**

**CY36T1: phasing has just started. Completion of the cycle is expected by mid-December. Content:**

- Assimilation:
  1. Microwave radiances:
    1. add the term emissivity\* $T_{surf}$  ( $\epsilon.T_s$ ) to the control vector as a new sink variable for VarBC (E. Gérard & F. Karbou),
  2. infrared radiances:
    1. *postponed to CY36T2*
  3. preparation for the pre-treatment of ADM/Aeolus data at MF, mostly in the “bator” pre-processing tool (C. Payan, C. Desportes)
  4. bugfix for the correct check of observation positions for big LAM domains in rotated geometry (OBATABS) (J.-D. Gril)
- Model dynamics:
  1. Miscellaneous cleanings following the agreements between MF+partners and ECMWF, based on Karim’s document
- Arpège/Aladin-France physics:
  1. Finalize the code for using the external surface scheme SURFEX
  2. Plug-in for using EDKF ; tunings for vertical turbulence (TKE-CBR) and shallow convection KFB
  3. Adaptations for using 3MT (modular multi-scale microphysics/turbulence) – J.-M. Piriou
  4. Add tendencies from the dynamics to the DDH diagnostic package (F. Voitus)
  5. Modified version of gravity wave drag for TL/AD models (O. Rivière)
- Arome :
  1. Protection against negative values in the turbulence scheme
  2. New diagnostic fields for wind gust (max value over the last 10 mns)
  3. Introduction of SURFEX Version 5
  4. Proper patch to take into account gridpoint  $Q_l$  and  $Q_i$  when converting  $T$  back to  $T_v$  in the minimization (case  $LSPRT=.T.$ ) ; various other corrections for Arome/FGAT
- Alaro physics : (first three items by F. Vana; others by R. Brozkova)
  1. turbulence (mixing length, solver);
  2. some optimisation of ESPCHOR, ESPCHORAD (consulted with Ryad);
  3. split of SL buffers to allow for computation of dynamical tendencies in DDH and for 3D turbulence (agreed with Fabrice and Karim).
  4. historic entrainment; (Doina)
  5. aerosols (in ACRANEB); (Tomas Kral)
  6. Rash-Kristjansson condensation scheme under 3MT (Lisa Bengtsson, Doina)
  7. cleaning and completing the 3MT cascade (Doina, Radmila)

- 8. cloudiness diagnostics (ACNPART routine only; Christoph Wittmann)
- Hirlam/Harmonie :
  1. Minor code adaptations (Ole Vignes)
- Miscellaneous and system:
  1. Improvements in configuration 901 (CPREP1) for surface field conversion TESSEL => ISBA/SURFEX (J. Ferreira, F. Bouyssel)
  2. Code reorganization under POS (K. Yessad)
  3. Plug-in the missing model code for running the 1D vertical model version in Arpège/Aladin, “Single Column Unified Model” (E. Bazile, O. Rivière): only the code for running unforced 1D columns will become available in the common official releases (i.e. forcing versions require extra code changes)
  4. Debugging for Fullpos and the RTTOV9 interface
  5. Optimisation in LAM 3Dvar code

**Action decided: MF shall send the source code of CY36T1 (at least, for “arp/ifs” directory) to ECMWF after cycle is completed.**

**CY36T2: proposed deadline for contributions by end of February 2010, to be constructed in March ? (calendar is pending several internal decisions at MF, linked with the SX9 upgrades and preparation of E-suites). Foreseen content:**

- Assimilation:
  1. Cleaning of Neural Network routines for AIRS (V. Guidard)
  2. Adaptation of code to use the ECMWF bias correction for radiosonde and SYNOP at Météo-France (P. Moll)
  3. Microwave radiances:
    1. Addition of emissivity parameterization using a Lambertian approximation for refractivity (F. Karbou) and compare with the specular hypothesis,
  4. Infrared radiances:
    1. Computation of cloud top pressures for cloudy IASI radiances (performed once during screening with a different formulation than in the IFS, V. Guidard and N. Fourrié). Same development already is operational for AIRS.
    2. Introduction of an alternative cloud detection method for AIRS and IASI (MMR code from Thomas Auligné), unless similar work planned at ECMWF (V. Guidard or N. Fourrié) – to be confirmed
- Arpège simplified physics schemes (O. Rivière):
  1. Modified gravity wave drag scheme (by ignoring the perturbations of some terms)
  2. New large scale precipitation scheme: adjustment Smith scheme ( $Q_v \Rightarrow Q_v^*, Q_l^*, Q_i^*$ , cloud fraction) followed by auto-conversion and precipitation of all condensed excess ( $Q_r^*$ )
  3. Convection scheme based on a simplified Betts-Miller scheme

Further code contributions until CY37 may concern (to be confirmed):

- A thorough overhaul of the SURFEX to atmospheric models interface, in order to improve its robustness and prepare for further optimizations (make it Open-MP proof)
- An overhaul of the physics/dynamics interface (CPTEND, CPUTQY) in collaboration with the Aladin/ALARO partners
- Extension of the MSG/SEVIRI raw radiance assimilation in the LAMs (Aladin and Arome) to cloudy radiances (S. Guedj)
- Cleaning of the MF\_PHYS interface (reduce substantially the number of dummy arguments) – Y. Bouteloup

**CY37: so far, the proposal is for May/June 2010. The final dates for the next common cycle shall be re-discussed with ECMWF in December 2009.**

**E-suite in 2009 (pending to finalization of some optimization and performance issues):**

- ARPEGE and ALADIN-France E-suite (autumn/winter 2009/2010):
  1. CY35T2
  2. new change of resolution of ARPEGE: T798C2.4L70
  3. new resolution for the 4D-VAR analysis increment: T107C1.0L70 (25 iterations) and T323C1.0L70 (30 iterations) with  $\delta t=1350$  s; the benefit of moving to 3 outer loops and minimizations has eventually not been clearly seen, thus the multi-incremental 4D-VAR will stay with 2 outer loops
  4. changes in the assimilation ensemble: L70
  5. Double the density of about all radiance types (change the scale of data use from one spot every 250 km to one every 125 km)
  6. assimilation of NOAA-19 channels; reactivate VarBC for channel 13 of AMSU-A
  7. extend the number of assimilated IASI channels (surface channels and WV channels),
  8. introduce a bias correction for MSLP and T observations (based on ECMWF practice)
  9. retuned error standard deviations: REDNMC from 2.0 to 1.6;  $\sigma_0$  multiplied by 0.9 globally
  10. Physics: new moist simplified physics version for TL/AD (based on Smith) including some microphysics;
  11. ALADIN-France: L70, slight increase of resolution to about 7.5 km
- AROME-France E-suite (over the same period) :
  1. AROME will inherit some of the ARPEGE/ALADIN changes (doubled radiance density, NOAA-19) and will gain new features (AIRS, IASI, SSMI assimilation, activate VarBC for SEVIRI)
  2. Assimilation of radar reflectivity
  3. Increased vertical resolution (60 levels)
  4. Activation of an upper level sponge towards the coupling model (in the forecast), based on the spectral coupling formulation
  5. Assess the direct lateral boundary coupling between ARPEGE and AROME

- 6. test new choice for B-level parallelization (made possible after correcting an old, sleeping bug in the B-level decomposition of LAM Semi-Lagrangian advection scheme)
- 7. new version of shallow convection (to increase the persistence of Sc clouds)
- 8. new version of CANOPY, including a fix to allow proper initialization of CANOPY fields at timestep 0
- 9. one fix to prevent negative values on some water species contents
- PEARP Version 2: main target is an increase of PEARP members from 11 to 35 + coupling with the ensemble assimilation + some physics perturbations + L65. Forecast set-up upgraded to the latest standard of the deterministic ARPEGE physical parameterization except those schemes contributing to the "modelling error" representation approach.

ECMWF confirms that MHS data is still totally blacklisted in the IFS.

### **Plans for 2010:**

Once the end-of-2009 configurations will be well under way, significant efforts will be dedicated to upgrade the organization and maintenance of the operational suite, with a view to make the switch of an R&D suite from OLIVE to operations easier.

Another important change will occur in the Computer Centre, with the successive upgrades of the two NEC/SX9 clusters (add more CPU on each of them). This upgrade will require to shut down successively each cluster for about two weeks, and new Acceptance Tests will be done. This work should take place over February/March/April.

Possible contents of the 2010 E-suites:

- Arpège physics:
  - new convection scheme
- SURFEX scheme in some Aladin models (France, Overseas, ...)
- PEARP: increase horizontal resolution
- Arôme-France:
  1. ICE4 microphysics (including hail)
  2. extend horizontal size of domain

## **5. ECMWF progress and plans**

### **CY36R1 in E-suite since 26/09/09:**

- Deterministic model: T1279L91 (~16km)
- Outer loop of 4D-Var T1279L91 and increase inner loop (T159/T255/T255)
- EPS target resolution T639 (to 10 day) and T319 thereafter
- Wave model (25km and 36 directions)

A bug has been spotted in the solar RRTM code (McICA version), probably in the code since several cycles. This is also of interest to MF who wishes to test the scheme in Arpège by the end of the year.

**Action: ECMWF will send the bugfix for RRTM and appropriate documentation to MF**

The CY36R1 E-suite is scheduled to go to operations on 26/01/10.

CY36R2:

- EnDA scripts for initializing the EPS (perturbations in the EPS would then be a mix of EnDA and initial time SV structures; evolved SV would go away)
- scripts and software for increasing the scalability in preparation of the increase of vertical levels later on (CY36R3)
- Forecast-Sensitivity-to-Observations (FSO) diagnostic active online
- GRIB\_API becomes the sole GRIB1/GRIB2 interface in the IFS (GRIBEX interface disappears)
- modified allocations for RTTOV9 (optimization issue for NEC)
- cleaning of code as agreed with MF

This E-suite will be started in parallel to the previous one, and is planned for operations in mid-February.

**Action: ECMWF shall send the source code of CY36R2 (at least the “arp/ifs” directory) to MF for cross-checking on the code cleaning (and preparation of the phasing for CY37)**

CY36R3:

- EKF for soil moisture assimilation
- upgrade of the land surface model (introduce lakes and extend vegetation types)
- extend 4D-VAR window to 24h
- flow-dependent observation selection (using the error variances from the EnDA)
- observation error spatial correlations for Atmospheric Motion Vectors and perhaps satellite radiances
- decrease thinning distance for AMSU-A from 120 km to 60 km
- upgrade of the microphysics
- preparation for the tests with 130-140 vertical levels (to be tested in E-suite by end of 2010)

## 6. AOB

1. **ODB and archiving strategy of ODB on MARS:** this project will force ECMWF to re-arrange the tables inside the ODB, thus modifying the descriptor files (.ddh). This change will have direct consequences on the IFS code and any ancillary tool with a direct plug into the ODB (obstat, odbviewer etc ...). Anne has sent an email to Dominique Puech on this issue. The development will start rather soon, but inclusion inside the IFS is planned for after CY37. **Action: MF shall check internally for comments and possible further questions or suggestions towards ECMWF**
2. ECMWF mentions that they have evaluated the code optimization performed by NEC staff for the radiation code at MF. They accept the code as it has been

provided, but they point out that the new version of the code is quite complicated and now difficult to read (“anti-cleaning” of code). Both sides agree that such re-coding should be kept to a very strict minimum inside the IFS.

## **7. Next meetings:**

phone call on Tuesday March 16 2010, 1 pm Reading / 14h Toulouse ;

coordination meeting on Thursday June 24 2010 in Toulouse (ECMWF's delegation probably would be JNT+DS+AF)

## **8. List of actions:**

1. DS, REK, KY and Tomas Wilhelmsson to look at evolution of Arpège/IFS coding norms. This will be discussed during Ryad's stay at ECMWF in early December (8/12).
2. Preparation of ECMWF's IPR guidelines: CF to further liaise internally and with JNT about possible comments or changes proposed by MF for the IPR document.
3. JNT and CF to look at current agreement between MF and EC to see if it needs updating in view of HIRLAM. JNT will check internally with E. Kallen and D. Marbouty. Action to be continued: make a new status of this document at the next phone call.
4. DS, JNT, CF: confirm timing for CY37: try to settle the dates for CY37 in December 2009 (contact between AJ/CF and JNT/DS).
5. MH, KY and REK to find a way to not split SUGAW: it is not yet clear whether Mats will provide the upgraded code (with the agreed split of SUGAW in the setup) of Karim. DS will check with MH what is the situation at ECMWF. Action to be continued (DS, MH, KY, CF).
6. Surface buffers as potential source of bugs: Deborah to hand over Karim's document to Lars Isaksen and Drasko Vasiljevic. Then wait for some possible feedback from them. The doc is still under investigation. Action to be continued.
7. MF shall send the source code of CY36T1 (at least, for “arp/ifs” directory) to ECMWF after the cycle is completed.
8. ECMWF will send the bugfix for solar/RRTM and appropriate documentation to MF
9. ECMWF shall send the source code of CY36R2 (at least the “arp/ifs” directory) to MF for cross-checking on the code cleaning (and preparation of the phasing for CY37)
10. Changes in the ODB tables and descriptors in link with the archiving of ODB in MARS: MF shall check internally for comments and possible further questions or suggestions towards ECMWF