

# IFS/Arpège Video-conf Coordination Meeting

November 25 2011 (10:00 – 12:00 Toulouse; 9-11am Reading)

## Participants:

ECMWF: Jean-Noël Thépaut, Deborah Salmond, Anne Fouilloux, Sylvie Malardel

Météo-France: Alain Joly, Florence Rabier, Claude Fischer, Ryad El Khatib, Stéphane Martinez,

## 0. Adoption of the agenda (all)

adopted

## 1. Approval of Minutes of last coordination meeting and Action status (all)

minutes approved. The list of actions from June 25 is reviewed:

- 1 *ECMWF will write a short note about how to add new fields in the GOM arrays); This action was to be deferred until reorganisation and cleaning of the OBSHOR part of the code was completed in CY38. => action deferred to after completion of the dataflow re-arrangements (ongoing work by John with help by Karim), so probably after CY38R1 (ECMWF)*
- 2 *GRIB\_API: Ryad would check if MF were satisfied with performance. => Ryad presents results from performance checks using Tomas' test programs (very good test programs). The results are disappointing, with a significant drop of performance on NEC compared with Intel-platform (about 7 times slower encoding and decoding). More investigations will be done, and further discussions should take place including contacts with other NEC users. Ryad will contact DWD (Uli Schättler); ECMWF RD will pass information about the poor performance on NEC to their OD (MF will send Ryad's plot to EC).*
- 3 *Mike Fisher will give a final check and circulate the final version of the coding rules received from MF. => coding norm guidelines are completed, and will now be circulated around in the community (MF, EC, LAM partners). Action closed.*
- 4 *ECMWF will prepare C++ coding guidelines for OOPS. => EC has a preliminary version of C++ coding rules, but that will need further input, in particular from the scientific review of OOPS this winter. Action is deferred and kept open.*
- 5 *Claude to set up a tele-conf to discuss the work on GFL – with a view to starting the work early in 2012. => Karim has updated two technical*

documents, one for GFL and one for the physics interfaces. The GFL note has been sent to ECMWF, and will be input for the next technical video-conf (December 8). Sylvie will check the note and send comments in advance to Karim (she already mentions a proposal to try to make the GMV setup somewhat converge towards the GFL one, by defining similar attributes). Each Center has listed its priorities concerning the physics interfaces for 2012: EC will start a major clean-up of CALLPAR. Also the call to the All-sky radiance operator will be moved out of CALLPAR, into HOP. MF (Alain) asks about the precise link between the GFL and phys/dyn action on the one hand, and OOPS on the other hand: EC (Sylvie and Deborah) explain that there's an interest in some convergence of GMV/GFL setup for the STATE object in OOPS, and the move of the call to RTTOV out of CALLPAR will enable to remove a trouble-making observation-type of interface out of what should become the OOPS-forecast (propagator) interface. MF will clean and optimize specific aspects of the AROME interface in 2012. MF considers the work on GFL as higher priority than the physics interface (EC agrees). Actions: for the sake of completeness, Claude will send the updated phys/dyn interface doc to EC; GFL will be on the agenda of the next tech video-conf (Dec 8), for deciding how to start with this rationalization.

6 *Sylvie and Karim would slightly re-work the GFL document to have a more step-wise approach and provide a start-up for the forum discussions (and help with the interaction with other work going on in the physics/dynamics interface). => see above, item 5*

7 *Actions around COPE & ODB:*

a) *There is an ODB tutorial available which could go on the ALADIN website. Also a link to the ODB on-line documentation for the current ODB and ODB-2 – this would have to be in the password-protected part because of licensing issues. Anne would check if this would be OK. Anne => done. Claude will send the user and password for the Aladin pwd-protected site to Deborah.*

b) *EC will send a formal document about COPE to MF – which will be relayed to HIRLAM and ALADIN. => there's an ongoing discussion at EC between Research and Operations Depts (RD, OD) about the precise strategy of development of the conversion tools that will come with COPE (BUFR\_API as a new component for the future “ecCode” software, the extended GRIB\_API; BUFR2ODB as a flexible ODB2-interfaced software). ECMWF has already sent a draft memo about COPE and a memo about the rewriting of the acquisition package. Once finalized documents are available, EC will circulate them. MF would like to contribute to COPE by helping on specific filters and test programs for some obs types, and provide a list of its own quality control (QC) flags and where they appear in MF's obs handling (Frank Guillaume and Patrick Moll). MF mentions the interest of various partners for a flexible BUFR2ODB tool, able to handle various BUFR-formats in input. Anne explains that the conversion will concern the Parts 1 and 2 of the messages; Jean-Noël raises the issue of partners providing extra manpower to help if requirements would have to be extended. The technical issues and the coordination between MF and EC will be further addressed in the*

forthcoming COPE-devoted meetings (Note: the first COPE video-conf was held last Monday)

*c) MF will try to install and test the new ODB-2 software with the NEC C++ compiler. => not started yet. EC (Anne) will send an updated version of ODB2 to MF. This can be compiled as a standalone library on PC and on NEC. MF will test compilation and try to run some test program on NEC. Report back at next coordination meeting if ready. The decision to introduce ODB2 already in CY39 is pending successfully completed tests at MF.*

*d) MF to send info about compiler restrictions on C++/F90 interoperability to ECMWF (STRUCT format and link with ODB-2). Claude. => good progress has been obtained this autumn concerning the C++/F90 interoperability with the NEC compiler. MF now has a test release of the f90 compiler able to handle C-binding extensions along with other compiler options (default implicit switch of REAL's to double precision when NOT explicitly stated with KIND). Also, C-binding with derived types now should work (successfully tested with a 2010 version of the OOPS toy code). MF will now continue to discuss with NEC various other aspects like any possible limitation of the compiler (the "STRUCT" question) and the use of BOOST libraries. MF will keep EC informed about these discussions. Claude will send EC a short email report about the tests and progress so far (thanks to the efficient support by Louis-François Meunier).*

The issue of removing the command line option has been put on the table. We agree to discuss this item at the forthcoming OOPS steering committee, as this change will have an impact on the scripts (EC mentions that this part is delayed due to manpower shortage). The technical question would also be addressed at the next tech video-conf. (remainder: the command line options should be removed at some stage, in line with the re-organization of the setup).

Another item to remember for the next technical video-conf is the re-organization of SL interpolators (this discussion already started at previous video-confs, so there will be a wrap-up).

## **2. COPE/ODB2 and C++ aspects to enter CY39 (and maybe even in the cycles after ?)**

See also item 7 above. The discussion has eventually been focused on the short/mid-term plans at EC and MF (until beginning of 2012).

### **MF side:**

- **Next E-suite (start in Nov/Dec 2011):** preliminary list !
  - CY37T1
  - Assimilation (4D-VAR Arpège & AEARP):
    - retuned  $\sigma$ 's (after a re-evaluation of the diagnostics following Desroziers et al., 2005): AMSU-A, GPS-RO; potentially, conventional observations;

- increase of number of observations: IASI (tropospheric channels over sea, stratospheric channels everywhere), ground-based GPS from EGVAP (*NB: those already are in Arome*);
- assimilation of cloud-affected IASI (using CO2-slicing for cloud detection), of EARS/IASI radiances and EARS/ASCAT winds;
- revisited strategy for GPS ZTD blacklisting (allow more data to be assimilated), removal of VarBC for AMSU-A/channel 13;
- miscellaneous technical changes for OBS: ground-based GPS in BUFR format with dynamical screening (task “pregpsol” disappears from the suite); switch to vertical interpolations inside RTTOV (pending on optimization issues for NEC), preparations for NPP (CrIS, ATMS);
- Inflation factor to take into account model error, applied as a renormalization of the perturbations of the ensemble members (and impact on the derived  $\sigma$ 's for 4D-VAR);
- Arpège/Aladin-France physics and surface treatment:
  - Some optimization and cleaning (CANARI, physics, SurfexV6+);
  - Aladin-Réunion becomes the reference test Aladin model (instead of Aladin-France, which should be stopped in early 2012)
- Arpège EPS (PEARP):
  - Take into account the inflation factor from AEARP and maybe add a first set of surface field perturbations
- Arome-France:
  - impact due to the changes in the Arpège assimilation;
  - assimilation of Doppler radial winds from the Grèzes and Plabennec radars, monitoring of the two X-band radars from the RHYTMME network, assimilation of SEVIRI over land, assimilation of AMSU-A at higher density (80km instead of 125km);
  - use daily  $\sigma$ 's of AEARP/Arpège in the Arome 3D-VAR
  - improvements in EDKF (treatment of ice/snow/graupel) and in the cloud scheme (minimum threshold for condensed water);
  - *very open issues (pending further testing)*: use of higher resolution orography, use of Ecoclimap-2 and HSWB
- technical changes (*only if ready in time !*): switch SURFEX file format to FA; more frequent calls to the radiation scheme in Arpège if CPU time is available (within the first 36 or 48 hours ?); some applications might be deported to a scalar server (CANARI, bator)

next interim cycle at MF, including Aladin/Hirlam partners (note: the call for contributions is still open, so this is an incomplete list):

**CY38T1: deadline for contributions end of February/beginning of March**

- SURFEX official release V7.2 & plug-ins in “mse” interface (to be issued by January/February’12):
  -
- Optimizations in the “mse” library for Surfex (concerns “prep” when called from Full-POS/e927, Philippe Marguinaud):
  - Use FA format for input/output file format (instead of LFI)
  - Compression of data (using a workaround for handling the masks)
  - Note: 2 FA files would be handled, one for constant surface fields (PGD) and one for the remaining fields (presumably mostly prognostic ones)
- optimizations for canari (vector and scalar architectures) – R. El Khatib -
- E-zone treatment in gridpoint LAM model revisited (M. Hortal, Belgian team, based on specs by Ryad) & Boyd LBC coupling code (Belgian team)
- Dynamics and cleaning (Karim Yessad):
  - Introduce an alternate way to compute the vertical displacement in the SL scheme (direct code only)
  - More flexible options for Rayleigh friction
  - Recode sponge to allow it in 3D models
  - Momentum equation RHS: code to be gathered at one location (under CPG\_GP)
  - New structures in the dynamics (types TXYB and TVAB): replace sequences GPPREH+GPXYB+GPPREF by a new routine GPHPRE, pass YDVAB instead of individual components in some GP.. and GNH.. routines
  - Types TRCSGEOM, TRSGEOM, TOROG: pass variables defined with these types in one step to routines under CPG, CPGTL and CPGAD
  - GMV and GFL to be passed in one go to CPDYDDH, CP\_FORCING and VPOS
  - Reduce some calling tree complexity (remove SCAN2H etc.)
  - New versions of GMPFC with less dummy arguments
  - CPG5\_GP: bugfix for code under LPROCLDTL
  - Complete externalisation of coupling and spectral nudging for temporal interpolation and relaxation
- ALARO physics:
  - Improved version of TOUCANS scheme: code impacts below APLPAR (increased numerical stability & debugging)
  - radiation, microphysics, cloud scheme and convection (to be further defined)
- ARPEGE/ALADIN physics:
  - Inclusion of PCMT code: creation of 6 new GFL variables, convection code (updraft, downdraft, link with microphysics), CPTEND\_NEW, new associated diagnostics in DDH (J.-M. Piriou)

MF mentions that it will arrange at least one coordination video-conf with the Hirlam correspondents (Ulf Andrae is contact in Hirlam), for the upstream coordination of

their contribution to CY38T1. This video-conf would take place in December (week 50 ?).

**ECMWF side:**

CY38R1 (operational implementation Spring 2012)

Satellite section:

- Assimilation of MHS channel 5 over land
- QC changes for use of emissivity atlas and data screening over land
- Tightening the ozone first-guess check
- Fix of skin-temperature/emissivity sink variable for sounder channel assimilation over land (tbc)
- Assimilation of AMSU-A channel 4 through all-sky system (from one am and one pm satellite)
- Assimilation of ASR product from SEVIRI onboard Meteosat-9
- Code changes for NPP/CRIS
- Capability to assimilate cloud affected IR radiances
- FY-3B code changes
- Reorganisation of ozone Var-BC configuration
- Preparation for GOES-15 AMVs
- FASTEM-5 code
- Radiance spread from the EDA in the ODB
- Simplification of RTTOV/IFS interaction
- Updates to the simulation of cloudy radiances in RTTOV, affecting the simulation of geostationary satellite images
- Option to average FOVs for ATMS

Data assimilation section:

- Objective filter for EDA
- New Jb statistics based on 37R2 with revised REDNMC (=1) setting
- Correction of observation error for TEMP in the stratosphere
- Monthly varying CDF matching for ASCAT soil moisture monitoring
- Implementation of [COPE](#) suite for screening of conventional data
- Code for correlated radiance observation error in EDA
- Code to enable assimilation of high resolution BUFR TEMP
- Code to enable assimilation of aircraft humidity data
- Code to enable assimilation of BUFR SYNOP data
- Code to calculate TEMP x-y-z drift based on TEMP winds
- Code for VARBC bias correction of ground based GPS data
- Cleaning of suite definition files and scripts, especially to introduce the ability to run combined 4D-Var & EDA experiments
- OOPS related changes and cleaning

- Technical changes related to the overlapping windows
- Introduction of new obstype (NLIDAR) for Aeolus data and other lidar data

#### Physical aspects section:

- Relative humidity dependent downdraught entrainment, and reduction from 0.35 to 0.3 of updraught mass fraction converted to downdraught
- Introduction of perturbations of the surface exchange coefficients in the TL/AD models
- Modifications to cloud ice fallspeed profile
- Correction to ice supersaturation in partially cloudy gridboxes
- Change ice melting to rain rather than cloud liquid
- Introduce timescale for freezing rain
- Introduction of 3 new diagnostic fields : CIN, K-Index, TT-Index
- Add climplot Macros for correlations (SM etc., off-line)
- Switch off Rayleigh friction (wavenumber 0) for model version with more than 100 levels and the top higher than 1 hPa. This is to prepare for increased vertical resolution
- Introduction of new cloud variables in the DDH
- Changes to the coefficients that control respiration in the carbon model
- Changes to the aerosol parts of the model following work with Sarah on volcanos

#### Reanalysis section:

- Extensions in the odb tables (collection\_identifier, unique\_identifier at conv)
- Ingestion of odb2 data from MARS
- Ability to use Hadley SST2 in the sst analysis.

#### Numerical aspects section:

- De-aliasing of the pressure gradient term, reduction in the horizontal diffusion in the 10d forecast (not in the inner loops of 4D-Var), removal of the trajectory filtering in 4D-Var for resol  $\geq 255$

#### Marine aspects section:

- Changes to improve swell (Sin+Sdissip)
- Switch on OSCAT assimilation (with proper bias correction)
- Technical changes to have nesting working again
- Output of energy and momentum flux from waves to ocean
- ODB for Altimeter wind and wave data
- Introduce option to run IFS and NEMO as single executable
- Simplification to second-order calculation

#### Probabilistic forecasting section:

- Use of the new surface reanalysis to initialize the surface fields in the EPS hindcasts
- Extension of the EPS hindcast years from 18 to 20
- Redefine the EDA perturbations using the EDA ensemble mean instead of the EDA control as the reference

#### CY38R2 (operational implementation Autumn 2012)

- Increased Vertical Resolution (137 levels)
  - ...and everything that goes with it (diffusion, JB, etc.)
  - Technical changes such as:
    - Code to enable assimilation of high resolution BUFR TEMP
    - Code to enable assimilation of aircraft humidity data
    - Code to enable assimilation of BUFR SYNOP data
    - Code to calculate TEMP x-y-z drift based on TEMP winds
    - Code to assimilate METOP-B, NPP, MSG-3, Megha-Tropiques, etc.

#### CY39R1 (Spring 2013, tentative)

- Introduction of lake model (FLAKE)
- New stable boundary layer formulation
- Introduction of interaction between radiation and prognostic ozone
- Aerosol climatology from MACC for medium-range forecasting systems
- Diagnostics explorer for RD-experiments
- Updated diagnostics package for coupled model
- Use of flow-dependent background error covariances in deterministic 4D-Var
- Implementation of 24h weak-constraint 4D-Var
- Use of prognostic cloud condensate as control variable in data assimilation
- Continued enhancement of radiance assimilation in presence of clouds, precipitation and aerosols
- Assimilation of ground-based GPS
- Production of ERA-20C (surface pressure observations only)
- First release of OOPS prototype
- Detailed scientific validation and extension of calibrated products for System 4
- Prototype IFS-WAM-NEMO model introduced

#### questions by MF:

- spread for radiances: the Sigma\_B's for radiances would be computed from the statistics of spread in the EDA, rather than by randomly perturbing the HBH^t (this is a piece of code inside the IFS)
- the objective filters follow the work in collaboration with Laure Raynaud (MF). EC further mentions that the new, consolidated B-matrix ensemble statistics



derived from CY37R2 (L91 levels) absolutely are needed before building the L137 suite, as they bring a significant improvement in the existing assimilation.

- Strategy for implementing the 24h long window 4D-VAR and OOPS?: EC would implement the 24h weak constraint 4D-VAR using a single 4D-time window (no splitting) and with the bias-correcting weak-constraint formulation (not the state vector correcting formulation). The OOPS prototype in CY39R1 would possibly not be a full 4D-VAR version; this might still be a 3D-VAR or 3D-FGAT version (under logical switch, as an optional code in the IFS Fortran).

### **3. coordination issues related with CY39**

content: see above, Section 2.

timing: CY39 remains scheduled for September/October 2012. EC would send at least one CY38R? to MF before the summer, for code inspection and tests of installation on the NEC.

### **4. preparation for the OOPS/SC**

The SC will take place on November 30. Jean-Noël will send MF and the Aladin/Hirlam participants a set of 3 preparatory documents: top-down approach (Yannick), bottom-up (Deborah), revised GANTT chart (JNT). Claude will prepare a short overview of MF actions and give a status about OOPS discussions held inside the Aladin/Hirlam community since this summer (Aladin/Hirlam strategy workshop, LTM meeting, Aladin General Assembly).

Jean-Noël stresses the announcement of a strike of the British Civil Services on Nov 30. This would have an impact on Border control (passport control) in the airports. Therefore, the SC meeting might be either deferred, or changed into a video-conf<sup>1</sup>.

The LAM participants will be informed (preparatory docs by Jean-Noël, practical arrangements and risk of SC re-organization). Claude stresses that Aladin would be represented by Daan Degrauwe (IRM/Belgium), instead of Piet Termonia.

### **5. AOB**

ECMWF would like to start planning a visit by Karim to Reading (1 week ?), to help with the IFS cleaning actions. This needs to be sorted out for Dec 8 (budget request to be prepared at EC).

Various other items addressed by Deborah:

- EC will send MF a list of optional keys from the assimilation code, which might be pruned from the IFS if agreed

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<sup>1</sup>Post-meeting: MF and EC agree that the SC could take place as a video-conf on Nov 30, if the strike is confirmed and Border control delays are likely. Claude has informed Piet Termonia, Daan Degrauwe and Ulf Andrae by email. An update will be made on Monday 28.

- VORTEX: EC would like to arrange a visit of two staff members to Toulouse, in order to get updated information about the work, and possibly discuss EC's involvement in Vortex (avoid re-doing things in parallel at EC, when re-writing the scripts for OOPS). Contacts at MF will be Alain Joly and Eric Sevault.
- ODB norm checker: Anne has a norm checker that tests basic compliance of the ODB data base with ODB governance (no new, undeclared tables, columns etc.). There's no need to share the ODB checker with MF or other partners, but everyone should be aware of the existing rules (contact at EC is Anne, for any question or "regularization")
- Claude stresses that we would need a careful planning of the ongoing cleaning actions related with OOPS, towards CY39 and beyond towards CY40. There is indeed an unknown concerning the scheduling of CY40 (before or just after the summer 2013), but CY40 is very likely going to be the last common cycle before MF will have to focus its attention and manpower to porting its operations to the next HPC.
- EC stresses the importance for a good visibility of developments (cleanings) done by MF. Development branches from clearcase should be sent to EC when relevant for cross-coordinated actions. In the same spirit, EC will send preliminary code to help for any pre-phasing when needed (*post-meeting note by Claude: this could concern the code for the GEOMETRY object ?*)

## 6. Date and Place of Next Meeting

next technical video-conference: December 8, 2011 at 1am (Rdg) / 14h (Tlse)  
 another tech video-conf will tentatively be scheduled for week 50

next coordination video-conf: Thursday, 29 March 2012 at 9am (Reading) / 10h (Toulouse)

next coordination meeting in Toulouse: Thursday, 28 June 2012 (all day)

## **List of actions:**

1. *ECMWF will write a short note about how to add new fields in the GOM arrays); This action is deferred to after completion of the GOM dataflow re-organization (after CY38R1).*
2. *GRIB\_API: More investigations about performances on the NEC/SX9 needed at MF (profiling ?). Ryad will contact DWD (Uli Schättler); ECMWF RD will pass information about the poor performance on NEC to their OD (MF will send Ryad's plot to EC)*
3. *ECMWF will prepare C++ coding guidelines for OOPS: post-poned to after the scientific review and its outcome*
4. *GFL and phys/dyn interface: GFL rationalization will be discussed at the Dec 8 video-conf with a view to start the work in early 2012 (possibly, preliminary comments on Karim's updated doc would be sent by Sylvie to Karim); Claude will send the updated version of the phys/dyn technical note (by Karim) to EC, for information.*

5. COPE: EC will send MF a consolidated spec document once the working arrangements between RD and OD have been agreed. (Further coordination and MF involvement will be arranged via the COPE-devoted video-confs.)
6. COPE: EC and MF will exchange the list of "filters" necessary for COPE that they perform in the various pre-processing steps.
7. ODB2: Anne will send MF (Dominique Puech) the updated library of ODB2; MF will check installation on NEC and try to run some test programs.
8. NEC F90 compilation environment w/r to OOPS requirements: Claude will send EC a short email report about the tests and progress so far (at the time of writing these minutes: Nov 25). MF will keep EC informed about the further progress of the compiling system on the SX9, as regards the requirements for OOPS and COPE ("STRUCT" issue if any, use of BOOST)
9. command line option: to be discussed at the OOPS SC, and addressed technically at the Dec 8 video-conf
10. arrange visit for Karim to ECMWF: to be decided by Dec 8
11. EC will send MF a list of optional keys from the assimilation code, which would be pruned from the IFS if agreed
12. VORTEX: EC would like to arrange a visit of two staff members to Toulouse, in order to get updated information about the work, and possibly discuss EC's involvement in Vortex (avoid re-doing things in parallel at EC, when re-writing the scripts for OOPS). Contacts at MF will be Alain Joly and Eric Sevault.