

IFS/Arpège Video-conf Coordination Meeting

March 29 2012 (10:20 – 12:30 Toulouse; 9.20-11.30am Reading)

Participants:

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

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

HIRLAM : Ulf Andrae

0. Adoption of the agenda (all)

adopted

Jean-Noël proposed to well separate coordination matters (for the coordination meetings) from the technical matters. Only technical aspects with a consequence on coordination would be addressed at the regular coordination meetings (timings, resources, working practices, difficult decisions on developments). This split is agreed; the present coordination video-conference can be considered as a transition one with this respect.

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

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).=> this action is deferred to the end of the GOM/MPOBSEQ code overhaul proposed by ECMWF (Alan Geer), so this will be discussed further at the technical video-conferences. Action closed.*
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) => MF received a new version of GRIB_API which contains porting optimization made by NEC. The last available version built inside the Arpège libraries did not give any significant speed-up. More recent versions might be under test by the NEC support, but so far there is no clear signal that the encoding/decoding parts can be efficiently optimized. On top of that, MF has noticed a severe increase of timing in a specific GRIB_API I/O part of the assimilation (Set-up of Sigma_b fields) which is under investigation for the E-suite on CY37T1. 2 new actions are decided: (1) MF to inform ECMWF about outcome of its analysis and possible adaptation of the GRIB_API/Sigma_b setup code (maybe liaison with Deborah and Mats in*

- Reading) (2) MF to keep ECMWF informed about tests of new GRIB_API versions for NEC either by its NEC support or in Arpège. *Action opened.*
3. *ECMWF will prepare C++ coding guidelines for OOPS: post-poned to after the scientific review and its outcome => Action opened*
 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. => GFL rationalization will be part of discussions during Karim's visit to Reading in May. Action closed.*
 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.) => Action closed. See also item 5.4.*
 6. *COPE: EC and MF will exchange the list of "filters" necessary for COPE that they perform in the various pre-processing steps. => Action closed. See also item 5.4.*
 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. => Anne will send a new version of ODB2 once consolidated. ODB2 will not be part of CY39, and its inclusion in the IFS can be done in a progressive manner starting with items not affecting the IFS/Arpège common parts. This would allow MF and other partners to adapt progressively. The whole move would take about 2 years, and one could even chose below the F90 ODB interfaces whether the databases should be handled as ODB1 or ODB2. Note: ODB2 will however be mandatory for COPE and its filters; an ODB2=>ODB1 converter will be maintained for some time as well. MF asked to what extent ODB2 was making use of features related to C++/F90 interoperability and Boost. ECMWF said C_binding is used within the interface from F90 to the ODB2, while Boost was not recommended at the time of the developing ODB2 (so this is different from the OOPS recommendations). Anne proposed to write and send MF a set of test programs illustrating the various manners of using C_binding within COPE and ODB2, to help for porting tests on other platforms (NEC/SX9 at MF and others). Action opened.*
 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) => Claude explained that the porting of the Technical Review version of the OOPS code was problematic on NEC, with various crashes (at least one in the link and one in the execution) + some suspicious behaviour of the compiler with pointer management inside F90 structures (not reproducible between OOPS and a full-shape F90 test case). So porting of OOPS versions to NEC/SX9 remains a non-robust issue (Note: the 2010 version was ported successfully after several compiler corrections had been made by NEC). The Tech. Review version has been handed over to NEC support. More*

- information when available at the technical video-conferences (or wrap-up at the OOPS/SC). *Action closed (matter for technical coordination).*
9. *command line (C.L.) option: to be discussed at the OOPS SC, and addressed technically at the Dec 8 video-conf => this was discussed at the technical video-conf: it is agreed that the C.L. Would not be used in the OOPS version of IFS, and a progressive pruning can be done in the F90 code. This pruning would mostly be done by MF. Action closed.*
 10. *arrange visit for Karim to ECMWF: to be decided by Dec 8 => visit to take place on week 21. Action closed.*
 11. *EC will send MF a list of optional keys from the assimilation code, which would be pruned from the IFS if agreed => a list of prune-able options was prepared at the technical video-conference, and agreed between EC and MF. Action closed.*
 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. => see Item 5.2. Action closed .*

2. For all participants: overview of the technical video-conferences held on December and February/March (4) (Deborah & Claude)

A few specific words on the following items:

- GOMS/MPOBSEQ second stage of code overhaul (based on Alan Geer's proposals): MF will send EC a technical note on how it uses the 2D GOM arrays for the treatment of radar observations (this is for computing and handling the humidity and temperature retrievals derived from reflectivity in an 'extended' Arome screening). EC will send MF a prototype code of how the new GOM structures would look like. This is under preparation by Alan Geer. This item should be part of a (perhaps specific) technical video-conference. It is expected that the new code will form part of CY39.
- Update on foreseen work with COARRAYS and outlook about EC's plans concerning porting to next generation's HPC: EC is testing in Research mode strategies to enhance scalability of the IFS on many-core computers (EU-funded CRESTA project). George Mozdzynski is starting to assess the benefits of using COARRAYS. EC confirms however that they would not include such a feature in the IFS in a hard-coded manner, as this was a F2008 standard that may not be available in all F90 compilers (as extension to the F90 norm). EC will give updates on this work when it has more results.
- Visit by Karim to ECMWF (21-25 May): KY will speak with EC staff on plans for the overhaul of horizontal interpolators, GMV/GFL structures. It is agreed that the outcome of the visit would be discussed at a technical video-conference.
- Plans towards GIT: status about exchange of technical information. There already was some exchange of information. MF sent a technical note describing how they will implement GIT as a successor to clearcase (cc). In the short term, MF want to replace cc with GIT by implementing the presently

existing facilities. EC have started to analyse the possibilities of GIT as a possible successor to Perforce, but no decision has been taken yet. The matter shall be addressed between RD and OD. In the meanwhile, EC will write a technical memorandum and send it to MF. Claude mentioned that the new technical facilities offered by modern SCR management tools could potentially raise issues on the side of working practices, an item which perhaps could be considered in the light of the increasing number of groups contributing to the common system. However, we should take time and analyse the needs in the spirit of “how to make life easier when pre-phasing and phasing”.

There were about 4 technical video-conferences since the last coordination meeting, which was found good for the technical coordination and the IFS re-factoring work. Deborah and Claude mentioned that care should be taken not to set too ambitious plans within these meetings. Alain pointed out that these video-conferences should not prevent scientists and developers to have good direct contacts to trigger collaboration. So the direct exchanges on technical and scientific work must continuously be encouraged. Claude agreed and took the GOM/MPOBSEQ code overhaul as an example where the involved people will have to liaise directly, in complement to video-conferencing.

3. Progress and plans / Highlights

please refer to the Appendices for a detailed list of P&P.

At Météo-France:

- CY38T1: March 5 - April
 - Dynamics cleanings; more flexibility in MF’s horizontal diffusion settings
 - DDH: complete budget including dynamics
 - Use of spherical wavelets in Arpège
 - Wrap-up of E-suite modset: tuning of σ ’s, physics
 - Finalize code for new convection scheme PCMT
 - Arome physics (E-suite), extra radars, SURFEX V7.2
 - LBC coupling and E-zone treatment (new options)
 - Full-POS: part of the algorithmic overhaul (spectral computational aspects)
 - CANARI/OI: new structure functions linked with Euro-4M work
 - Optimizations: surface files, CANARI
 - ALARO physics changes
 - HIRLAM/HARMONIE
- CY38T2 ?: between mid-May and June (if any)

E-suite and operational matters:

- CY37T1_op1:

- Retuned σ 's
- Increase number of obs: IASI, ground-based GPS from E-GVAP, cloud-affected IASI, EARS/IASI, RARS/SCAT winds
- Inflation factor to take into account model error in EnsDA (AEARP) and PEARP
- Adaptations in convection scheme, Arpège timestep reduced to 514s & slight increase of horizontal diffusion
- Aladin models: following Arpège
- Arome-France (see Appendix)
- Aladin-France switched off on March 27; La-Réunion application becomes reference for Aladin
- Begin implementation of Vortex in OLIVE & Operations (end of 2012)
- Move SCR to GIT (end of 2012 or beginning of 2013)
- Next E-suite: Jan 2013-June 2013 on CY38 or CY39

At ECMWF:

The next operational implementation is planned for the end of May 2012, although the interaction of this implementation with the installation of the HPC Power 7 will have to be managed.

The scientific content corresponds to CY38R1:

- 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
- Monitoring 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
- Objective filter for EDA
- New Jb statistics based on 37R2 with revised REDNMC (=1) setting
- Correction of observation error for TEMP in the stratosphere
- Relative humidity dependent downdraught entrainment, and reduction from 0.35 to 0.3 of up-draught mass fraction converted to downdraught
- Introduction of perturbations of the surface exchange coefficients in the TL/AD models
- Modifications to cloud ice fall-speed profile
- Correction to ice super-saturation in partially cloudy grid-boxes
- Change ice melting to rain rather than cloud liquid
- Introduce timescale for freezing rain
- De-aliasing of the pressure gradient term, reduction in the horizontal diffusion in the 10-day forecast
- Changes to improve swell
- 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
- Others...

CY38R2, planned for November, will be dedicated to increasing the number of vertical levels (from 91 to 137). Any scientific changes not directly related to this vertical resolution increase will not be active.

By late spring 2013, it is planned to implement a new Cycle CY39R1, with the following content (tentative):

- Increase of vertical levels for EPS to L92
- Improvement of surface properties in model
- light precipitation parametrization,
- Introduction of a lake model,
- 24-hour DCDA 4D-Var
- Improvement of balance operators
- Retuning of observation errors (SAT and CONV)
- revision of EDA perturbations
- Others...

4. Contents and timings for the next cycles (CY39, CY40, outlook beyond ...)

Following on from CY39 in Sept/Oct 2012, it is foreseen that CY40 would be produced before summer 2013. A short discussion took place on the precise timing of CY40, which is constrained on MF side by the necessity to have most of their technical staff available to port applications on the first cluster of their next HPC solution. This porting will start in very early July. Basically, two periods have been considered for producing CY40: March/April and April/May (leaving some back-up window in June). Release of CY40 must be completed in June 2013 the latest. The exact timing will be decided at the June 28 coordination meeting.

The technical content of CY40 was expected to include:

- Work on SL interpolators (Karim)
- Obs-interpolation restructuring, part of it (Alan Geer / John)
- Further break-up of setup routines (Tomas+ LAM)
- Cleaning of CDCONF
- Command line (part of it)
- GFL/GMV cleaning (Sylvie + Karim for discussion and liaison)
- Enable more than one geometry (Tomas)
- Call only GPHPRE (EC + Karim)
- Optimisations in the lateral coupling (Karim / if time left to do that)

During the technical video-conference, CY41 was very tentatively foreseen to be released Spring/early Summer of 2014.

CY42 was the target for OOPS to replace IFS in operations at EC.

5. Specific items of cooperation

5.1. OpenIFS and IFS-ARPEGE software agreement : Jean-Noël explained that the legal aspects of code dissemination in the frame of OpenIFS are in contradiction with part of the IFS/Arpège software agreement, most notably the part dealing with access restriction to the code by third parties, that is subject to MF's agreement. As OpenIFS is now starting to become a concrete project, a discussion should take place at management level in order to iron out these legal issues. Jean-Noël gave the example of the use of the IO_SERV facility, that ECMWF want to adapt for OpenIFS purposes. Alain explained that CNRM is performing a comprehensive survey of its software, in order to issue a complete licensing strategy. The overview and licensing is made difficult due to contaminating licenses (for instance, RTTOV has its own policy already). This comprehensive licensing is now also under discussion for all of MF's software. It is agreed that first views on licensing aspects should be exchanged at the forthcoming OOPS Steering Committee (May 3), where Erland Källen and Philippe Bougeault will be present. About IO_SERV, MF said that information exchange can start, and as the code is fully included inside the IFS/Arpège common libraries, EC may proceed with its investigations. The only point was to minimize the requested support and maintenance effort for MF staff in this context. One point raised by Claude was about how developments imported from OpenIFS collaborations into the common IFS/Arpège system would be handled and coordinated. For instance, in areas which are known to easily create phasing conflicts. ECMWF thought this might not happen quickly, and any such import would be handled by EC staff anyhow. Also, OpenIFS so far is restricted to the model forecast system (not assimilation).

5.2. VORTEX exchange of information and visits : it is agreed that an ECMWF delegation of about 3 people will visit MF (Gabor Radnoti, Mike Fisher, Paul Burton). The earliest possible date for the visit is 14-15 May (needs confirmation with MF, contact is Alain Joly to fine-tune the dates).

5.3. OOPS steering group preparation: the next SC will take place on May 3. It is agreed that the Scientific Review of OOPS will not yet be completed by that date, but this would not be a blocking issue. EC will visit MF on this occasion, with a delegation of 4 (Erland, Jean-Noël, Deborah and Yannick). Yannick would stay an extra day to discuss OOPS matters with MF assimilation experts.

5.4. COPE and cooperation status: ECMWF will send the finalized spec documentation to MF and Hirlam (MF already has a version of it). A video-conference should be arranged after this send (JNT, Florence). Anne would visit MF one extra day before or after the June 28 coordination meeting.

5.5. Code Cleaning: Principles and coordination : EC mentioned that some code cleaning done for CY38 by MF had been problematic for their scientists, especially code where useful comments had been pruned. Furthermore, too many cosmetic changes can make the code differences difficult to read, when new developments are to be included or a bug is traced. EC proposed that source code only developed by one specific group should be cleaned only by this group. MF said that this was fine as a general principle, but that it should apply only to manual cleaning. For automatic cleaning, where we would use some script, it is generally better to clean all the

projects and routines in a single go. The principle of not over-cleaning the code also was confirmed, as this already had been agreed during the discussion on the revisited coding norms. Claude also stressed that it would be up to him and Deborah to ensure that decisions of code cleaning taken at technical video-conferences are accepted by all involved staff; comment lines dealing with explanations of code or science, obsolete code with some wrapped-around comments etc. probably eventually must remain on the responsibility of each scientist.

6. AOB

None.

7. Date and Place of Next Meeting

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

List of actions:

1. *GRIB_API: (1) MF to inform ECMWF about outcome of its analysis and possible adaptation of the GRIB_API/Sigma_b setup code (maybe liaison with Deborah and Mats in Reading) (2) MF to keep ECMWF informed about tests of new GRIB_API versions for NEC either by its NEC support or in Arpège*
2. *ECMWF will prepare C++ coding guidelines for OOPS: post-poned to after the scientific review and its outcome*
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4. *COPE: ECMWF will send the finalized spec documentation to MF and Hirlam (MF already has a version of it). A video-conference should be arranged after this send (JNT, Florence). Anne would visit MF one extra day before or after the June 28 coordination meeting.*
5. *VORTEX: visit of ECMWF delegation at MF to be fine-tuned (date, participants)*
6. *GIT: EC will write a technical memorandum and send it to MF.*
7. *OpenIFS and source code agreement: exchange first views about licensing issues for the common IFS/Arpège system at the OOPS/SC of May 3, where Erland Källen and Philippe Bougeault will be present.*

Appendix A: Météo-France detailed content of cycles and P&P

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). The documentation for V7.2 will be made available on the SURFEX-lab website: <http://www.cnrm.meteo.fr/surfex-lab/>
- Optimizations in the “mse” library for Surfex (concerns “prep” when called from Full-POS/e927, P. Marguinaud & F. Taillefer):
 - Use FA format for input/output file format (instead of LFI)
 - 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 & F. Taillefer –
- Bugfixes and various optimizations (outcome of MF’s benchmarking efforts); spectral part of Tayfun Dalkilic’s work on re-factoring the multi-grid / multi-truncation handling in the core of Full-POS, including a change of the corresponding namelist keys (new NFPOS, LECFPOS); relax condition on vertical levels in the I/O step w/r to model vertical discretization (new key LIOLEVG) – R. El Khatib -
- E-zone treatment in gridpoint LAM model revisited (LNOEXTZ key: M. Hortal, Belgian team, based on specs by Ryad) & Boyd LBC coupling code (LFPBOYD: D. Degrauwe). Corresponding partner is D. Degrauwe (IRM/Belgium).
- Include MESAN’s correlation functions in CANARI (C. Soci / Euro-4M Project)
- Dynamics and cleaning (Karim Yessad):
 - Introduce an alternate way to compute the vertical displacement in the SL scheme (direct code only)
 - More flexible way of setting the vertical profiles of spectral horizontal diffusion; use of EC’s horizontal functions in Arpège is made possible in the Arpège setup (*note: the opposite is not possible*)
 - 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, TRGSGEOM, 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 and VPOS; CP_FORCING: move CPG_DYN into CPG_GP

- Reduce some calling tree complexity (remove SCAN2H etc.)
- New versions of GPMPFC with less dummy arguments
- CPG5_GP: bugfix for code under LPROCLDTL
- Removal of obsolete options for CLCONF; removal of old 923; various code re-organizations in the spirit of OOPS/IFS-cleaning
- Complete scientific closure of the DDH model budgets, including the terms from the dynamics (F. Voitus)
- Code cleanings in holo/unholo code (L. Auger)
- Encapsulation of spectral geometry arrays & making some Aladin setup routines mirroring IFS/Arpège one's (K. Yessad & A. Mary); collect all GFL setup into SUGFL (K. Yessad)
- Spectral nudging for coupling large scale structures in the LAM's (F. Voitus):
 - the idea is to estimate the tendency of {wind, temperature, pressure} by a finite difference between two successive coupling files, take the large scale part of it and relax the model tendencies towards these large scale tendencies at each model time step (this code uses the "old" key LTENC, which was coded for GP fields only);
 - 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) – F. Vaña -
 - radiation, microphysics, cloud scheme and convection (a few corrections and improvements) – R. Brožkova –
 - 3MT in Arpège (R. Brožkova & F. Bouyssel)
- 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)
 - Match-ups w/r to MF's E-suite CY37T1_op1 (PROC team)
- AROME physics: match-up of MF's E-suite changes for Arome-France (based on CY37T1_op1, Y. Seity): EDKF, condensation/cloud scheme, use of HSWB 1-km data, use of GTOPO30 higher resolution orography
- MUSC 1D model: adapt JPFORC value, some further developments if ready (Y. Bouteloup)
- Assimilation:
 - Phasing Bator with respect to MF's last E-suite version (preparation of ODB, F. Guillaume)
 - Wrap-ups from CY37T1_op1: tuning of σ 's for ASCAT winds; inclusion of GOES-15 data (C. Payan)
 - Updates for Arpège 4D-VAR in the spherical wavelet code, and for the representation of model error (L. Berre, G. Desroziers, H. Varella)
 - Radar assimilation in Arome-France: for the use of radial winds from 3 new radars (Plabennec, Grèzes, St-Maurel) – E. Wattrelot -

- Code inclusion in official libraries for the computation of LAM B-matrices: reference version of FESTAT & FEDIACOV codes (in the “uti” project/library) – L. Berre (in collaboration with T. Montmerle)
- HIRLAM (contacts are Ulf Andrae /SMHI & Niko Sokka /FMI): the whole modest in preparation is visible at <https://hirlam.org/trac/wiki/Phasing/cy38t1>.
 - New snow temperature computation (T. Aspelién)
 - Changes in Cellular Automata code and Rasch-Kristijansson convection scheme (L. Bengtsson)
 - Changes in cloud diagnostics: max random overlap including weighting for ALARO, cloud class diagnostic based on Z-height rather than model level for AROME (L. Bengtsson)
 - Changes in EDMFM/EDKF code (W. De Rooy)
 - Miscellaneous porting and optimization features in Surfex (T. Aspelién) => committed to the Surfex trunk V7.2 (S. Faroux)
 - Hirlam’s spectral nudging facility re-coded in CANARI (O. Vignes)
 - Various fixes and porting issues (localized changes)

Appendix B: ECMWF detailed content of cycles and P&P

Jean-Noël's slides shown at the IFS/Arpège video-conference can be handed over. Please contact ECMWF (Deborah Salmond) or MF (Claude Fischer) if requested.