OOPS technical meeting - 8th December 2011
IFS cleaning and re-factoring

Participants (MF) : Claude Fischer, Karim Yessad, Stéphane Martinez, Alexandre Mary, Yves Bouteloup
Participants (EC) : Deborah Salmond, John Hague, George Mozdzynski, Mike Fisher, Tomas Wilhelmsson, Sylvie Malardel

1. wrap-up of actions from last tech'meetings:

October 6 actions:

Action: Mike to send document to Claude to be circulated and passed to OOPS steering committee before their next meeting on 30th November => *done.*

Action: Tomas would keep contact with Karim to agree the list of modules to define the Geometry. => *closed, see item 3*

Action: Deborah would check with George on how this would fit with his work and Sylvie would give feedback on Karim's proposed re-write of LASCAW. => *closed, see item 4*

Action: John would communicate with Karim by email to get a good solution for the mpobseq work. => *closed , see item 2*

October 20 actions:

Action 1: Claude to produce updated version of coding norm document, and send it back to Mike => *done*

Action 2: Claude to check if MF can provide a new norm checker version. Deborah to check who is contact at ECMWF => *Paul Burton will adapt the existing PERL script to the new norm violations; contact at MF will be Stéphane (GCO). Action closed.*

Actions: ECMWF

- **move or replace LU* routines from ECMWF's physics[1] => *Mike will replace these calls by LAPACK calls for CY38R2***
- **extend the use of the encapsulated RIPI* arrays => *Deborah will do this cleaning for CY38R2***
- **decision about SUGAWA => *Deborah to discuss with Mats Hamrud. Action open*.**

Action: Karim to deliver an updated version of his cleaning document, after CY38 is declared => *done.*

Action: Claude will summarize the code patches in the old toy model, and send the information to Mike. Mike will check and adapt the OOPS code w/r to NEC porting issues. =>

1 Note from after the meeting: LUBKSUB and LUDCMP are from Numerical Recipes (and contain comments to that effect). They are also included as module routines in MODULE ARRAYTOOLS (aeolus/support). They can be replaced with DGETRS and DGETRF from LAPACK. (In "cloudsc", they are called one after the other, so we could use the simpler LAPACK routine DGESV, which does the decomposition and solves in a single call)

the tests of compilation and running the April 2010 toy OOPS on NEC have been successfully validated with a new compiler revision (rev441). Mike will adapt the present OOPS code to the changes proposed by MF (explicit KINDs, call to LAPACK, I/O files changed from Binary to ASCII format etc.). Next steps for MF/NEC liaison will be: to iron out any details in possible compiler limitations (STRUCT ?) and to assess the portability of Boost on the SX9. Claude will keep EC informed about any progress when relevant.
Please refer to Appendix: numerical comparisons of test runs and graphics.

2. OBSHOR cleaning

John has started the re-write of the GOM addressing, in the lines of Karim's proposal. He now has a preliminary version for GOM-1D, not yet adapted to GOM-2D and surface GOMS. John finds the encapsulated new setup code rather long and more complex than before (MPOBSEQ is simpler, on the other hand). He would like a few experts to check if this code is OK before proceeding.
MF confirms that GOM-2D are used for the Arome radar data, so they will have to test the future new code for the 2D dataflow anyhow, as EC has no means to test it.

Action: John (if more recent version) or Karim to forward the prototype code of GOM-1D to OBS people. At MF, this will be Eric Wattrelot and Françoise Taillefer for GOM-2D and CANARI, resp. (plus probably Patrick Moll and /or Vincent Guidard). Feedback is expected for February 2012. John would resume the work in March, including missing parts for GOM-2D and surface.

3. Geometry object (status of work by Tomas and short glance on start of MF's work)

Tomas has a prototype of an encapsulated Geometry object Fortran code, but this still contains a lot of old setup which is not purely Geometry. However, it is difficult to separate everything from scratch, so the prototype presently helps for setting up the 3D-VAR demonstrator. Tomas will continue to little by little disentangle the non-Geometry setup from this object.

In addition Karim proposes to separate the setup for vertical geometry, with respect to horizontal, as this will help for future changes in the dynamics (for instance, SI part only needs vertical information). This split is relevant for the Model object, as the Geometry object per se would focus on horizontal aspects.

Claude proposes that Tomas presents the status of his work, and how he proceeds, at the forthcoming “LAM/OOPS working days” at ECMWF (February 2012). This is because the Geometry object is going to be a crucial item for the LAM code.
MF also will proceed to some preparatory work towards encapsulated Geometry setup: re-arrange some Aladin setup so that it mirrors the IFS/Arpège one (Karim); encapsulate spectral setup (Alexandre with Karim's supervision). The target for this code adaptation is CY38T1 (March'12).

4. Rationalization of horizontal interpolators

The discussions about the re-write of more generic interpolators had two sides: (1) how far should we go in terms of generality or flexibility of the interpolators ?; (2) the coordination of the code changes with EC's plans for improving scalability of the SL communications. Sylvie indicated that the implementation of new interpolation methods should be made as easy as possible, and this aspect should not be forgotten in the cleaning effort. Karim and George said that this could indeed be evaluated, but too much generality might be too ambitious a goal. George introduced his plans in

the frame of the CRESTA project (porting the IFS to exascale HPC): his intention is to implement COARRAYS in some key parts of communications (transpositions, SL halo communications), and this effort would interfere with a re-write of the SL code. So a rather stable code until CY39 is better.

Eventually, the plan for interpolators is to:

1. remove global MODULEs from LASCAW*, and move the code to a separate library. The associated setup would follow the same move (SLCSET, SLRSET), plus possibly a new "inquiry" facility for retrieving information about the SL halo structure (in the spirit of what was done by Mats for the spectral transforms) => George, for CY39
2. discuss, consolidate or amend Karim's proposal for the re-write. Karim would start the re-write after CY39. So we need to keep a wrap-up discussion on his proposal (doc) for a technical visio-conf in 2012.
3. start the re-write after CY39 (Karim)

A by-side discussion on EC's plans for the revisit of the strategy for MPP communications took place. George explained that he will implement COARRAYS in areas such as the transpositions (TRMTOL, TRLTOM around the Legendre transforms to start with) and the SL halo communications (SLCOMM1). This will be done by pre-compiler directives (#ifdefs) so that the code can be filtered before compilation if required. Claude indicated that COARRAYS (Fortran-2008) go beyond the agreement to use F90-standards in IFS/Arpège (are pre-compiler directives an exception ?).
Another aspect for COARRAYS in the IFS is that various arrays need to be transposed first, in order to arrange the correct contiguity of columns in memory. This will have to be hard-coded in the IFS for CY39. Claude asked whether these transpositions can have an impact on performances, for instance on vector machines. EC said that they will test this on MF's NEC.
Claude asked that this activity can be addressed at one of the forthcoming IFS/Arpège coordination meetings (end of March).

5. Rationalization of GMV/GFL structures

Before the meeting, Karim and Sylvie exchanged views on the further rationalization of GFL and GMV data structures. Karim produced an updated version of his technical note, and this version is now the basis for future discussions.
One specific item under discussion was how far to go in the re-coding for CY39 ? EC would like to take several of the proposed steps until CY39, but MF has difficulties with this strategy because it would like first to well settle the specifications (especially about the list of GFL-attributes, the split between namelist and in-core parameters, some partial convergence between GMV and GFL parameters). Another problem for early 2012 is that MF will have a significant phasing to do on the side of GFL, since it plans to implement a set of new fields in link with the new Arpège convection scheme (PCMT). MF would prefer to postpone the bigger GFL cleaning to after CY39.

The decision is to follow a step-wise approach:

1. for CY39: MF (Karim) will proceed to a first stage cleaning, mostly gathering all GFL-related setup at one place
2. discussions and decisions should be proposed for the next steps, based on Karim's note, until May 2012. One issue will be to understand if we can go for a rather concentrated, more ambitious change between CY39 and CY40, or whether a very staged approach is acceptable.
3. the proposal should be discussed at the IFS/Arpège coordination meeting in June, along with

a proposal of share of work.

4. Further rationalization starts after CY39

Sylvie expressed interest in the new DDH dataflow. Claude will check at MF (PROC team)[2]. Contacts are Fabrice Voitus and François Bouyssel. One open technical issue is the compliance with Open-MP, which has to be studied. MF will work on this in 2012.

6. Cleaning action, based on Karim's document V7d

to be discussed on December 15. For the cleaning actions towards CY39, it is agreed to address the appendices E, G, I, L in Karim's long-term cleaning document V7d.

7. Pruning of 4D-Var switches

to be discussed on December 15.

8. Command line option

to be discussed on December 15.

9. Frequency of cycles and exchange of technical changes (item from OOPS/SC)

to be discussed on December 15.

to be assessed later:
overview of OOPS & IFS-cleaning changes for CY39, and those to come after (for CY40, for CY41) ??

8. Next meetings:

next tech'video conf: Thu Dec 15, 10h (Tlse time) / 9am (Rdg time) => if relevant, one item could be to give a status about the 3D-VAR OOPS/IFS prototype (tbc)

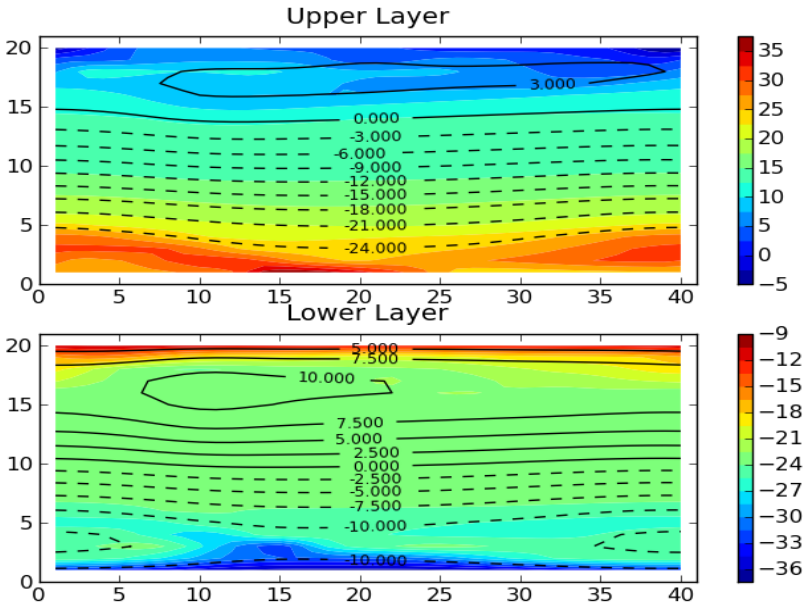
OOPS/LAM meeting: early February 2012 at ECMWF

2 Post-meeting info: Sylvie and Fabrice already are in contact, actually. François Bouyssel has been informed as well.

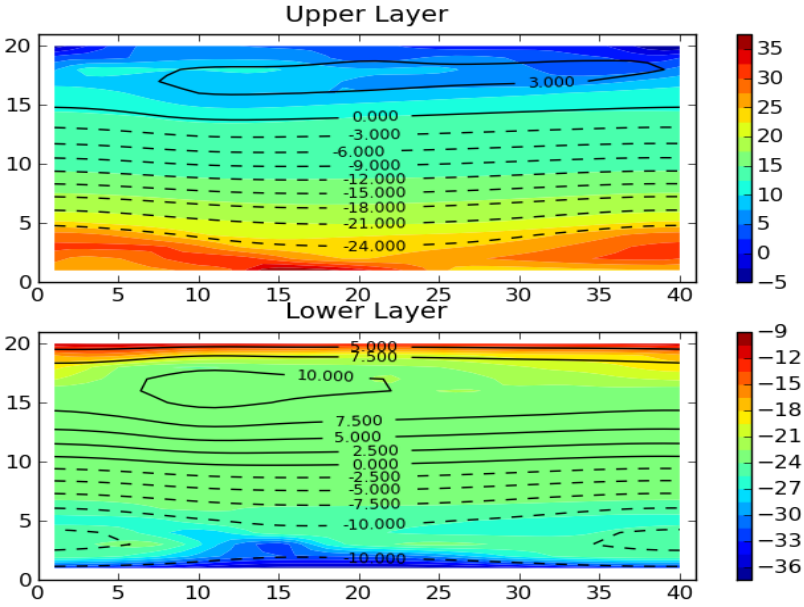
Appendix: comparisons between PC/Linux and NEC/SX9 runs of the April 2010 toy QG model

Results after 1.5 months of QG truth forecast:
PC/Linux:
max(psi)= 11.1028317252 min(psi)= -26.7152765669
max(pv)= 37.0227247835 min(pv)= -36.5199715394
NEC/SX9:
max(psi)= 11.1028312207 min(psi)= -26.7152765379
max(pv)= 37.0227233327 min(pv)= -36.5199709569

Forecast fields: from the PC/Linux run

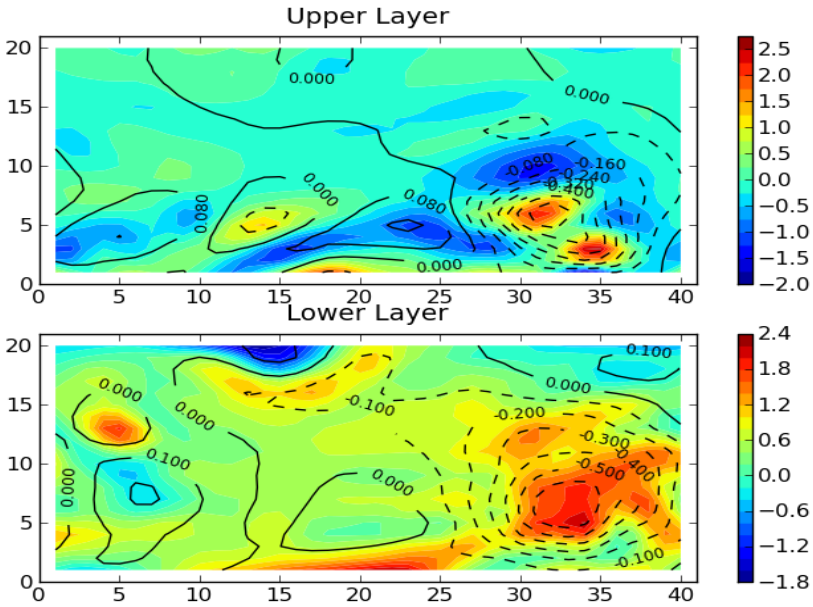


from the NEC/SX9 run:



4D-VAR analysis fields:
PC/Linux values:
max(psi)= 11.1729892994 min(psi)= -25.4323921402
max(pv)= 37.3260006787 min(pv)= -32.2260505621
NEC/SX9 values:
max(psi)= 11.1729893421 min(psi)= -25.4323921231
max(pv)= 37.3260008363 min(pv)= -32.2260488706

4D-VAR analysis increments: from the PC/Linux run



from the NEC/SX9 run: