Subject:	Progress and plans: cycles & MF operational perspectives.
Summary:	Please see below, the detailed plans about the forthcoming R&D code releases as well as the progress and plans at MF about E-suite/operational implementations.
Action(s) required:	• Take note of the MF E-suites: CY42_op1 from July through beginning of 2017 • Call for phasers CY43T1 (closed) and CY44 (autumn 2016) • please also take notice about the plans for the BULL Phase 2 clusters at MF. The first phase 2 cluster (new "prolix") is to become operational soon; in June, "beaufix" will be stopped for its phase 2 upgrade. All beaufix-users will receive a user account on prolix, but they will have to copy their /home files by themselves.

<u>Cycles, code releases and a few comments:</u>

CY42: March - June 2015. Declared on 17 June 2015.

This cycle includes several OOPS aspects, and was the merge of CY41R2 with CY41T1:
- OOPS and other technical aspects:
  - Reordering and cleaning of dynamics code (K. Yessad and D. Salmond)
  - Continuation of Model variables encapsulation in IFS and Arpège (T. Wilhelmsson, E. Arbogast + PROC team)
  - Pass fields (GMV, GFL, etc.) by arguments list only (O. Marsden, A. Mary)
  - MF IO-server code adapted to IFS (M. Hamrud, D. Salmond)
  - Others: refer to FLUBs of CY41R2 and CY41T1
- Scientific content of CY41R1 (i.e. CY40R3) and CY41R2
- Scientific content of CY41T1

Note: in the close follow-on of the IFS/Arpège coordination meeting of 15 June, and of the OOPS Board meeting of 16 June (Reading), the proposal to build a 2nd joint cycle still in 2015 started to be evaluated. The main reason was to be able to catch up quickly, in a common cycle, with the significant OOPS re-factoring that was to take place in summer 2015 mostly by ECMWF (see below list of content to CY43). This strategy received a rather positive echo from the EC and MF management, so that soon after CY42 another common IFS/Arpège(/LAM) cycle became a concrete target in the plans. One major aspect of the CY43 re-factoring was the OOPS-compliancy of the observation operator codes, and it did take place in two phases. Phase 1 was about cleaning and re-factoring in the NL obs operator code (including a new interface access from Fortran to the ODB), which was done by EC. Phase 2 was about Arpège aspects and TL/AD obs operator re-factoring, and was mostly done by MF.

One by-side consequence for MF and the LAM partners however was that the planned CY42T1 had to be cancelled (lack of time) and the next target for the MF and LAM common codes now is a CY43T1 in spring 2016.

CY43: September 2015-February 2016

Content:
- Code re-factoring for OOPS:
  - Pre-OOPS cleaning of observation codes (phase 1 of re-factoring):
    - VarBC cleaning and rationalization (H. Hersbach, A. Geer)
    - cleaning steps in and around HOP and implementation of GOM_PLUS (A. Geer)
    - generalize a clean use of "seqno" for ordering observational sets (A. Geer)
    - new interfaces to ODB from IFS Fortran code (P. Lean)
    - encapsulated MKGLOBSTAB for horizontal interpolations (T. Wilhelmsson, M. Hamrud)
  - split background from perturbation in Jb code (M. Fisher)
  - Phase 2 of observation operator re-factoring - (EC and MF)
    - New interfaces for HOP; HOPTL/AD included in HOP; GOM and GOM_PLUS passed by arguments + Geometry

- - - Removal of HRETR, as this facility is now included in HOP
      - Observation types are handled inside HOP by calling specific OP_OBS_* routines (this is a new interface level)
      - New vertical preparation routines called PPNEW, to replace the PPOBSA* routines
      - Arpège options updated (almost !): APACHE, ACHMT/TL/AD, CO2-slicing
  - New version of trajectory code for OOPS-IFS VAR (Y. Trémolet, O. Marsden)
  - Further encapsulation: completed passing by arguments the GEOMETRY. Remove global variables and pass all fields and parameters as arguments via Fortran structures. This re-factoring also applies to relevant LAM codes and variables – (O. Marsden, A. Mary)
- Pruning of LFI file format I/O in "mse", so that only FA file format remains possible for Surfex surface files in Aladin, Arome or Alaro (Ph. Marguinaud)
- Note from CY42R2: first changes for building a configuration 903 within FP (R. El Khatib)
- LAM code phasing performed in the autumn 2015, originally based on CY42R2 (Aladin phaser team in Toulouse + GCO), complemented with extra LAM adaptations of interfaces for CY42R3 (REK, A. Mary, O. Marsden)
- Scientific inputs from CY41T1_op1 (re-phased on top of CY42 and merged into CY43) and CY42R1.

Note: at ECMWF, three interim cycles were produced between CY42 and CY43, R1 was a catch-up of the e-suite changes from CY41R2, R2 and R3 were two technical cycles for OOPS re-factoring. MF had sent their OOPS contributions to EC for inclusion in R3.

CY43T1: build presently expected over [mid-April through June 2016]. Deadline for code commitments in MF's GIT repository was set to Monday 18 April 2016.

Provisional content:
- System:
  - Support and debug for GRIB1 encoding in FA files (R. El Khatib)
  - Encoding with GRIB2 using the GRIB_API library in FA files (P. Marguinaud)
  - Post-processing server coupled with the forecast model (P. Marguinaud)
  - Optimization for BULL and CRAY (R. El Khatib)
  - Removal of ISP (aka as "movies") (R. El Khatib)
  - Open-MP compatible DDH-flexible (F. Voitus)
  - Reorganize the set-up of TSTEP in IFS for a further oopsification (proposal by Karim, tbd) (tbc)
- Assimilation and use of observations:
  - Option for anti-aliasing in the computation of σb (L. Berre, G. Desroziers, V. Chabot).
  - Option for the normalization of wavelet covariances (L. Berre, G. Desroziers, V. Chabot).
  - Option for taking into account the relaxation of balances in the stratosphere, when computing wavelet covariances or local σb's (L. Berre, G. Desroziers, V. Chabot).
  - Restructure SUJBVARENS (computation of σb from the Arpège EDA) in order to make

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it LAM-compatible and enable objective filtering of tensor components/lengthscales (Y. Michel).

- o New code for EDA with AROME: inflation, modification to the stochastic perturbation scheme, merge of covariance matrices, etc. (Y. Michel)
- o Update of the code for the recursive filters (to make it match the development made for EnVAR with OOPS) and for the perturbation of the SST (Y. Michel).
- Processing and assimilating observations in the NWP suites:
    - o Infrared satellite radiance aspects (V. Guidard)
    - o Adapt neutral wind calculation to SURFEX output (C. Payan)
    - o Adapt scatterometer input and screening to enable use of higher density ASCAT data (12km instead of 25km) (C. Payan)
- Finalize the adaptation of Arpège options to the re-factored observation operator codes of phase 2: APACHE, ACHMTTL/AD (MF/ OBS team)
- ARPEGE forecast model:
    - o Changes for the new convection scheme PCMT (JM Piriou)
    - o Make SURFEX work for ARPEGE (F. Taillefer, Y. Bouteloup) (tbc)
- AROME forecast model:
    - o ORORAD impact of subgrid orography parameters on the surface radiation budget (A. Mary, Y. Seity, ZAMG/C. Wastl, Hirlam)
    - o Necessary updates in "mse" in order to switch Surfex V8
- Surface schemes:
    - o Version 8 of SURFEX (P. Marguinaud, Y. Seity)
- ALADIN/ALARO (R. Brozkova):
    - o Radiation code ACRANEB2:
        - ▪ Sunshine duration computation also for ACRANEB2 (complete a missing code);
        - ▪ Fix in APL_AROME of the ACRANEB2 call (to initialize a field needed by SURFEX with TEB);
        - ▪ Introduction of the exponent-random overlap in ACRANEB2;
        - ▪ Improvement of the bracketing weights computations in ACRANEB2 (long wave part).
    - o Turbulence scheme TOUCANS:
        - ▪ New shallow convection;
        - ▪ Some cleanings.
        - ▪ Coupling with Surfex ? (Radmila & Rafiq ?)
    - o Add a new variable in Full-POS: ventilation index (tbc)
- HIRLAM (highlights, detailed list tbc)
    - o Upper air assimilation:
        - ▪ Corrections to run 4DVAR in AROME (Jan Barkmeijer KNMI, Magnus Lindskog SMHI)
        - ▪ Scheme for generation of random perturbations with structure of B-matrix covariance (Jelena Bojarova, Met Norway)
        - ▪ GNSS, observation perturbation method etc.
    - o Numerical aspects:
        - ▪ Application of Davies relaxation at the upper boundary LUNBC (Mariano Hortal AEMET, left over from CY41T1, code phased by Toon Moene KNMI)

- - Changes related to running with cubic grid (Mariano Hortal AEMET)
      - First order in time scheme (avoiding time extrapolations) during the first few time steps.
      - The second is to limit the value of the computed 3-dimensional divergence in the model to half the inverse of the time step. This limit is chosen because it is the limit of convergence of the trajectory computation in the semi-Lagrangian method.
    - Physics aspects:
      - Optional RACMO turbulence formulations in AROME (Wim De Rooy, KNMI)
      - Changes in coefficients and default settings for radiation (Christian Pagh Nielsen DMI, Laura Rontu FMI, Emily Gleeson Met Eirann) See note sent to MF/ECMWF
      - CA resolution dependent changes (ALARO) (Lisa Bengtsson SMHI)
      - Correction and cleaning of cloud overlap calculations (ALARO/AROME) (Lisa Bengtsson SMHI)
    - Technical aspects: cleaning, porting, fixes, ODB etc.
  - Wrap-up of late changes of the ARPEGE and AROME-France e-suite versions of CY41T1_op1 or CY42_op1 (operational since 8 Dec, 2015) (GCO team)

Note that the reference version for validation of Arpège global configurations shall be CY41T1_op1 and/or CY42_op1 (the latter is the CY42-phased version of the former, in rough words). For the LAM adiabatic "mitraillette" tests (Aladin dynamics), the same reference applies. For the Arome-France CMC, the reference shall be CY41T1_op1 + the additional plug-in and testing of SURFEX Version 8.

CY44: Sept-Oct 2016 ? (tbd with EC)

Provisional input:
- Code re-factoring for OOPS:
  - final phase 2 re-factoring of observation operator codes (EC)
  - pass by arguments MODEL variables and parameters. Remove global variables and pass all fields and parameters as arguments via Fortran structures. This re-factoring also applies to relevant LAM codes and variables – (O. Marsden, A. Mary)
  - updated GMV/GFL structures in order to match requirements for the OOPS INCREMENT object ? (T. Wilhelmsson, M. Hamrud)
  - other re-factoring aspects: …
- Pruning of obsolete options in the dynamics (K. Yessad):
  - The old code for the sponge
  - LRNHC1+LSLINLC1
  - LRETCFOU+LWRTCFOU (specific handling of radiation coefficients for the simplified radiation scheme of Arpège 4D-VAR)
  - The NH code for GEO-GW (coded in 2007, never used nor fully validated)
  - Note: in this process, some specific Aladin/LAM code will be removed
- Scientific inputs from CY43T1 and CY43R1/R2.

Progress and plans of E-suites/O-suites:

Progress and plans for MF's NWP suites in 2016:

The next forthcoming important scientific targets concern the implementation of new applications:
- **Arome-Nowcasting ("Arome-PI")**: the operational porting was completed in December 2015, and the production is available to the forecasters since March 2016;
- **Arome-airport** application (for SESAR production). The operational implementation is to be discussed between Research, Production and IT Depts;
- **Arome EPS ("PEARO")**: porting to operational environment planned in summer 2016, and operational declaration expected for the end of 2016;
- **Arome Overseas:** five domains in dynamical adaptation from the IFS (except La Réunion – 3D-VAR and Arpège coupling). In operations since 11 February 2016.

The following items are under discussion for entering an E-suite in the 2nd semester of 2016 (e-suite to start by July, with a switch to operations expected for beginning of 2017):
- **CY42_op1**
- Arpège/Aladin physics:
  - new convection scheme "PCMT" in Arpège
  - SURFEX in Arpège
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HPC aspects at MF:

Here is the current status of the porting to BULL and the implementation of MF's next HPC configuration:
- The first Phase 2 BULL Cluster was installed at the Clément-Ader computing centre in the beginning of January 2016. System and User validations started on Wed 9 March. For installing the Phase 2 cluster, the Phase 1 cluster had first to be dismantled. Thus, MF only had one Phase 1 cluster ("beaufix") available for both research and operations over end-Dec 2015 / end-Feb 2016. The new cluster (its official name shall remain "prolix") should become fully operational by beginning of July 2016.
- Then, the second Phase 1 cluster ("beaufix") shall be stopped and dismantled ([end-July / beg-Sept 2016]), leaving only one Phase 2 cluster for both research and operations at MF. The second Phase 2 cluster ("beaufix2") should become available for beginning of October 2016.