Subject:	Progress and plans: • status of common IFS/Arpège/LAM cycles, • MF operational and R&D activities.
Summary:	Please see below, the detailed plans about the recent R&D code releases in MF's GIT repository, as well as the progress and plans at MF about e-suites and operational implementations.

Action(s) required:	• Take note of MF's plans for e-suites and operations in 2018 and 2019. Especially, please note the upcoming change of resolution of Arpège, planned for operations in the end of 2018.
	• take note of the content and timing of IFS/Arpège cycles.
	• With respect to MF's e-suite cycles (CY42, CY43T2 under test), as well as for the export code versions (CY40T1, CY43T2 in test by some partners), take note that the possible code versions for local implementation are lagging fairly behind the most recent IFS joint cycles (CY46). We should aim in the next one-two years at "re-phasing" these two aspects a little more.
	• For all LTMs and representatives, please check within your teams for potential candidates for the upcoming phasing exercises in Toulouse:
	    ◦ CY46T0/T1: **autumn (from mid-September through December) 2018**
	    ◦ **candidates for January-March 2019**, for the next joint IFS/Arpège/LAM CY47.

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

CY45T1: Oct-Dec 2017. Deadline for contributions Thursday 28 September, 23:59 CET.

Content:
- System operational aspects (Météo-France o/e-suites):
  - Only a few fixes phased on top of CY45, found when starting to test screening and minimization in Arpège 4D-VAR and Arome 3D-VAR *in CY43T2* (P. Moll, F. Suzat, **C. Payan**, P. Brousseau, E. Arbogast). *Note: many specific fixes however did not make into CY45T1_main* (**)
  - *Note: fixes for CANARI/CY43T2 did not make it at all in CY45T1_main* (**)
  - Phased contributions to MF's Arpège+Surfex e-suite based on CY42_op2 (GMAP staff) *=> basically completed, though pending some extra technical arrangements in the code* (**)
- System technical aspects:
  - PREP with FA file formats, deactivate default use of LFI format (Ph. Marguinaud)
  - FA file format support in FESTAT (R. El Khatib)
  - fixes for LAM+SURFEX and MPI in order to enable MPI tasks running in E-zone regions only (REK)
  - optimizations for Full-POS; important updates for Full-POS in OOPS (configuration 903 for Arpège and Arome, and PostProcessor object in OOPS) (REK)
  - pruning of FEMARS in CNT3/IFS code (REK)
  - drHack: a runtime profiling facility to dynamically generate call tree information for any configuration (F. Suzat)
- Diagnostics and specific post-processing:
  - add surface fields to DDH diagnostics (Y. Seity)
  - Flexible DDH OpenMP debugging (F. Voitus):
    - Introduction of a new DDH type devoted to the DDH bugdet in APL_AROME
    - Fix for storing and cleaning the DDH structure when KSTEP=0
- Arpège and Arome model dynamics:
  - first codes for implementing the Quasi-Elastic NH equations in global and LAM (for finite differences at least) (K. Yessad, F. Voitus)
  - vertically variable SITRA in SI operator (K. Yessad)
  - more flexible filtering of orography for PGD files (KY)
  - simplifications in the code of LASCAW when interpolating half-level fields (KY)
  - if ready: enable to only switch on higher-order interpolations in the last iteration of P/C scheme (could be numerically cost-effective when LPC_FULL, KY)
- Arome physics:
  - add a term of deposition for the microphysics (Y. Seity)
  - a significant rewrite of the ICE3 microphysics code in order to reduce the dependency upon the time step value (Note: some bugs fixed while rewriting) (S. Riette)
  - recent updates for computing gust winds, from the CY42 e-suite (enable to compute gust winds over a different time range than the forecast range of the output file) (Y. Seity)
  - *implement SURFEX V8.1 ? => cancelled for CY45T1 (Y. Seity)*
  - first version of the LIMA two-moment microphysics scheme (Y. Seity, B. Vié)
- Assimilation methods:
  - updates for Ensemble Data Assimilation (EDA) and for using grid point σb's in

AROME. This contribution includes a significant rewrite of LSPFCE=.FALSE. for LAM, *which will change its functioning* (Y. Michel)
  - o enable to diagnose the content of one column of B; enable NETCDF I/O of LAM stabal and stabcv files for the B-Matrix (Y. Michel)
  - o optimization of code for filtering B matrix structures and for computing the inflation factor for AROME EDA (previous codes already in CY43T1) (Y. Michel)
- Observations:
  - o enable monitoring of data from the MTVZAGY microwave radiometer on board METEOR (Russia) (Ph. Chambon, F. Suzat)
  - o enable monitoring, possibly assimilation, of data from the AMSR2 microwave radiometer on board GCOM-W1 (Japan) (P. Chambon, F. Suzat)
  - o implement monthly varying versions of microwave surface emission atlases (F. Suzat)
  - o monitoring and potential use of scatterometer winds from the Indian satellite ScatSat-1 (tbc, C. Payan in coordination with ECMWF/G. De Chiara)
- ALADIN:
  - o fix for quadratic/cubic coupling (Jan, following Jozef and Alexandre)
  - o fixes for ALARO-1 (Jan Masek)
  - o combination of SURFEX with TOUCANS (D. Degrauwe and R. Hamdi)
  - o prognostic graupel scheme "LGRAPRO" (B. Bochenek)
  - o phasing of VFE work for NH dynamics (Petra Smolikova)
  - o note: a fix for writing out spectral orography in e923 clim files was added as well, already in CY45_main (originally fix by F. Taillefer)
- HIRLAM:
  - o observation pre-treatment aspects, Bator/Oulan (mostly E. Whelan)
  - o Surfex changes have been ported into the GMME/Surfex trunk as a specific NWP branch version (P. Samuelsson)
  - o miscellaneous cleaning and fixing
  - o Note: several changes in model and assimilation eventually were not ready in time to make it into CY45T1
- OOPS re-factoring:
  - o further reorganization, encapsulation and passing-by-arguments of the LBC code for LAMs (H. Dhouioui, A. Mary, K. Yessad, B. Bochenek)
  - o encapsulation of the "coupling frequency update" diagnostic (O. Douba, R. El Khatib, C. Fischer)
  - o more generally, finalize the adaptation of Arpège options to the re-factored observation operator codes of phase 2: APACHE, ACHMTTL/AD (MF/ OBS team)

CY45T1 was declared in MF's GIT repository on 24 January 2018. In terms of validation, CY45T1_main <u>does not</u> contain the fixes to technically run assimilation (neither Arpège 4D-VAR, Arome 3D-VAR, CANARI). It has been validated against CY45 and CY42_op2 for model, Full-POS, (e)923 configurations, except ALARO (suspicions on norms), incremental DFI (LINCR step problem in kinetic energy norm – fixed in CY46), ALADIN+Surfex (requires code cleaning and some re-factoring within surface and diagnostic fields handling – to be done post-CY46). These remaining problems will be investigated according to priorities and staffing.

CY43T2_bf upgrades of 2018:

(**) in parallel to the build of CY45T1, a significant update of the base version of CY43T2 (i.e. CY43T2_main) was started including a complete wrap-up of the e-suite changes from CY42_op2 and the fixes for running data assimilation configurations with CY43 codes. This effort lead to successive versions of a bugfix branch **CY43T2_bf**.

The stand on February 2018 was that Arpège 4D-VAR and Arome 3D-VAR, as well as CANARI, were technically running with CY43T2_bf.04 (in MF on BULL). However, a few caveats had been identified that required further investigation (innovation values and screening of AIRS, Jo values of radiances in general, coupling with Surfex-V8 in the Arpège assimilation, preparation of initial files for the DA cycle using PREP). A number of "small" fixes also had been spotted (Full-POS, ...).

HIRLAM (contacts Daniel and Roger) and ALADIN (CHMI) partners started to install and test CY43T2_bf.04 as well, as "alpha-release versions".

On 5 April 2018, progress made in MF enabled to upgrade the codes of CY43T2_bf for the Arpège 4D-VAR and Arome 3D-VAR assimilations as well as the Arome EPS. The upgrade lead to v06 and includes a number of fixes, specific step-backs in Surfex V8 (back to V7.3), some wrap-up of changes from CY42_op3 and on-the-fly adaptation of operational needs (for observations handling typically some Bator stuff).

Known weaknesses of this v06 are AEARP (pending a fix for "pertobs") and validation of all Arpège physics versions used in PEARP. In addition, some wrap-up of CY42_op3 for AEARO is scheduled for v07.

Versions built in 2018 (starting with CY43T2_bf.04), and recent fixes listed on-top of v04:
- v04 was built on 25 January 2018. Headline list of content:
  - a number of fixes: for Arpège wavelets B; for Surfex in Arpège; for θ'w(1,2) in FP; to enable handling the LAM grid detection case in ecCodes/GRIB2; for PGD/ORORAD; new code for reading AEARP members in FA format; fixes for Arpège 4D-VAR and CANARI in CY43; for AEOLUS
  - coupling of Surfex in Alaro (D. Degrauwe, R. Hamdi)
  - Alaro-1 fixes (R. Brozkova, J. Masek)
  - Bator updates: fix for ODIM format; adaptations to new WMO BUFR recommendations
- v05 was built on 16 February 2018. Content:
  - enable FA format in PGD (NWP style) (A. Mary)
  - fix PPOBSAP for CANARI towards CY45 (C. Payan)
- v06 was built on 5 April 2018:
  - Surfex version 8 aspects:
    - several fixes for PREP proposed by the GMME/Surfex team (S. Faroux) – Note: in addition, for 4D-VAR experimentation, it is recommended to use the corrected input databases for CLAY and SAND, and to set LVERTSHIFT=.FALSE. In namelist of PREP (V. Guidard, P. Moll, C. Birman)
    - step-back on change for ECUME from V8 to V7.3 in routine ecume_flux.F90 (Y. Bouteloup, V. Guidard, P. Moll, C. Birman)
    - Note: in order to reproduce operational-type of behaviours of Arpège or Arome in MF, when using Surfex, it is highly recommended to set in namelist { &NAMXFU LXNUVCLS=.TRUE., / wherever LXCLS=.TRUE. (this recommendation does not apply for configurations not using Surfex, like Alaro/ISBA)
  - backphased fix for LINCR=.TRUE. In dfi2.F90 from CY46 (Alexandre)
  - Full-POS:
    - fixes for FABEC outputs in pos.F90: computation of CTSTAR, passing of argument ZPDEP (I. Etchevers & R. El Khatib)
    - 3 fixes found by Hirlam: ebicli.F90, fpcorphy.F90 (via Ryad, also fixed in CY46)
  - Ensemble systems:

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- updates for using AEARO IC perturbations in the Arome-France EPS, reported from CY42_op3 (PEARO) (L. Raynaud)
- fix for "pertobs" for AEARP (B. Ménétrier, L. Berre)
  - OBS and assimilation codes:
    - fix to enable 3D-VAR runs in hop.F90 (C. Payan, P. Brousseau)
    - fix for initializing the field TROAD5 instead of TROAD3 for TEB, in OI_MAIN (P. Brousseau)
    - mf_blacklist.b: proper accounting of quality index for GOES-16 (C. Payan)
    - backphasing from CY45T1: in "aro_ground_diag.F90", handling of neutral winds; another item for setting neutral winds in XFU (C. Payan & R. El Khatib) – note: required namelist changes …
    - TROAD2 correctly updated (C. Payan)
    - fixes for scatterometer DA and handling of neutral wind field (C. Payan)
    - fix for hretr_rad.F90: improved phasing between SSMI/S and AIRS (V. Guidard or C. Payan)
    - initialization problem in canari_sfx.F90 (V. Guidard, P. Moll, C. Birman)
    - adapted codes for properly handling Mode-S with respect to other obs types (V. Pourret, C. Payan)
  - BATOR updates (F. Guillaume):
    - recover 'satellite instrument' value (from GPSRO BUFR files) in the sensor@hdr ODB column to avoid future updates of OBSTAT,
    - add decoding software for MWRI and MODE-S (V. Pourret) data in bator_decodbufr.F90,
    - changes in param_bator.cfg to handle these new data and change for GPSRO,
    - add TS_MWRI type in namel_bator,
    - add codetype MODE-S (147) in yomcoctp.F90
    - avoid an error return when none of the following file formats is being asked: BUFR, NetCDF, HDF5
    - cancel forcing REDZONE to 0. for CANARI (from P. Brousseau)
  - the use of ecCodes is now made possible in preparation of GRIB2, and is *required for compiling* the codes. Note however that, at run time, a "classical" use of I/O functions (FA routines) does not require GRIB2.
- v07 (items under investigation):
  - finalized changes for the Arome EDA system reported from CY42_op3 (mostly inflation in AEARO) (Y. Michel)
  - fix for 1D ocean model fields initialization by PREP (S. Faroux, G. Faure)
  - one fix required for reading Mercator input file in PREP (problem of date for ocean tile) (G. Faure & P. Marguinaud)

CY46: January-March 2018. The start of build was on 16 January. This cycle contains several new stages of the FORTRAN re-factoring of the IFS for OOPS.

List of content with a focus on re-factoring:
- OOPS re-factoring in IFS FORTRAN codes:
  - VarBC (work started to split into smaller pieces, to be continued after CY47)
  - pruning of TSCV and LTSCV from control vector codes
  - encapsulation of TOVSCVX and LTOVSCV for control vector
  - code adaptation for multi-incremental (multiple resolution) – Sqrt_B formulation added to OOPS
  - adapted handling of time and time step variables for multiple MODEL instantiation - Step 1

- to be continued for CY47
  - ○ Full-POS work not already in CY45T1 (this is a continuous work in progress until end of 2018)
  - ○ pruning of many of the duplicated model routines temporarily defined for CY45_OOPS. For the parallel maintenance of OOPS-IFS and IFS, for a few cycles, the STEPO(TL/AD) routines, as well as the TRAJ* routines, will have to be maintained with both their OOPS-IFS and IFS versions
  - ○ removing/pruning many of the global model variables references in USE statements (duplicated with passing by arguments of CY45)
  - ○ Removal of LQSCATT switch
  - ○ Cleaning and improvements to oopsifs interface layer – especially consistent use of linked list
  - ○ Cleaning of NOBSHOR settings
  - ○ Move of GBRAD Obs operator to HOP position
  - ○ Some fixes for T to TV conversions – expect more needed here
  - ○ any other content of the CY45_OOPS branch that might not already have done it into an interim cycle in either Reading or Toulouse
- pruning of deep atmosphere code option in IFS/ARPEGE/LAM dynamics; pruning of namelist key LNHDYN replaced by LNHEE (== former LNHDYN version) and LNHQE (K. Yessad)
- fixes for Quasi-Elastic NH version (KY). Note that the NH-QE code is not yet fully functioning in a scientific proof manner. In particular, the RHS of the tendency for vertical velocity *w* has to be redesigned. This is a target for CY47.
- LAM code phasing (K. Yessad, R. El Khatib, O. Spaniel, A. Ambar)
- OOPS/C++ or system aspects (scripts etc.):
  - ○ split namelist blocks enabled for multiple objects instantiation in OOPS-IFS (+ use of json to handle the namelist trees), link with new scripts for OOPS-IFS
  - ○ Jo-table enabled
  - ○ test programs for model TL/AD, obs operator TL/AD
- scientific contents of CY45T1 and CY45R1+OOPS -note: there was no CY45R2 at ECMWF

CY46 has been declared on Tuesday 10 April 2018 in MF's GIT repository.

CY46T0/T1: this one (or two?) cycle should include all updated fixes enabling to run Arpège and LAM data assimilation systems [phasing up from CY43T2 – would include CANARI revival] + updates for Arpège-Surfex_v8 (adapted from CY42_op2) + any other fixes collected within [CY43-CY46].
If only these "technical" updates enter a T-cycle, then this would lead to a "T0" definition. If additional new science would be allowed in, then a "T1" version could be defined. Whether the two are only one T-cycle is left open for now.
Timing: Sept-Oct or Oct-Nov 2018. Declaration certainly to occur by X-mas.

Provisional content, tentatively including some science or system development:
- System operational aspects (Météo-France o/e-suites):
  - ○ adapted fixes for Arpège+Surfex_v8 (from testing CY43T2_bf and comparison with CY42_op2)
  - ○ adapted updates from CY42_op3 suite (i.e. for AEARO)
  - ○ any fix needed to run Arpège 4D-VAR or LAM 3D-VAR as tested in CY43T2_bf, and possible extra re-phasing with respect to CY45-CY46
  - ○ re-phased fixes and recoding necessary to revive CANARI
- System technical aspects:

- ○ reminder: GRIB2 facility enabled using ecCodes software (mandatory for compiling CY46)
- Diagnostics and specific post-processing:
  - ○ harmonize the names of fluxes and tendencies (3D and 2D) in ARPEGE and AROME (flexible DDH, F. Voitus),
  - ○ finish the implementation of DDH terms from the dynamics (flexible DDH, F. Voitus)
  - ○ *new fields in model outputs – tbd -*
- Arpège and Arome model dynamics:
  - ○ various dynamics updates and cleaning by Karim (K. Yessad & F. Voitus):
    - NHQE treatment of *w* improved (note: the version coded in CY46 is unstable)
    - simplification of spectral SI operator (H and NH, global and LAM)
    - modified handling of bottom boundary condition for *w*: implement a modified *W* following the condition *W_mod = 0* (proposal by L. Auger)
    - more proper use of *R_dry* (versus *R_moist*) in dynamics
    - several fixes for the treatment of the NL Laplacian term in NH-QE
- Arpège atmospheric physics:
  - ○ tunings and code adaptations needed for Arpège new resolution Tl1798C2.2L105
  - ○ *first rewrites of PCMT code (J.-M. Piriou, Y. Bouteloup)*
  - ○ *review stability functions for PBL with respect to consistency of energy cycle, potential impact of Lewis number # 1 (P. Marquet)*
  - ○ *TL linear physics for 4D-VAR: updates in microphysics (C. Loo)*
  - ○ *other Arpège physics changes ??*
- Arome atmospheric physics:
  - ○ *improved ICE3/ICE4 for forecasting hail (Y. Seity, S. Riette)*
  - ○ *first version of LIMA available (if not already in CY45T1) (Y. Seity, S. Riette)*
  - ○ *diagnose visibility for post-processing and end-user applications (O. Jaron, Y. Bouteloup, I. Etchevers)*
  - ○ *other Arome physics changes ??*
- SURFEX based on v08 in [CY43-CY46T*] (Y. Seity):
  - ○ bf for TEB when garden not activated (wrong calculations of vertical/horizontal fractions)
  - ○ bf for 1D-ocean mixing layer model CMO (used in AROME-Overseas)
- Assimilation methods:
  - ○ improvements on EDA for AROME, use of EDA information in AROME-France 3D-VAR (Y. Michel, P. Brousseau, L. Berre, B. Ménétrier)
- Observations:
  - ○ AMDAR humidity data: optimize QC and assimilation in ALARO or AROME 3D-VAR (P. Moll, A. Trojakova, F. Meier)
  - ○ first codes for assimilating all-sky radiances using a Bayesian inversion method (P. Chambon)
  - ○ new satellites/instruments: 1) Aeolus L2 HLOS winds, 2) MTG-IRS, 3) IASI-NG, 4) winds from various scatterometers (GMAP/OBS)
  - ○ adapt codes for assimilating European radar data from OPERA (E. Wattrelot)
  - ○ preparations for assimilating radar dual-polarisation data (E. Wattrelot)
  - ○ use of infrared emissivity atlases for the use of IASI skin temperature retrievals (V. Guidard)
  - ○ *first potential code adaptation of IFS/Arpège/LAM codes in order to test COPE3 pre-processing tools (E. Wattrelot, M. Dahlbom) tbc*
- ALADIN: to be discussed - see list below
- HIRLAM: to be discussed - see list below
- OOPS re-factoring:
  - ○ Full-POS continued adaptation for OOPS and configuration 903, possibly not yet fully

completed (later for CY47 or CY47T1) (R. El Khatib)
- ○ adaptation of LAM MODEL components, possibly DDH code, to OOPS (A. Mary)
- ○ remove the Tomas' trick for YOMPHY* variables. Proper handling of the MODEL parameters inside calls to MF obs operators (A. Mary & OBS team ?)
- ○

CY47: January-March 2019.

Provisional content:
- OOPS re-factoring in IFS FORTRAN codes:
  - ○ VarBC tidy-up for OOPS-IFS, C-VarBC
  - ○ VarQC, observation error correlations
  - ○ adapted handling of time and time step variables for multiple MODEL instantiation - Step 2
  - ○ final work for Full-POS as PostProcessor object (MF/REK)
  - ○ any required fix in order to run OOPS-IFS in a full PrepIFS experiment (CY46R1)
- contents of CY46R1 and CY46T0 or T1

CY47T1: spring 2019 or autumn 2019 ??

Provisional content:
- System operational aspects (Météo-France o/e-suites):
  - ○
- System technical aspects:
  - ○
- Arpège and Arome model dynamics:
  - ○ 3D grid point solver for SI hydrostatic model (research version) (L. Auger)
- Arome physics:
  - ○ horizontal gradients and horizontal turbulent mixing treated within the Arpège/Arome code algorithm, probably building on available spectral/grid point arrays and SL stencil computations (R. Honnert) – for tests in sub-km Arome configurations
- Assimilation methods:
  - ○ first "official" codes for EnVar in ARPEGE or AROME implemented in common libraries, including interface codes to OOPS/C++ (E. Arbogast, Y. Michel, T. Montmerle)
- Observations:
  - ○ *GNSS ZTD horizontal gradients observation operator (P.Moll) tbc*
  - ○
- ALADIN: to be discussed - see list below
- HIRLAM: to be discussed - see list below
- OOPS re-factoring and prototypes:
  - ○ in the FORTRAN code libraries: any potentially missing issue after CY47, or bug-fixes for running the OOPS binaries for standard configurations (4D-VAR Arpège, 3D-VAR Arome, Unit tests with Arpège or Arome data, Arpège and Arome forecast models etc.)
  - ○ *first implementations in official SCR of OOPS/C++ towards FORTRAN/IFS interface codes, enabling the 4D-VAR and 3D-VAR prototypes to run*
  - ○ *FORTRAN and interface codes for EnVar solutions as developed for ARPEGE and AROME*

CY47T2: any time or good reason to do a T2 before end of 2019 ??

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CY48: very open timing ! Could be a "quick" IFS/Arpège joint cycle before the end of 2019, or a late joint cycle after new HPCs (and move to Bologna for EC Data & Computer centre).
Note: there was a strong recommendation not to let more than 1 year between two joint cycles (eg. CY47 to be declared end of March 2019).

ALADIN-HIRLAM listed potential contributions for either CY46T1 or CY47T1, as derived from the joint Rolling Workplan for 2018:
- ALADIN:
  - *Dynamic definition of the iterative time schemes: call the corrector step "on demand" (J. Vivoda, tbc)*
  - physics-dynamics interface consistent with energy budget, thermodynamics including mixed phases and NH equations (D. Degrauwe)
  - *prognostic graupel scheme "LGRAPRO" if not already in CY45T1 (B. Bochenek) tbc*
  - *other Alaro physics changes ??*
  - *Development and implementation of new random number generator (SPG) suitable for LAM EPS environment (M. Szucs) ??*
- HIRLAM:
  - LAM DA methods: back and forth nudging (O. Vignes), variational NH balance (C. Geijo)
  - assimilation of all-sky radiances using the ECMWF method (R. Randriamampianina)
  - GNSS slant delays (S. de Haan)
  - 1D model studies, potential code changes in order to improve the representation of fractional cloud cover for Harmonie-Arome (W. de Rooy)
  - *other Harmonie-Arome physics changes ??*
  - codes linked with flow-dependent aspects for Harmonie DA (4D-VAR, hybrid, etc.)
  - adapted changes for the assimilation of existing observations, if necessary and after coordination with MF and other partners: radar (OPERA), Mode-S, GNSS ZTD, scatterometer winds, AMVs, clear-sky radiances, cloud-affected radiances, near-ground observations, radiosonde data
  - Assimilate wind data from recreational hot-air balloon flights (C. de Bruijn)
  - replace upper boundary spectral nudging by a relaxation of either Davies or weak constraint type (M. Kupiainen)
  - fix problems with the pattern generator of SPPT (O. Vignes, A. Callado)
  - *introduce EPPES in common codes ?. EPPES is an ensemble prediction and parameter estimation system developed in Finland, which will be used to find optimal values for sensitive parameters, and their PDF's. This will in turn be used for perturbing the parameters using a spatio-temporal correlation pattern (SPP-approach). First application would be for Cellular Automata => adapt code for using SPP applied to the Cellular Automata parameterization (U. Andrae)*
  - continued work and potential code changes for computing random perturbations based on the LAM B-matrix structure (J. Bojarova, O. Vignes, U. Andrae)
  - surface perturbations (test different scales for different parameters), test alternative SST perturbations (O. Vignes, U. Andrae ?)
  - add code for perturbing roughness length for heat and moisture, over various vegetation types, assess optimal lengthscale of these perturbations (O. Vignes, U. Andrae ?)

Progress and plans of E-suites/O-suites 2018-2019:

Specific changes in suites, or new applications, not requiring a new cycle version (base: **CY42_op2**):
- extension of some Arome forecast ranges. On 14 March 2018, the following extensions have been implemented: Arome-France [43→48h for 00 UTC; 40→45h for 03 UTC; 37→42h for 06 UTC], Arome-IFS [43→48h for 00 UTC], Arome-EPS (PEARO) [46→51h for 21 UTC].
- A second set of extension and additional production became operational on 29 March: Arome-France [43→48h for 12 UTC; 37→42h for 18 UTC], PEARO [46→51h for 09 UTC], new production instances of PEARP [0→48h for 00 and 12 UTC] and PEARO [0→45h for 03 and 15 UTC]. Note that MF will then operate 4 EPS runs per day for both global and LAM EPS.

A "mini" e-suite will be implemented in order to port the Arome ensemble data assimilation system (AEARO) to operations (April-May):
- code basis: **CY42_op3**
- main characteristics: 3.8km/90 levels, 25 members coupled with the AEARP (Arpège EDA) members, hydrostatic dynamics, perturbation of SST, inflation based on a spread-to-skill diagnostic, 3h cycling 3D-VAR with perturbed observations

A new scientific e-suite is scheduled to be implemented in spring 2018, for a switch foreseen by the end of 2018. Expected content:

- Cycle version basis: **CY43T2_bf** under evaluation (if confirmed, will then become the base for a CY43T2_op1); if so, the SURFEX version would become V8+
- Migration to VORTEX (Python toolbox) for ARPEGE 4D-Var, EDA and AROME 3D-Var
- Migration to GRIB2 format for post-processing (lat/lon) files and using GRIB2 encoding for historical files (model geometry) based on the GRIB_API library included in the ecCodes package of ECMWF (note: otherwise, GRIB1 remains available as well via ecCodes)
- New horizontal resolutions for global systems (deterministic, EDA, EPS):
  - ARPEGE: ~5km over France (Tl1798c2.2L105)
  - 4D-VAR: 2 minimisations in Tl224c1L105 (90km) and Tl499c1L105 (40km)
  - EPS: 35 members (unchanged) at ~7.5km over France (~Tl1198c2.2L90)
  - EDA: 50 members in Tl499c1L105 => will sample B-matrix from 3*50 instead of 6*25 as now
- Scientific changes (tbc):
  - Observation correlation errors taken into account for IASI and CRIS
  - Variational bias correction for GNSS observations
  - Assimilation of GNSS-RO on FY-3C
  - Assimilation of wind from ScatSat-1 (Ku band)
  - Assimilation of AMVs from GOES-R (16)
  - Monitoring of AMSR-2 from GCOM-W1 (7 channels)
  - Use of ATOVS, ATMS, MWHS-2 DBNet data
  - Monitoring/assimilation of Doppler winds and radar reflectivities (OPERA european radars)
  - Tuning in the dynamics (horizontal diffusion, SL iterations number)
  - Tuning of convection scheme in ARPEGE
  - Improved version of AROME microphysics scheme
  - Initialization of CMO-1D in AROME-Overseas with Mercator 4x per day
  - Improvements in AROME surface analysis

- ○ Graupels in ARPEGE microphysics
- ○ New aerosols climatology originating from ARPEGE-Climat model
- ○ New diagnostics: visibility, etc.

An executive outlook of MF's R2O plans on 2018-2019, reflected with respect to code cycles, could read as follows:
- CY43T2:
  - ○ baseline validated end of April;
  - ○ build e-suite version (April-May-June);
  - ○ port to Operations as e-suite (June);
  - ○ switch to operations by end of 2018;
- CY46:
  - ○ IFS/Arpège joint cycle declaration on 10 April 2018;
  - ○ requires phasing of fixes for assimilation in summer-autumn 2018;
  - ○ build a CY46T0 or T1 in the autumn (tbc);
  - ○ start preparing a Research e-suite version beginning of 2019;
  - ○ port e-suite to operations by mid-June 2019;
  - ○ operational switch in the autumn 2019;
  - ○ note: if CY46T0/T1 would prove more difficult to validate than expected for now, then the back-up cycles for the S1/2019 e-suite would be either CY45T1 or CY43T2 (or in a worst-case scenario, CY42_op4 or _op5)
- Build CY47 over January-March 2019
- prepare an S2/2019 e-suite version based on CY47 and port to operations (summer-autumn 2019); switch to operations by March 2020 or so
- Migration to new HPC: mirror suite to start on 1 May 2020 (tbc), based on the operational code version of April 2020