

# RESEARCH DEPARTMENT MEMORANDUM

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To: RD Scientific Staff and Consultants

Copy: DR, DO, HMD, HMAS, HMOS, John Hodgkinson, François  
Bouttier, Claude Fischer, Ryad El Khatib, Karim Yessad,  
John Hague

From: Deborah Salmond et al.

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**Subject: IFS Memorandum Cycle CY38R2**

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Cycle 38r2 was created in June-August 2012. Active contributions have been marked **ACTIVE**. Contributions which are/are not Bit-reproducible with CY38R1 are marked **BR/Not-BR** respectively.

This Cycle is mainly to enable the introduction of 137 levels.

*Contributors:*

Alan Geer, Anne Fouilloux, Antje Inness, Anton Beljaars, Carole Peubey, Deborah Salmond, Elias Holm, Filip Vana, Gabor Radnoti, George Mozdzynski, Gianpaolo Balsamo, Giovanna De Chiara, Glenn Carver, Hans Hersbach, Jean Bidlot, Jean-Jacques Morcrette, Joaquim Munoz-Sabater, Johannes Flemming, John Hague, Karim Yessad, King-Fai Li (CalTech), Marta Janiskova, Martin Koehler (DWD), Massimo Bonavita, Mats Hamrud, Michael Rennie, Michail Diamantakis, Mike Fisher, Niels Bormann, Nils Wedi, Noureddine Semane, Oliver Treiber, Patricia de Rosnay, Paul Poli, Peter Bechtold, Pirkka Ollinaho, Richard Engelen, Rossana Dragani, Sarah Keeley, Simon Lang, Sylvie Malardel, Tomas Kral, Tomas Wilhelmsson, Tony McNally, Will Weir, Yannick Tremolet

# NUMERICAL ASPECTS

**Michail Diamantakis - namd\_CY38R1\_qmfixerFinal - PASSIVE/BR**

**Bermejo and Conde quasi-monotone mass fixer for semi-Lagrangian advection**

**Expts: folv, fosi, fp0c**

The purpose of this development is to implement a 3d version of the mass fixer described in MWR 130, pp 423-430 for global mass conservation of IFS GFL variables. The algorithm corrects an advected field preserving monotonicity (provided the original field is also monotone). It uses a local error measure to decide where to distribute the correction of the total mass imbalance. For this reason it will work only for these variables where high order (cubic) interpolation is used.

*Files created(IFS):*

adiab/gppwcvfe.F90 laminmaxint.F90 laqmlimiter.F90  
control/qmfixer.F90

*Files modified(IFS):*

adiab/call\_sl.F90 laitre\_gfl.F90 laitre\_gmv.F90 lapineb.F90 larcinb.F90  
control/gp\_model.F90  
module/gfl\_subs\_mod.F90 yom\_ygfl.F90 yomdyn.F90  
namelist/namdyn.h namgfl.h  
setup/sudim1.F90 sudyn.F90 sudyn\_setgflattr.F90 sugfl.F90

# PHYSICS

**Filip Vana - pafv\_CY38R1\_pacontrib3\_for\_cy38r2 - Not-BR**

**Merged contributions from PA section**

**Expts: foj0 (control), fp98 (test) and folg (control) , fp99 (test)**

**Anton Beljaars - paa\_CY38R1\_order2soV8 - ACTIVE**

**Reduced vertical resolution dependence in the subgrid orography scheme**

*Files modified(IFS):*

phys\_ec/gwsetup.F90 sugwd.F90

**Peter Bechtold - pae\_CY38R1\_f38r2\_alln4\_rdays**

**Peter Bechtold - Not BR**

**Cleaning+consistency**

Replace hard coded general physical constants by their nominal IFS values from module YOMCST, introduce invariant time unit RDAYI=86400s

*Files modified(IFS):*

phys\_ec/ec\_phys.F90 cldpp.F90 phys\_radi/mcica\_cld\_gen.F90

## **Peter Bechtold + Nouredine Semane + Sylvie Malardel + Jean Jacques Morcrette - BR**

### **Preparation for small planet configuration**

- Bug corrections: use new invariant RDAYI instead of RDAY for parts of SW radiation
- Code cleaning: hard coded gravity, length of day=RDAY, introducing gravity multiplication factor RPLRG, passing small planet scaling factors RPLRADI, RCORIOI, RPLRG to surf and wave model to consistently modify scaling for all sub-models of IFS
- Automatic scaling of cloud (fall speeds) and vertical diffusion (length scales and entrainment) for modified gravity

Note: as HEATFAC is actually not used in rrtm\_rrtm\_140gp.F90 rrtm\_rrtm\_140gp\_mcica.F90 these give also bit identical results

*Files modified(IFS):*

adiab/cppsolan.F90 module/yomdyncore.F90 namelist/namdyncore.h  
oops/ifs\_constants.F90 phys\_ec/aer\_sdust.F90 culight.F90 ec\_phys.F90 methox.F90  
suphec.F90 suecozv.F90 updtier.F90 sucldp.F90 vdfexcu.F90 vdfhghtn.F90  
wvcouple.F90 phys\_radi/rrtm\_ecrt\_140gp.F90 rrtm\_ecrt\_140gp\_mcica.F90  
srtm\_srtm\_224gp.F90 srtm\_srtm\_224gp\_mcica.F90 rrtm\_rrtm\_140gp.F90  
rrtm\_rrtm\_140gp\_mcica.F90 setup/sucst.F90 sudyncore.F90 suoph.F90 surandl.F90  
surayfric.F90 susta.F90 utility/mod\_ini.F90 updtim.F90

*Files modified(SURF):*

external/susurf.F90 interface/susurf.h module/suscst\_mod.F90 susurf\_ctl\_mod.F90  
offline/driver/suphec.F90

*Files modified(WAM):*

Wam\_oper/initmdl.F iniwcst.F sbottom.F wavemdl.F module/yowpcons.F

## **Peter Bechtold - BR**

### **Miscellaneous cleaning**

- Cleaning of convection: remove all parts related to obsolete shallow and mid-level entrainment rates ENTRSCV, ENTRMID as only one entrainment rate=ENTRORG is used. Also remove optional updraught iteration part which will not be used anymore, remove code related to division and remultiplication by RG, add LMFPEN in convection namelist namcumf.h and remove commented PEXTR block in callpar.F90
- Small Planet: Automatic scaling of convection (modified gravity): this reduces to just rescale 4 basic parameters related to height (geopotential is conserved not z)!! (updraught and downdraught entrainment and detrainment rates, as well as autoconversion for microphysics)

- Deletion of unused or empty TL/AD routines: The convection routines cu\* have already been targeted for deletion in 38r1 by Philippe Lopez but final 38r1 merge was not complete, the aerosol routines aer\* are empty and historical
- Enabling starting forecasts from forecast experiments via prepIFS

*Files modified(IFS):*

module/yoecumf.F90 namelist/namcumf.h phys\_ec/cuascn.F90 cubasmcn.F90  
cuddrafn.F90 cuentr.F90 cumastrn.F90 sucumf.F90 callpar.F90

*Files added(IFS):*

phys\_ec/cuddrafnad.F90 cuddrafnad.F90 cudlfsnad.F90 cudlfsnt1.F90 cuflxnad.F90  
cuflxnt1.F90 aer\_bdgtmss\_ad.F90 aer\_bdgtmss\_tl.F90 aer\_scavbc\_ad.F90  
aer\_scavbc\_tl.F90 aer\_scavin\_ad.F90 aer\_scavin\_tl.F90 aer\_sdust\_ad.F90  
aer\_sdust\_tl.F90 aer\_sedimnt\_ad.F90 aer\_sedimnt\_tl.F90 aer\_ssalt\_ad.F90  
aer\_ssalt\_tl.F90

*Files modified(SCRIPTS):*

gen/getini getmars

## **Peter Bechtold + Pirkka Ollinaho**

### **Bug fixes and new MJO Cost function for EPSparameter estimation project EPPES**

*Files modified(SCRIPTS):*

metview/EPPES\_costfunct.met EPPES\_costfunct\_mjo.met

## **Peter Bechtold + Martin Koehler (DWD)**

### **Diagnostics**

Adapting Climplot package for Metview4 Automatic computation of dates for "short days" in small planet  
Automatic scaling of wind fields for planet with modified rotation and automatic scaling of total column fields  
(TCWV etc ) for planet with modified gravity

*Files modified(SCRIPTS):*

metview/climate\_obs.met climplot\_batch compvar\_ens.met monmeans\_clim.met  
monmeans\_clim\_batch plot\_amp\_phase\_clim.met save\_mean\_diurnal\_flux.met  
cossinlon1.f90 wind\_maps\_clim.met Z500\_bias\_era\_mm.met zondia-seas-icon\_mars  
zondia\_def\_contour zondia\_seas\_icon\_batch.met  
sms/check\_periods.sms climplot.sms mmeans\_ml.sms mmeans\_pl.sms mmeans\_sfc.sms

## **Peter Bechtold + King-Fai Li (CalTech Institute) + Nils Wedi**

### **New diagnostics for Climplot: plotting of Wavenumber and Frequency spectra**

*Files modified(SCRIPTS):*

def/climplot.def fc.def

*Files added(SCRIPTS):*

metview/coastline\_180W\_540E.dat MAINgen.pro marsretr\_wavfreq.met arrow\_kfl.pro  
calday.pro cputime.pro demonth.pro detrend.pro image\_close.pro image\_setup.pro  
jd2year.pro legend.pro loaddata.pro mapaxislab.pro mnave.pro nancenter.pro  
plotcontour.pro plotwksts.pro pltmnavg.pro readnetcdf.pro ritenc.pro  
rot\_div\_spectrum\_plot.pro setplot.pro waveeq.pro wksts.pro tcpack.F90  
tcpackens.F90

## **Filip Vana - pafv\_CY38R1\_callpar0 - Not-BR**

### **Cleaning of callpar**

Cleaned and bugfixed physics dynamics interface, version 0. In addition the solver in CLOUDSC from Numerical Recipes (under restricted copyright) was replaced by much optimized code.

#### *Files added(IFS):*

ifs/phys\_ec/aero\_init.F90 update\_fields.F90

#### *Files modified(IFS):*

phys\_ec/aer\_diag1.F90 ca\_profpert.F90 callpar.F90 callparad.F90 cloudsc.F90  
cloudst.F90 cond.F90 cucalln.F90 cucalln2.F90 phys\_ad.F90 phys\_nl.F90

## **Filip Vana - pafv\_CY38R1\_noogw - BR**

### **Bugfix for data assimilation destroying too much of GFL space**

#### *Files modified(IFS):*

module/gfl\_subs\_mod.F90

## **Gianpaolo Balsamo - pad\_CY38R1\_surface - BR**

### **Changes to run offline the land surface**

#### *Files added(SCRIPTS):*

def/surface.def gen/archive\_an.ksh archive\_fc.ksh archive\_flx.ksh  
compile\_master.ksh create\_forcing.ksh create\_init\_clim.ksh extract\_forcing.ksh  
osm\_makex.ksh osm\_setup.ksh prepare\_an.ksh prepare\_fc.ksh prepare\_flx.ksh  
surface\_model.ksh sms\_osm/archive\_an.sms archive\_fc.sms archive\_flx.sms  
create\_forcing.sms create\_init\_clim.sms prepare\_an.sms prepare\_fc.sms  
prepare\_flx.sms surf.sms surface\_model.sms

#### *Files modified(SCRIPTS):*

def/gen.def

#### *Files modified(SURF):*

offline/driver/callpar1s.F90 driver/cpedials.F90 driver/stepols.F90  
driver/suflake.F90 driver/suphec.F90 driver/wrtdcdf.F90 driver/wrtres.F90  
util/convNetcdf2Grib.F90 util/conv\_forcing.F90 util/create\_init\_clim.F90  
util/find\_points.F90

## **Marta Janiskova - BR**

### **Fixed radiation scheme used in TL/AD models**

*Files modified(IFS):*

```
phys_radi/lw.F90 lwc.F90 lwv.F90 lwvt1.F90 lwvad.F90 phys_ec/radlsw.F90  
radlswt1.F90 radlswad.F90
```

## **Filip Vana - Not-BR**

### **Extension of paa\_CY38R1\_order2soV8 changes to TL and AD code**

*Files modified(IFS):*

```
phys_ec/gwsetuptl.F90 gwsetupad.F90
```

## **Filip Vana - pafv\_CY38R1\_lsprt2 - Not-BR**

### **Fix of LSPRT=.T. option in TL/AD code**

**Expts: T511 foj0 (control), fp5s (test)**

Fixed both T -> Tv and Tv -> T conversion in TL and AD models. New way of storing trajectories to be appropriate to those needed after lagged dynamics.

Testing:

1. Taylor test of TL model (configuration 501) was done for the model dynamics (in T21) showing now the desired convergence of TL code toward the non-linear model. The AD test (config 401) at the same resolution (this time with physics) was also successful.
2. TL159 singular vectors test (targeted on the extra tropics and targeted on a tropical cyclone). The growth rates were found similar to the CY38R1 reference.
3. TL evol test was done to check the convergence of the full TL code toward the full non-linear model. It was confirmed that with the LDRY\_ECMWF=.T. option the correspondence of the two models remains very similar to the CY37R3 reference. In addition the LDRY\_ECMWF=.F. starts to deliver reasonable results although a bit more affected by noise in the atmosphere above PBL.
4. The pafv\_CY38R1\_lsprt\_fix\_for\_cy38r2 tested with full assimilation T511 runs for the winter period. So far 3 months are completed showing neutral impact with respect to the Gabor's reference foj0. The experiment id is fp5s. (The preliminary scores are available in /scratch/rd/pafv/pssc[1-4]\_38r1\_tlad files.)

*Files modified(IFS):*

```
adiab/cpg_dyn.F90 cpglag.F90 cpglagad.F90 cpglagtl.F90  
control/gp_model_ad.F90 gp_model_t1.F90 scan2mad.F90 scan2mt1.F90  
module/traj_semilag_mod.F90
```

## **Peter Bechtold - pae\_CY38R1\_f38r2\_alln4\_rdays - BR**

### **Radiation and Cloud scheme scaling**

*Files modified(IFS):*

phys\_ec/radlswr.F90 sucldp.F90 phys\_radi/rrtm\_ecrt\_140gp.F90  
rrtm\_ecrt\_140gp\_mcica.F90 srtm\_srtm\_224gp\_mcica.F90 srtm\_srtm\_224gp.F90

## **DATA ASSIMILATION**

### **Elias Holm - dae\_CY38R1\_xxx - ACTIVE**

**For 137 Levels**

### **Patricia de Rosnay and Tomas Wilhelmsson - dap\_CY38R1\_ssapi - Not-BR**

#### **Grib API surface analysis**

**Expts: T511 foj0 (control), fp9o (test)**

The surface analysis Optimal Interpolation code is used for (i) the screen level parameters and snow analyses (2D OI) and (ii) the soil temperature analysis (1D OI). In the FORTRAN routines used by the surface analysis, all the remaining call to GRIBEX are replaced by GRIB API. In addition a bug was fixed in the 1D OI for the soil temperature analysis. The bug has been in the 1D OI since its implementation in 1999. It resulted in a wrong day of year used for the solar angle computation (that modulates the OI coefficients). Note that whilst the bug was limited to the soil temperature analysis since November 2010, it was affecting both the soil moisture and the soil temperature analyses before Nov 2010 (and it is still in ERA-Interim)

They are not bit identical because of (i) the bug fix in soilinc.F90 used for the soil temperature analysis (ii) different lat-lon given by soilinc.F90 with GRIBEX in 38R1, which was not correct, compared to GRIB API with grib\_get\_data (which is correct) in the submitted branch. A set of experiments was conducted with different levels of modifications in ssa and prepdata to ensure that only the bug fix and the lat-lon issue in GRIBEX are responsible for the non-bitidenticality

*Files modified(IFS):*

climate/updclie.F90

*Files modified(PREPDATA):*

programs/soilinc.F90

*Files modified(SCRIPTS):*

build/Makefile.root.ssa

gen/mkabs\_ssa

*Files modified(SSA):*

module/yomiodssa.F90 yomssa.F90

namelist/namssa.h

plot/coordinates.F90 getfields.F90 output.F90 print\_field.F90 print\_nml.F90

```
print_summary.F90
sub/reg_to_gg.F90
util/setcomssa.F90
```

## **Joaquim Munoz-Sabater - daq\_CY38R1\_SMOS\_monitoring\_standalone - BR**

### **Monitoring of passive data**

#### **Expts: T511 foj0 (control), fov0 (test)**

This sets the infrastructure to monitor passive data (i.e., data which is not part of the atmospheric 4DVAR analysis) out of the first model trajectory and critical path. It is also part of COPE. This will also make SMOS monitoring operational and soon it will be tested with other satellite data. There is NO meteorological impact as it should be.

#### *Files modified(SCRIPTS):*

```
def/an.def sms_an/monitoring.sms gen/ifsvar mergeodb ifstraj presmos
```

#### *Files modified(IFS):*

```
op_obs/mpobseq.F90 mpobseq_pack.F90 namelist/namct0.h var/sacmac1.F90 taskob.F90
module/yomct0.F90 setup/suct0.F90 sumpini.F90 smos/smos_screen.F90
smos_process.F90
```

#### *Files modified(ODB):*

```
cma2odb/ctxinitdb.F90
```

#### *Files added(SCRIPTS):*

```
gen/ofb_smos.sql
```

#### *Files added(ODB):*

```
ddl/stat_obs_3.sql
```

#### *Files added(IFS):*

```
ar/monitoring_summary.F90
```

## **Joaquim Munoz-Sabater - daq\_CY38R1\_SMOS\_SEKF\_for\_CY38R2 - BR**

### **Assimilation of SMOS data + bias correction**

#### **Expts: T511 foj0 (control), fp96 (test)**

This builds all the infrastructure needed to assimilate SMOS data within the SEKF for the analysis of soil moisture, as well as to correct the data from bias through a CDF-matching approach. The last version of CMEM to simulate brightness temperatures is also included in this contribution. There is No meteorological impact.

#### *Files modified(IFS):*

```
def/an.def gen/presmos sekf_sm mergeodb ifstraj sms_an/mergeodb.sms
```

#### *Files modified(IFS):*

```
programs/bufr_screen_smos.F90 cmem/cmem_soil.F90 vegetable.F90
```

#### *Files modified(IFS):*



op\_obs/mpobseq.F90 mpobseq\_pack.F90 sekf/sm\_ekf\_main.F90 susekf.F90  
store\_sekf\_cv.F90 sekf\_write.F90 namelist/namsekf.F90 control/csekf2.F90  
gp\_model.F90 utility/dealsc2.F90 obs\_preproc/sekf\_prep\_ascat.F90  
phys\_ec/callpar.F90 ec\_phys.F90 smos/smos\_obsop\_setup.F90 smos\_process.F90  
smos\_update.F90 common/yomdb\_defs.h yomdb\_vars.h module/yomsmos.F90 parsmos.F90  
yomsekf.F90

*Files modified(ODB):*

cma2odb/ctxinitdb.F90 initmdb.F90 ctxgetdb.F90 maketimeslot\_index.F90 ddl/cma.h  
robhdr\_mwave\_process\_smos.sql robbody\_mwave\_process\_smos.sql  
robhdr\_mwave\_update\_smos.sql robbody\_mwave\_update\_smos.sql  
buf2odb/bufr2odb\_smos.F90

*Files added(IFS):*

obs\_preproc/sekf\_prep\_smos.F90 smostb\_cdfpar.F90

*Files added(IFS):*

ddl.ECMA/robbody\_smos\_sekf.sql update\_modstep.sql ddl/robbody\_smos\_sekf.sql  
update\_modstep.sql

*Files added(IFS):*

sms\_an/mergeodb\_sekf.sms

## **Massimo Bonavita - dav\_CY38R1\_BCALC -BR**

### **On-line computation of wavelet JB**

#### **Expts: T511 fpkm (control), fpko (test)**

The branch contains the implementation of the basic framework required for the on-line computation of the wavelet JB from the EDA. This is a technical development propaedeutic to the use of on-line covariances in 4D-Var.

*Files created(SCRIPTS):*

gen/fetch\_jb\_fields\_mem pre\_fetch\_jb\_grid pre\_fetch\_jb\_spectral  
sms\_an/fetch\_jb\_fields\_mem.sms pre\_fetch\_jb\_grid.sms pre\_fetch\_jb\_spectral.sms

*Files modified(IFS):*

module/yomwavelet.F90  
setup/su0yomb.F90  
var/sujb.F90 sujbwavallo.F90 sujbwavalls.F90 sujbwavelet.F90 sujbwavwri.F90

*Files modified(SCRIPTS):*

def/an.def  
gen/ifsmin ifsvar vardata

# SATELLITE

## Rossana Dragani - st3\_CY38R1\_ODBozone\_clean - BR

### Ozone cleaning

**Expts: T159 forecast fozi (control), fozi (test)**

- Ozone/retrieval products sql cleaning
- Remove the sql request of "sensor" in get\_soe\_resat.sql as available from robhdr.sql

#### *Files modified(IFS):*

op\_obs/hop.F90

#### *Files modified(ODB):*

ddl/get\_soe\_resat.sql

## Niels Bormann and Anne Fouilloux - str\_CY38R1\_for\_CY38R2 - BR

### ATMS changes

**Expts: T319 foy9 (control), fp6q (test)**

The branch fixes a problem concerning the footprint averaging for ATMS, and provides enhanced quality control for ATMS, based on estimates of the liquid water path and scatter indices. These changes only take effect if ATMS data are present. The branch also includes the calculation and storage in the ODB of liquid water path estimates and scatter indices for other microwave sounders.

#### *Files created(IFS):*

op\_obs/mw\_screen\_cloud\_and\_rain.F90

#### *Files modified(IFS):*

common/yomdb\_defs.h yomdb\_vars.h  
obs\_preproc/new\_thinner\_no\_sq.F90 pre\_thinner.F90  
op\_obs/hretr.F90

#### *Files modified(ODB):*

bufr2odb/bufr2odb\_atms.F90  
cma2odb/initmdb.F90 shuffle\_odb.F90  
ddl/radiance.h sathdr\_screen\_atovs.sql  
module/init\_module.F90  
tools/Bufr2odb.F90

#### *Files modified(SCRIPTS):*

gen/mondb\_tovs.sql ofb\_tovs.sql

**Modernisation of the interpolation operator for observations (GOM)**

**Expts: T511 folg (control), fpak (test)**

After 20 years of incremental development, the code for interpolation from model space to observation space (GOM) has become unmaintainable. It presents an insurmountable obstacle to scientific improvements in observation usage.

Much of the GOM code has been completely rewritten using a modular approach that is as close to object-oriented as allowed by Fortran-95. Most data structures and procedures are "private" and are encapsulated in the new module gom\_mod.F90. The code is completely generic and is not intended to be modified very often. If a new GOM variable is required, it can simply be added to a list, with its properties specified (e.g. its dimensions, the type of interpolation required, the observation types for which it should be made available). The new module offers public access functions allowing model fields to be transferred into the GOM pipeline at one end (e.g. in cobs.F90), and the interpolated fields to be used in the observation operator at the other end (e.g. in preint.F90). Functionality that previously required around 10,000 lines of code has been removed and replaced by about 2,000 new lines.

The work is ongoing, and it is hoped to extend this kind of approach to the model fields in future cycles; it is also hoped to further simplify the observation operator, e.g. in hop.F90 and preint.F90. The current branch supports ECMWF operations but does not yet allow use of the "2D" GOMs (required experimentally and by Meteo France) or of some interpolation modes specific to Meteo France. These functions will be supplied in future branches, to be incorporated into 38r2 if available in time, or as patches on top of 38r2 otherwise.

*Files created(IFS):*

module/gom\_mod.F90

*Files created(ODB):*

ddl.CCMA/sugoms.sql

ddl.ECMA/sugoms.sql

ddl/sugoms.sql

*Files modified(IFS):*

adiab/gprhtl.F90 gpxybt1.F90 laidlic.F90 laidlicad.F90

canari/calver.F90 canari.F90 cancer.F90

control/cnt4.F90 cnt4ad.F90 cnt4tl.F90 scan2m.F90 scan2mad.F90 scan2mtl.F90

dia/preset\_grib\_template.F90

module/yomglobs.F90 yomsc2.F90 yomtag.F90

obs\_preproc/black.F90 gefger.F90 mkglobstab.F90 prech.F90 repra.F90 sualobs.F90

sugoms.F90 suobs.F90 suobsaddr.F90

oops/allobs\_mod.F90 fields\_interp\_mod.F90 gom\_setup.F90 obstraj\_mod.F90

op\_obs/amv\_get\_preds.F90 amv\_oberr.F90 bgobs.F90 cobs.F90 cobsad.F90 cobsall.F90

cobsallad.F90 cobsalltl.F90 hop.F90 hop\_rad.F90 hop\_rad\_ml.F90 hopad.F90

hoptl.F90 hradp.F90 hradp\_ml.F90 hradp\_ml\_ad.F90 hradp\_ml\_tl.F90 hradpad.F90

hradptl.F90 hretr.F90 hretr\_aeolus.F90 laiddiobs.F90 laiddiobsad.F90

laidliobs.F90 laidliobsad.F90 obshor.F90 obshorad.F90 obsv.F90 obsvad.F90

obsvtl.F90 preint.F90 preintad.F90 preintr.F90 preintrad.F90 preintrtl.F90

preints.F90 preintsad.F90 preintstl.F90 preinttl.F90 rtl\_hop\_ld.F90

rtl\_hop\_ld\_ad.F90 rtl\_hop\_ld\_tl.F90 rtl\_hop\_2d.F90 rtl\_hop\_2d\_ad.F90

rtl\_hop\_2d\_tl.F90 slint.F90 slint\_canari.F90 slintad.F90

phys\_dmn/mts\_phys.F90  
phys\_ec/callpar.F90 callpartl.F90 radintg.F90  
pp\_obs/ppinitz.F90 ppobsa.F90 ppobsaad.F90 ppobsac.F90 ppobsacad.F90  
ppobsactl.F90 ppobsas.F90 ppobsatl.F90 ppobsaz.F90 ppobsn.F90  
utility/deallo.F90 gstats\_label\_ifs.F90  
var/sumoderr.F90 taskob.F90 taskobad.F90 taskobtl.F90 vec2gp.F90

***Files modified(ODB):***

cma2odb/ctxinitdb.F90  
ddl/mkglobstab.sql

***Files modified(SCRIPTS):***

gen/archive\_obsgrp cycle\_times gems\_setup get\_exe getmars ifsmin ifstraj  
mkabs\_black model modeleps modelsv prep\_couplo4 prereo3  
oce/model\_nemoIFS model\_oceatm storm

***Files deleted(IFS):***

module/goms\_mix.F90 obshor\_cache\_mix.F90  
namelist/namgom.h  
op\_obs/cobslag.F90 cobslagad.F90 cobslagtl.F90 cobstl.F90 mpobseq.F90  
mpobseq\_pack.F90 mpobseqad.F90 mpobseqad\_unpck.F90 mpobseqtl.F90  
mpobseqtl\_pack.F90 obshortl.F90 post\_obshor.F90 post\_obshortl.F90  
pre\_obshorad.F90 preint2d.F90 preint2dad.F90 preint2dtl.F90 slinttl.F90  
parallel/gathergom.F90  
utility/prtgom.F90

***Files deleted(ODB):***

ddl.CCMA/prtgom.sql  
ddl.ECMA/prtgom.sql  
ddl/prtgom.sql

## MACC

### Richard Engelen - stj\_CY38R1\_MACC\_for\_38r2 - BR

**Richard Engelen, Johannes Flemming, Antje Inness, Jean-Jacques Morcrette, Angela Benedetti, and Richard Engelen - stj\_CY38R1\_aerosol\_update, pam\_CY37R3\_bugfix\_jjm\_02, std\_CY38R1\_CIFS\_for\_38r2**

### Updates to MACC-II aerosol model and C-IFS

#### Expts: foj0 (control), fp1t (test), fp52(MACC)

The contribution includes updates to the aerosol model, especially to improve the desert dust forecast. There are also updates to the C-IFS model as well as code needed to use C-IFS in data assimilation mode. Finally, there are some script changes based on optimizing the MACC configuration in OD.

***Files created(SCRIPTS):***

gen/add\_nrt\_fire\_chem get\_nrt\_fire\_chem

sms/aod.sms

***Files modified(IFS):***

adiab/cpedia.F90 postphy.F90  
chem/chem\_inext.F90 chem\_main.F90 chem\_scav.F90 tm5\_fparam.F90  
control/tracmf.F90  
fullpos/hpos.F90 sufpc.F90 wrmlfp.F90 wrmlfp1.F90  
module/couplo4\_mix.F90 parfpos.F90 yoe\_uvrad.F90 yoeaersnk.F90 yoeaersrc.F90  
yoeaervol.F90 yom\_ygfl.F90 yomafn.F90  
namelist/naeaer.h namafn.h  
phys\_ec/aer\_bdgtmss.F90 aer\_lidsim.F90 aer\_phy1.F90 aer\_phy2.F90 aer\_phy3.F90  
aer\_scavin.F90 aer\_sedimnt.F90 aer\_src.F90 aer\_volce.F90 callpar.F90 culight.F90  
ec\_phys.F90 gems\_init.F90 gems\_tend.F90 grg\_tendctm.F90 su\_aerp.F90 su\_aerw.F90  
prism/couplo4\_definitions.F90 couplo4\_endmpi.F90 couplo4\_exchange.F90  
couplo4\_inimpi.F90  
setup/suafn1.F90 suafn2.F90 suafn3.F90 succpicgfl.F90 sudefo\_gflattrib.F90  
sudim1.F90 supp.F90  
utility/prtgom.F90  
var/jbtomodel.F90 rdfpinc.F90

***Files modified(SCRIPTS):***

def/an.def fc.def  
gen/anml ansfc aod\_pp chem\_setup cycle\_times fetchobs gems\_setup get\_exe  
get\_tm5\_initcond getgrb getini getmars ifstraj mklinks model modeleps modelsv  
prep\_flux prep\_initcond  
oce/model\_nemoIFS model\_oceatm storm  
sms/archivectm.sms getfcdata.sms ml.sms prep\_chem.sms sfc.sms  
sms\_an/4dvar.sms anml.sms ansfc.sms ifstsave.sms vardata.sms

## **AEOLUS**

### **Michael Rennie - da7\_CY38R1\_Aeolus\_COPE\_submission - BR**

#### **Doppler wind lidar assimilation**

#### **Expts: T319 fp2k (control), fp1m (test)**

Further technical development (no meteorological impact) for Aeolus processing and assimilation tasks; particularly developments of Aeolus processing as a COPE task.

IFS: Modifications to allow the Aeolus processing in COPE to work.

ODB: Modifications to allow the Aeolus processing in COPE to work.

SCRIPTS: Modifications to allow the Aeolus processing in COPE to work.

AEOLUS: Many changes to project to accommodate continuous mode Aeolus data.

***Files created(AEOLUS):***

AMD\_file\_handling/Makefile.aeolus\_odb.test ODB\_to\_AMDdata.F90  
DataStructures/Test\_L2B\_AMD\_PCD\_ADS.F90 Test\_L2B\_Grouping\_ADS.F90  
Test\_L2B\_Meas\_Map\_ADS.F90 Test\_L2B\_Meas\_PCD\_ADS.F90  
Test\_L2B\_Mie\_Wind\_PCD\_ADS.F90 Test\_L2B\_Rayleigh\_Wind\_PCD\_ADS.F90  
Test\_L2B\_Wind\_Profiles\_MDS.F90 Test\_L2C\_Common\_AssimPCD.F90  
Test\_L2C\_Mie\_AssimPCD\_ADS.F90 Test\_L2C\_Rayleigh\_AssimPCD\_ADS.F90  
l2b\_amd\_pcd\_ads.F90 l2b\_grouping\_ads.F90 l2b\_meas\_map\_ads.F90  
l2b\_meas\_pcd\_ads.F90 l2b\_mie\_wind\_pcd\_ads.F90 l2b\_rayleigh\_wind\_pcd\_ads.F90  
l2b\_wind\_profiles\_mds.F90 l2c\_common\_assimpcd.F90 l2c\_mie\_assimpcd\_ads.F90  
l2c\_rayleigh\_assimpcd\_ads.F90  
InputScreening/Test\_Screening\_AMD\_Data.F90 screening\_amd\_data.F90  
L1B\_BRC\_Grouping/TestBRCgrouping.F90  
L1B\_geolocation\_extraction/L1B\_pred\_orb\_to\_ODB.F90 Makefile.aeolus\_odb\_test  
Objects.txt l1b\_data\_extraction.F90  
L2B\_WindResultExtraction/Makefile.aeolus\_odb\_test  
WindResultExtraction\_to\_ODB.F90  
L2C\_construction/Makefile.aeolus\_odb.test  
RayleighBrillouinProcessing/dataflow.txt plot\_dat\_files.py  
Scripts/generate\_makefiles\_for\_local\_use.py install\_L2BP.sc  
run\_feedback\_agent.py use\_ee\_cfi\_software.sc use\_simple\_xml.sc  
external/Makefile.aeolus\_odb\_test Objects.txt Objects\_odb2.txt  
dummy\_odb2\_module.F90 odb2\_module.F90  
support/TestHeightConv.F90 height\_conv.F90

***Files created(ODB):***

ddl.ECMA/links\_aeolus\_hdr.sql  
ddl/links\_aeolus\_hdr.sql

***Files created(SCRIPTS):***

gen/L1B\_gtt2odb2 aeolus\_auxmet\_odb fetchorbpre2 get\_external\_l2b\_odb

***Files modified(AEOLUS):***

AMD\_file\_handling/ConvertKnmiAscToAMD.F90 Makefile.aeolus TestReadAMDdata.F90  
TestWriteAMDdata.F90 writeamdata.F90  
Application\_Client\_Example/application\_client\_example.F90  
AuxCal\_file\_handling/TestReadAuxCaldata.F90 TestWriteAuxCaldata.F90  
writeauxcaldata.F90  
AuxClim\_file\_handling/TestReadAuxClimData.F90 TestWriteAuxClimData.F90  
readauxclimdata.F90 writeauxclimdata.F90  
BUFR\_file\_handling/L1B\_BufrUtil.F90 L1B\_bufr2ee.F90 L1B\_ee2bufr.F90  
L2BC\_ee2bufr.F90 Makefile.aeolus Makefile.verify\_bufr\_interface  
TestBufrWrapper.F90 TestL1B\_ee2bufr.F90 bufr\_l2b\_pcd.F90  
Classification/TestClassification.F90 classification.F90 construct\_obs.F90  
DataStructures/Makefile.aeolus Objects.txt Test\_AMD\_DataStructure.F90  
Test\_AMD\_Geoloc\_ADS.F90 Test\_AMD\_Met\_MDS.F90 Test\_AuxCal\_DataStructure.F90  
Test\_AuxCal\_SPH.F90 Test\_AuxClim\_DataStructure.F90 Test\_AuxClim\_SPH.F90  
Test\_DataSetDescriptor.F90 Test\_FixedHeader.F90 Test\_JobOrder\_DataStructure.F90  
Test\_L1B\_Cal\_ADS.F90 Test\_L1B\_DataStructure.F90 Test\_L1B\_GWD\_ADS.F90  
Test\_L1B\_Geoloc\_ADS.F90 Test\_L1B\_Meas\_ADS.F90 Test\_L1B\_MieCorePars\_ADS.F90  
Test\_L1B\_PCD\_ADS.F90 Test\_L1B\_SPH.F90 Test\_L1B\_US\_MDS.F90 Test\_L1B\_WV\_MDS.F90

Test\_L2BC\_DS\_Settings.F90 Test\_L2BC\_DataStructure.F90 Test\_L2BC\_SPH.F90  
 Test\_L2B\_AMD\_SPH.F90 Test\_L2B\_AuxPar\_DataStructure.F90 Test\_L2B\_AuxPar\_SPH.F90  
 Test\_L2B\_Geoloc\_ADS.F90 Test\_L2B\_Mie\_MDS.F90 Test\_L2B\_Proc\_Settings.F90  
 Test\_L2B\_Rayleigh\_MDS.F90 Test\_L2C\_MieVec\_MDS.F90 Test\_L2C\_RayleighVec\_MDS.F90  
 Test\_MainProductHeader.F90 Test\_RBC\_DataStructure.F90 Test\_RBC\_SPH.F90  
 Test\_Working\_Datastructure.F90 amd\_datastructure.F90 amd\_geoloc\_ads.F90  
 amd\_met\_mds.F90 auxcal\_datastructure.F90 datasetdescriptor.F90  
 ee\_cfi\_datatypes.F90 llb\_cal\_ads.F90 llb\_geoloc\_ads.F90 llb\_gwd\_ads.F90  
 llb\_meas\_ads.F90 llb\_miecorepars\_ads.F90 llb\_pcd\_ads.F90 llb\_sph.F90  
 llb\_us\_mds.F90 llb\_wv\_mds.F90 l2b\_auxpar\_datastructure.F90 l2b\_geoloc\_ads.F90  
 l2b\_mie\_mds.F90 l2b\_parameters.F90 l2b\_proc\_settings.F90 l2b\_rayleigh\_mds.F90  
 l2bc\_datastructure.F90 l2bc\_sph.F90 l2c\_mievec\_mds.F90 l2c\_rayleighvec\_mds.F90  
 mainproductheader.F90 rbc\_datastructure.F90 working\_datastructure.F90  
 DirectBinaryIO/TestBuffering.F90 TestDirectBinaryIO.F90 TestMpiBuffering.F90  
 TestUnformattedIO.F90 directbinaryio.F90 unformattedio.F90  
 HLOS\_retrieval/Test\_HLOS\_Retrieval.F90 hlos\_retrieval.F90  
 InputScreening/Makefile.aeolus Objects.txt Test\_Screening\_L1B\_Data.F90  
 Test\_Screening\_RBC\_Data.F90 screening\_llb\_data.F90  
 KVT\_module/TestKVT\_module.F90 kvt\_module.F90  
 L1B\_BRC\_Grouping/Makefile.aeolus brcgrouping.F90  
 L1B\_file\_handling/TestReadAndWriteL1Bdata.F90 TestReadL1Bdata.F90  
 TestWriteL1Bdata.F90 readllbdata.F90 writellbdata.F90  
 L1B\_geolocation\_extraction/Extract\_Geolocation.F90 Makefile.aeolus  
 L2BC\_file\_handling/TestReadL2BCdata.F90 TestWriteL2BCdata.F90 readl2bcdata.F90  
 writel2bcdata.F90  
 L2B\_AuxPar\_file\_handling/Test\_Read\_L2B\_AuxPar\_file.F90  
 L2B\_WindResultExtraction/Makefile.aeolus TestWindResultExtraction.F90  
 windresultextraction.F90  
 L2C\_construction/L2C\_Processor.F90 Makefile.aeolus append\_l2c.F90  
 LiteTestData/TestLiteDataModule.F90 litedatamodule.F90  
 Makefile.aeolus  
 Match\_AMD/Test\_Match\_AMD\_Module.F90 match\_amd\_module.F90  
 Meas\_Selection\_Weighting/TestSelAndWeighMeasurements.F90  
 select\_and\_weigh\_measurements.F90  
 MieCoreProcessing/MieCoreScan.F90 PlotMieCoreAtmDBScanResult.F90  
 TestMieResponse.F90 Test\_Mie\_Spectral\_Shape.F90 mieresponse.F90  
 OpticalProperties/TestOpticalProperties.F90 Test\_LUT\_RayCalib\_handling.F90  
 opticalproperties.F90  
 RBC\_FileHandling/TestReadRBCdata.F90 TestWriteRBCdata.F90 readrbcdata.F90  
 RayleighBrillouinProcessing/GenerateRBCdata.F90 TestRayl\_Br\_Proc.F90  
 Test\_correction.F90 calib\_grid.F90 calib\_tenti.F90  
 rayleighbrillouinprocessing.F90 tentispectrum.F90  
 Scripts/CheckForUpperCaseModuleNames.py CheckVersionNumbers.py  
 Set\_Permissions.sc Set\_Systemsettings.sc build\_L2BP.KNMI.sc build\_L2BP.sc  
 build\_L2BP\_NEC\_example.sc do\_aeolus\_setup do\_linecount.sc  
 ee\_cfi\_software.install.script.64bit.sc install.txt install\_binary\_datapack.sc  
 Set\_Makeoptions.sc  
 ThinLayer/AE\_TEST\_AUX\_PAR\_2B\_20050331T000000\_20111231T000000\_0000.EEF  
 TestReadJobOrderData.F90  
 Tools/Test\_diffftool.F90 diff\_module.F90 diffftool.F90

auxiliary/TestAuxiliaryModule.F90 TestDummyAuxiliaryModule.F90  
 auxiliarymodule.F90  
 configure ee\_cfi\_lib\_def  
 ee\_cfi\_wrapper\_module/Objects.txt ee\_xml\_wrapper.c simple\_write\_test.c  
 test\_ee\_xml.F90 xml\_module.F90  
 external/Makefile.aeolus aeolus\_l2bp\_odb\_transfers.F90  
 aeolus\_l2bp\_primary\_ec.F90 aeolus\_l2bp\_primary\_ec.h  
 lib/Makefile.aeolus  
 main/L2B\_processor.F90 l2bp\_module.F90  
 schemas/L2B\_HDR.xml L2B\_SpecificProductHeader.xml L2B\_SpecificProductHeader.xsd  
 L2B\_SpecificProductHeader\_invalid.xml L2C\_HDR.xml L2C\_SpecificProductHeader.xml  
 L2C\_SpecificProductHeader.xsd L2C\_SpecificProductHeader\_invalid.xml  
 simple\_xml/TestSimpleXML.F90  
 support/Makefile.aeolus Objects.txt TestAeolusConstants.F90 TestArraytools.F90 TestErrorHandl  
 TestLatLonHandling.F90 TestProfileInterpolate.F90 aeolusconstants.F90 arraytools.F90  
 errorhandler.F90 latlon\_handling\_simple.F90 lexer.F90 logging.F90 test\_binning\_1D.F90  
 test\_c\_support.F90

***Files modified(IFS):***

common/yomdb\_defs.h yomdb\_vars.h  
 module/aeolus\_getamd\_mod.F90 yomvar.F90  
 namelist/namvar.h  
 obs\_preproc/sugoms.F90 suobs.F90  
 op\_obs/hop.F90 hretr.F90 hretr\_aeolus.F90  
 var/suaeolus.F90 suvar.F90 taskob.F90

***Files modified(ODB):***

bufr2odb/get\_varindex.F90  
 cma2odb/ctxinitdb.F90 getatdb.F90 getdb.F90 init\_odb\_tables.F90 initmdb.F90  
 putatdb.F90  
 ddl/aeolus.h cma.h odb2ee\_aeolus\_auxmet.sql sat\_aeolus.sql  
 sathdr\_screen\_aeolus\_auxmet.sql sathdr\_screen\_aeolus\_hdr.sql  
 module/varindex\_module.F90  
 pandor/module/bator\_ecritures\_mod.F90

***Files modified(SCRIPTS):***

build/Makefile.root.aeolus  
 def/an.def  
 gen/aeolus\_auxmet aeolus\_l2b aeolus\_l2c archive\_obsgroup create\_ioassign  
 fetchorbpre gems\_setup get\_exe getmars gtt gtt2simulobs gtt2simulobs\_preproc  
 ifstraj l2b\_ee\_to\_odb mkabs\_aeolus mkabs\_black model modeleps modelsv odb2odb1  
 prep\_couplo4 prereo3  
 oce/model\_nemoIFS model\_oceatm storm

***Files deleted(AEOLUS):***

DataStructures/Test\_L2B\_PCD\_ADS.F90 Test\_L2C\_AssimPCD\_ADS.F90 Test\_Meas\_Map.F90  
 l2b\_pcd\_ads.F90 l2c\_assimpcd\_ads.F90 meas\_map.F90  
 L1B\_BRC\_Grouping/CreateSuperBRCs.F90  
 Scripts/generate\_makefiles\_for\_local\_use  
 use\_ee\_cfi\_software.sc use\_simple\_xml.sc



*Files deleted(IFS):*

module/aeolus\_l2bp\_wrapper\_mod.F90  
op\_obs/aeolus\_l2b\_to\_body.F90

*Files deleted(ODB):*

bufr2odb/bufr2odb\_aeolus.F90  
ddl.ECMA/sathdr\_screen\_aeolus\_1b.sql sathdr\_screen\_aeolus\_2b.sql  
sathdr\_screen\_aeolus\_2b\_part2.sql  
ddl/sathdr\_screen\_aeolus\_1b.sql sathdr\_screen\_aeolus\_2b.sql sathdr\_screen\_aeolus\_2b\_part2.sql

## RE-ANALYSIS

### Paul Poli, Hans Hersbach and Carole Peubey - eras\_CY38R1\_upgradefrom37r3 - BR

#### Preparations for ERA-20C, and clean-up of ERA options

##### Expts: foj0,folg (control), foxx,fp14 (test)

This branch contains various preparations for ERA-20C and other changes that will gradually allow all users to use what were, so far, "ERA-only" options.

The preparations for ERA-20C include:

- the ability to start an experiment from ECFS and not from MARS (from Carole)
- the ability to use observations not only in BUFR, but also in ODB-2 or ASCII (from Hans)
- the ability to run the surface analysis without observations (from Hans)
- support for new classes (ea, e2, ep) in IFS
- a workaround to run the surface analysis (which uses GRIBEX) with these 3 new classes
- the introduction of two new ODB columns timeseries\_index@conv and bias\_volatility@body
- the possibility to activate the surface pressure variational bias correction from prepIFS
- the possibility to use ODB columns source@hdr and collection\_identifier@conv in the blacklist
- cleaning-up of the SQL query blacklist number 1 to retain only conventional data (this query had progressively got used also by radar and lidar data – now all in SQL query blacklist number 10)
- the use of the marsgen mechanism to archive ODBs in MARS
- the correction of a bug in handling of PMSL observations, which only affects runs when only PMSL observations are available in altitude (irrelevant today since land stations systematically report also the station measurement)
- hourly radiation calls if longrange\_forcing (default off) is called

- new tasks `check_fail_traj.sms` and `set_tstep.sms` which check if the last trajectory of an assimilation has blown up and then sets the analysis cycle date/time back with a halved time-step until the blow-up date/time has been repeated (all this is unused by default).

Also, in the scripts and in prepIFS, reanalysis flags that were not supported any more have been removed (LERA40PP, ERA\_MODE, ERA40\_ENDOFMONTH, MEANS, MOMENTS, INTEGRALS, INCREMENTS, PLOTS, RSTBIAS\_SE).

In the scripts and in prepIFS, new flags have been introduced (possible values in parentheses, default listed first) reproducing current, non-ERA, behavior: LDIAGS\_ERA (false/true), LMON\_ERA (false/true), ERA\_NOGETBIAS (false/true), ERA\_POSTPROC (false/true), REDNMC (1.0), LBUFR (true/false), LAFORMAT (false/true), OBSASCIILIST (list of ASCII observation datasets input, empty character string by default), LOFORMAT (false/true), OBSODB2LIST (list of ODB-2 observation datasets input, empty character string by default), INIORIG (mars/ecfs), INIPATH (path where to get initial conditions from ECFS), LHADISST2 (false/true), OBS\_SURF\_CONV (true/false), VARBC\_PS (false/true), LCOLDSTART\_SFCOBS (true/false).

The idea is to eventually enable everyone to use reanalysis tools/diagnostics/monitoring and/or start an experiment from an old date, simply from prepIFS. So far all these operations typically required script changes on top of the prepIFS changes and the various ERA options were inter-dependent. The new flags are designed to be independent of one another.

Note, this branch does *\*not\** include yet the reanalysis additional diagnostics/monitoring tools.

*Files created(ODB):*

module/aligned.F90 odb1.F90 odb2.F90  
tools/Odb2\_to\_odb1\_era.F90

*Files created(SCRIPTS):*

gen/fetchmarsodb\_era odb2odb1\_era ofb\_groupid=17\_era.sql preascii premarsodb  
text2odb  
sms\_an/a2o\_conv.sms a2o\_surf\_conv.sms asci2odb.sms mergeodb\_formats.sms  
o2o\_conv.sms o2o\_surf\_conv.sms odb22odb\_era.sms preascii.sms premodb.sms  
sms\_era/check\_fail\_traj.sms set\_tstep.sms

*Files modified(IFS):*

common/yomdb\_defs.h yomdb\_vars.h  
dia/class\_grib.F90  
module/varbc\_sfcobs.F90 varbc\_table.F90 yomvarbc.F90  
obs\_preproc/black.F90 blackhat.F90 blinit.F90 repra.F90

*Files modified(ODB):*

cma2odb/initmdb.F90  
ddl/black\_robhdr\_1.sql black\_robhdr\_10.sql black\_robhdr\_2.sql black\_robhdr\_3.sql  
black\_robhdr\_4.sql black\_robhdr\_6.sql black\_robhdr\_7.sql black\_robhdr\_8.sql  
black\_robhdr\_9.sql black\_robbody\_1.sql black\_robbody\_10.sql body.h conv.h  
getsfcoobsid.sql varbc\_sfcobs\_robhdr.sql varbc\_sfcobs\_robbody.sql  
tools/Simulobs2odb.F90

*Files modified(SCRIPTS):*

build/Makefile.root.odb  
def/an.def enkf.def fsobs.def gen.def  
era/ContPlot\_tz.py

```
gen/anil anml anpl ansfc archive_obs archive_obsgrp compile_setup
convert_obsgrp copyodb create_odbglue cycle_times fc_sens_save feedback
fetchmars fetchmarsodb fetchobs gather_endaodb get_datafiles getbias getini
ifsmin ifstraj includes.h libsgen longrange_forcing mkabs_odbtools mkabs_reanal
mklinks mkvdb model obstat obstat_init p4_compile_setup prep_couplo4 restart_999
soilana ssaana sstana
sms/cancel.sms getfcdata.sms logfiles.sms sfc.sms
sms_an/4dvar.sms fetchmars.sms fetchobs.sms mergeodb.sms
sms_era/get_obtime.sms obtime.sms
wav/prep_wave
```

## Hans Hersbach - er9\_CY38R1\_HadISST2 - BR

### Ingestion of HadISST2 SST and sea-ice fields, and allowing the surface analysis to run without observations

This branch allows:

1. The usage of SST and sea-ice fields as they were delivered by the Hadley Centre within the ERA-CLIM project. At script level this is controlled with a new logical LHADSST2=TRUE It requires some modifications in the ssa library regarding the sst/ci analysis:
  - Allow ingestion of fields that are encoded either from NS or SN, and from any first longitude
  - Do not reset sea ice or modify SST locally. This is controlled by a new namelist variable: LCHECK\_SST\_ICE
  - Default (i.e., when not specified in namelist): TRUE, which gives bit-identical results with default Cy38r1
  - For HadiSST2 data: set to FALSE
  - Do not transform lake temperatures to a temperature at mean sea level. This is controlled by a new namelist variable: LMSL\_LAKE\_SST
  - Default (i.e., when not specified in namelist): TRUE, which gives bit-identical results with default Cy38r1
  - For HadiSST2 data: set to FALSE
2. Allow the surface analysis to complete without surface observations In the first pilot reanalysis, no data in the surface analysis will be assimilated. Currently this will lead to a failure, since it is insisted that there should at least be one surface observation. To by-pass this issue, a new namelist variable LOBS has been introduced in the ssa library:
  - By default (i.e., when not specified in namelist): TRUE, which gives bit-identical results with default Cy38r1
  - In case it is FALSE, the analysis is not performed and effectively the surface analysis equals its first guess.

*Files modified(SCRIPTS):*

```
gen/fetchmars sstana
```

*Files modified(SSA):*

```
module/comobs.F90 yomsst.F90
namelist/namssa.h
sub/control_ssa.F90 ice_analysis.F90 inisst.F90 reg_to_gg.F90 scan_cma_odb.F90
scan_odb.F90 sst_analysis.F90
util/setcomssa.F90
```

**David Tan - dat\_CY38R1\_AnalysisArchivePeriod - BR**

**More flexible archiving of atmospheric analysis**

Scripts-only branch, neutral for standard configurations, which makes it possible to archive the atmospheric analysis more frequently than 6-hourly (e.g. 3-hourly for reanalysis). To activate this, introduce PERIOD.-AN\_ATM in config.an.h (either through a handedit or PrepIFS overlay). The principal changes are: distinguish between archiving period for Atmospheric and Surface analyses, handle start/end of window, phase out use of PERIOD\_AN/2.

*Files modified(SCRIPTS):*

```
gen/ansfc anwave cycle_times forceinv2clim ifsmin ifstraj ifstsave sekf_sm
soilana ssaana sstana
```

## MARINE ASPECTS

**Jean Bidlot - wab\_CY38R1\_for\_next\_cycle - Not-BR**

**Modification of Snonlin for first frequency downshifting and technical changes for sea ice attenuation**

**Expts: T511 folg (control), fo0p (test)**

It was found that in very rare situations the non linear source term of WAM was not properly coded to handle the necessary frequency downshifting. Because the fix requires some more calculations, snonlin was optimised to be more efficient ( 10 %). WAM can now run with sea ice attenuation instead of a fixed sea ice mask. It is NOT active (LMASKICE=T in wam\_input). Under the default configuration, the masking of the wave spectra by the presence of sea ice is now done using directly the sea ice fraction. Global grid configurations (0.05, 0.1, 0.125 degree) have been prepared. The 0.125 configuration is to be used with the T2000 configuration.

Minor changes:

- Reduction in the amount of memory needed to run WAM (some more work is needed).
- Bug fix for the interpolation of spectrum from relative to absolute moving frame for the first frequency bin.
- Output of first guess spectra now possible.
- Proper resizing of arrays in intwaminput.
- The Red Sea area was added to the limited area configuration.

Sea ice changes are passive. changes to the non linear source term are both bug-fix and optimisation

*Files created(WAM):*

Wam\_oper/cigetdeac.F cireduce.F ciwaf.F fld2wam.F inisnonlin.F

*Files modified(SCRIPTS):*

def/an.def coup.def enkf.def eps\_nemo.def eps\_varfc.def fc.def fsobs.def  
ifs\_ctm.def longrange.def oc.def sens.def wam.def  
gen/ansfc archive\_obsgrp cycle\_times gems\_setup get\_exe getgrb getmars ifsmin  
ifstraj mkabs\_black model modeleps modelsv postenkf prep\_couplo4 prereo3 sekf\_sm  
oce/model\_nemoIFS model\_oceatm stage\_wave storm  
sms/wconst.sms  
wav/archive\_wave prep\_wave wam\_input wave\_bsdcol wave\_create\_bathymetry wave\_getcurrent  
wave\_getrst wave\_getwave wave\_getwind wave\_run wave\_set\_config wave\_set\_tstep wave\_  
setup

*Files modified(WAM):*

Alt/expoint.F  
Sar/sarinvert.F  
Wam\_oper/altas.F90 buildstress.F chief.F create\_wam\_bathymetry.F current2wam.F  
frcutindex.F getspec.F getstress.F getwnd.F getwspec.F grfield.F90 grib2wgrid.F  
implsch.F initmdl.F iniwcst.F intpol.F intwaminput.F inwgrib.F jonswap.F  
loc2glo.F mfredir.F micep.F mpbcstgrid.F mpuserin.F newwind.F nlweigt.F notim.F  
oifield.F out\_onegrdpt\_sp.F outbeta.F outbs.F outcom.F outgrid.F preproc.F  
preset.F prewind.F readpre.F readstress.F readwind.F rearrngsar.F rfl4wam.F90  
savstress.F sdissip.F setice.F snonlin.F tauhf.F timin.F unsetice.F updatewd.F  
userin.F wamassi.F wamodel.F wavemdl.F writestress.F wvalloc.F wvdealloc.F  
module/yowcout.F yowice.F yowindn.F yowpcons.F yowwind.F

## **Giovanna De Chiara - dig\_CY38R1\_test\_ascatb - BR**

### **Changes to assimilate ASCAT METOP-B**

#### **Expts: T255 fnyk (control), fnyl,fnym,fnyn (test)**

IFS was almost ready to read and assimilate wind speed and direction from METOP-B ASCAT. METOP-B ASCAT will have the same codtype as METOP-A but different Satellite ID. This is not an issue for the screening and quality control. But in the 4D-Var the diagnostic is based only on the codtype to select the different satellites. To simplify the process to select ASCAT-A and ASCAT-B in the JO table, the code has been modified in order to use the report type, rather than the codtype, to discriminate and compute diagnostics for each Scatterometer sensors.

*Files created(IFS):* var/suscat.F90

*Files created(ODB):* ddl.CCMA/suobarea\_scatt.sql ddl.ECMA/suobarea\_scatt.sql ddl/suobarea\_  
scatt.sql

*Files modified(IFS):* common/yomdb\_defs.h yomdb\_vars.h module/parersca.F90 yomersca.F90  
yommkodb.F90 namelist/nammkodb.h obs\_preproc/ascatif.F90 suobarea.F90 suobs.F90 op\_  
obs/hjo.F90 var/ecset.F90 ecset\_thsafe.F90 sualcos.F90

*Files modified(ODB):* cma2odb/ctxinitdb.F90 initmdb.F90 map\_reporttype.F90 ddl/hdr.h suobarea.sql

suobarea\_sat.sql suobarea\_satob.sql

*Files modified(SCAT):* programs/ascat\_bufr\_filter.F

*Files modified(SCRIPITS):* gen/fetchobs prescat

## **Sarah Keeley - nesk\_CY38R1\_caspian\_only\_esuite - Not-BR**

### **Sea Ice consistency check over Caspian Sea (OFF)**

**Expts: T511 forl (control), fozc (test)**

Turns off consistency checks for SST and sea ice over the Caspian Sea region (ice\_analysis.F90) this is important for low concentration ice in the region as the freeze up starts.

*Files modified(SSA):*

sub/ice\_analysis.F90

## **PROBABLISTIC FORECASTING**

### **ODB+COPE**

#### **Anne Fouilloux - nar\_CY38R1\_ENKF\_EDA\_for\_CY38R2 - BR**

##### **ENKF and ENDA common framework for ODB**

It contains changes for ENKF provided by Mats and optimization of ENKF tables for ODB (120 members) and new ODB tables for ENDA (100 members). ENDA tables are for now created and filled in the last trajectory in parallel (for each member) with ODB columns we want to keep in MARS. All these tables are available in the control ECMAs and archived in MARS (in one go i.e. we got rid of all the gather\_endaodb tasks)

Also improvement to RALT (odb2odb1) to make sure it does not fail when no ralt data is available

Also contains from Tony McNally: **Computation and ODB storage of Jacobian peaks for satellite channels - PASSIVE**

Quantities available during the screening call to RTTOV are used to compute the pressure and model level of the peak Jacobian sensitivity for satellite sounding channels. These are purely diagnostic quantities and have no impact upon the assimilation.

*Files created(ENKF):*

module/analysis\_mod.F03 comp\_kernel\_mod.F03 constants.F03 control\_mod.F03  
corr\_stats\_mod.F03 covar\_local\_mod.F03 covlocal.F90 debug\_mod.F03  
extern\_packages.F03 inflation\_mod.F03 kdtree2\_module.F90  
kdtree2\_precision\_module.F90 kdtree2\_priority\_queue\_module.F90 obs\_base\_mod.F03  
obs\_constants.F03 obs\_distr\_mod.F03 post\_inflate\_mod.F03 stand\_atm\_mod.F03  
state\_geometry.F03 state\_mod.F03 state\_utils.F03 xb\_state\_mod.F03  
programs/master\_enkf.F03 oper\_ens.F03

*Files created(IFS):*

dfi/pc\_ini.F90  
module/yomgwdiag.F90  
op\_obs/jacobian\_peak.F90

**Files created(ODB):**

cma2odb/store\_enda.F90  
ddl.CCMA/ensemble.h  
ddl.COUNTRYRSTRHBIAS/ensemble.h  
ddl.ECMA/ensemble.h links\_ensemble.sql store\_enda.sql  
ddl.RSTBIAS/ensemble.h  
ddl.SONDETYPERSTRHBIAS/ensemble.h  
ddl/ensemble.h global\_enkf\_105.sql global\_enkf\_110.sql global\_enkf\_115.sql  
global\_enkf\_120.sql links\_ensemble.sql store\_enda.sql update\_hprior\_101.sql  
update\_hprior\_102.sql update\_hprior\_103.sql update\_hprior\_104.sql  
update\_hprior\_105.sql update\_hprior\_106.sql update\_hprior\_107.sql  
update\_hprior\_108.sql update\_hprior\_109.sql update\_hprior\_110.sql  
update\_hprior\_111.sql update\_hprior\_112.sql update\_hprior\_113.sql  
update\_hprior\_114.sql update\_hprior\_115.sql update\_hprior\_116.sql  
update\_hprior\_117.sql update\_hprior\_118.sql update\_hprior\_119.sql  
update\_hprior\_120.sql  
interface/store\_enda.h

**Files created(SCRIPTS):**

gen/enkf\_inflate postenkf1  
sms\_an/enkf\_inflate.sms obstat\_ccma.sms postenkf1.sms

**Files created(TRANS):**

external/dist\_grid\_32.F90 gath\_grid\_32.F90  
interface/dist\_grid\_32.h gath\_grid\_32.h  
module/dist\_grid\_32\_ctl\_mod.F90 gath\_grid\_32\_ctl\_mod.F90

**Files modified(IFS):**

common/yomdb\_defs.h yomdb\_vars.h  
dia/preset\_grib\_template.F90  
module/enkf\_mix.F90 parcma.F90 yomdb.F90 yomvar.F90  
namelist/namvar.h  
obs\_preproc/defrun.F90  
op\_obs/gpscalc\_alpha.F90 gpsro\_op.F90 hjo.F90 hretr.F90  
var/suvar.F90 tslvstst.F90 writeoba.F90

**Files modified(ODB):**

cma2odb/ctxinitdb.F90 distribute\_odb.F90 getatdb.F90 getdb.F90 initmdb.F90  
opendb.F90 putatdb.F90 shuffle\_odb.F90 xchangedatadb.F90 xchangedatadistdb.F90  
ddl/body.h cma.h global\_enkf\_1.sql global\_enkf\_10.sql global\_enkf\_100.sql  
global\_enkf\_15.sql global\_enkf\_2.sql global\_enkf\_20.sql global\_enkf\_25.sql  
global\_enkf\_3.sql global\_enkf\_30.sql global\_enkf\_35.sql global\_enkf\_4.sql  
global\_enkf\_40.sql global\_enkf\_45.sql global\_enkf\_5.sql global\_enkf\_50.sql  
global\_enkf\_55.sql global\_enkf\_60.sql global\_enkf\_65.sql global\_enkf\_70.sql  
global\_enkf\_75.sql global\_enkf\_80.sql global\_enkf\_85.sql global\_enkf\_90.sql  
global\_enkf\_95.sql hdr.h robody\_traj.sql satbody\_screen\_atovs.sql  
update\_enkf\_links.sql update\_hprior\_1.sql update\_hprior\_10.sql

update\_hprior\_100.sql update\_hprior\_11.sql update\_hprior\_12.sql  
update\_hprior\_13.sql update\_hprior\_14.sql update\_hprior\_15.sql  
update\_hprior\_16.sql update\_hprior\_17.sql update\_hprior\_18.sql  
update\_hprior\_19.sql update\_hprior\_2.sql update\_hprior\_20.sql  
update\_hprior\_21.sql update\_hprior\_22.sql update\_hprior\_23.sql  
update\_hprior\_24.sql update\_hprior\_25.sql update\_hprior\_26.sql  
update\_hprior\_27.sql update\_hprior\_28.sql update\_hprior\_29.sql  
update\_hprior\_3.sql update\_hprior\_30.sql update\_hprior\_31.sql  
update\_hprior\_32.sql update\_hprior\_33.sql update\_hprior\_34.sql  
update\_hprior\_35.sql update\_hprior\_36.sql update\_hprior\_37.sql  
update\_hprior\_38.sql update\_hprior\_39.sql update\_hprior\_4.sql  
update\_hprior\_40.sql update\_hprior\_41.sql update\_hprior\_42.sql  
update\_hprior\_43.sql update\_hprior\_44.sql update\_hprior\_45.sql  
update\_hprior\_46.sql update\_hprior\_47.sql update\_hprior\_48.sql  
update\_hprior\_49.sql update\_hprior\_5.sql update\_hprior\_50.sql  
update\_hprior\_51.sql update\_hprior\_52.sql update\_hprior\_53.sql  
update\_hprior\_54.sql update\_hprior\_55.sql update\_hprior\_56.sql  
update\_hprior\_57.sql update\_hprior\_58.sql update\_hprior\_59.sql  
update\_hprior\_6.sql update\_hprior\_60.sql update\_hprior\_61.sql  
update\_hprior\_62.sql update\_hprior\_63.sql update\_hprior\_64.sql  
update\_hprior\_65.sql update\_hprior\_66.sql update\_hprior\_67.sql  
update\_hprior\_68.sql update\_hprior\_69.sql update\_hprior\_7.sql  
update\_hprior\_70.sql update\_hprior\_71.sql update\_hprior\_72.sql  
update\_hprior\_73.sql update\_hprior\_74.sql update\_hprior\_75.sql  
update\_hprior\_76.sql update\_hprior\_77.sql update\_hprior\_78.sql  
update\_hprior\_79.sql update\_hprior\_8.sql update\_hprior\_80.sql  
update\_hprior\_81.sql update\_hprior\_82.sql update\_hprior\_83.sql  
update\_hprior\_84.sql update\_hprior\_85.sql update\_hprior\_86.sql  
update\_hprior\_87.sql update\_hprior\_88.sql update\_hprior\_89.sql  
update\_hprior\_9.sql update\_hprior\_90.sql update\_hprior\_91.sql  
update\_hprior\_92.sql update\_hprior\_93.sql update\_hprior\_94.sql  
update\_hprior\_95.sql update\_hprior\_96.sql update\_hprior\_97.sql  
update\_hprior\_98.sql update\_hprior\_99.sql  
interface/ctxinitdb.h initmdb.h  
scripts/create\_global\_enkf\_sql.ksh create\_hprior\_links.ksh create\_hprior\_sql.ksh  
create\_ioassign  
tools/Create\_enkf.F90

**Files modified(SCRIPTS):**

def/an.def enkf.def  
gen/archive\_obsgrout convert\_obsgrout create\_ioassign cycle\_times enkf\_anal  
enkf\_ctl.h enkf\_ecfs ens\_stdev fc\_sens\_save fetchmars gems\_setup get\_exe getini  
getmars getxb ifstraj merge\_iomap.pl mkabs\_black mkabs\_prepdata model modeleps  
modelsv postenkf prelcrad\_screen prep\_couplo4 prereo3 sstana vardata  
oce/model\_nemoIFS model\_oceatm storm  
sms\_an/4dvar.sms bufr2odb.sms convert\_obsgrout.sms

**Files modified(TRANS):**

external/setup\_trans.F90

**Files deleted(ENKF):** dum

**Files deleted(ODB):**

ddl.CCMA/enkf.h



ddl.COUNTRYRSTRHBIAS/enkf.h  
ddl.ECMA/enkf.h  
ddl.RSTBIAS/enkf.h  
ddl.SONDETYPERSTRHBIAS/enkf.h  
ddl/enkf.h

*Files deleted(SCRIPTS):* gather\_endaodb.sms gather\_endaodb\_airs.sms gather\_endaodb\_amsre.sms  
gather\_endaodb\_amsua.sms gather\_endaodb\_amsua\_allsky.sms gather\_endaodb\_amsub.sms  
gather\_endaodb\_atms.sms gather\_endaodb\_conv.sms gather\_endaodb\_cris.sms gather\_endaodb\_-  
geos.sms gather\_endaodb\_gpsro.sms gather\_endaodb\_hirs.sms gather\_endaodb\_iasi.sms  
gather\_endaodb\_iras.sms gather\_endaodb\_meris.sms gather\_endaodb\_mhs.sms gather\_endaodb\_-  
msu.sms gather\_endaodb\_mwhs.sms gather\_endaodb\_mwri.sms gather\_endaodb\_mwts.sms gather\_-  
endaodb\_nexrad.sms gather\_endaodb\_ralt.sms gather\_endaodb\_resat.sms gather\_endaodb\_-  
resatak.sms gather\_endaodb\_satob.sms gather\_endaodb\_scatt.sms gather\_endaodb\_simulobs.sms  
gather\_endaodb\_smos.sms gather\_endaodb\_ssmi.sms gather\_endaodb\_ssmis.sms gather\_-  
endaodb\_ssu.sms gather\_endaodb\_surf\_conv.sms gather\_endaodb\_tmi.sms gather\_endaodb\_-  
vtpr1.sms gather\_endaodb\_vtpr2.sms gather\_endaodb\_windsat.sms

## **Anne Fouilloux - stf\_CY38R1\_for\_CY38R2\_v1 - BR**

### **ODB archiving improvements**

This contribution simplify the way ODB columns are chosen when archived in MARS both for OD and RD. In OD mode (and RD defaults), ODB columns are selected according to a set of pre-defined SQLs which were removed from performe scripts/gen and are now stored in XDATA/CYCLE/odb\_archive. Any changes (additional columns to archive or removal of any columns to archive) must be notified to the ODB governance which will update the corresponding SQLs (two per MARS group i.e. one for MFB and one for OFB). The list of columns to be archived for each cycle will be added in the ECMWF ODB governance (not done yet).

For RD prepIFS runs, users can now "easily" modify these SQLs by either specifying a path (on the supercomputer) where we expect to find all the SQLs or add any ODB columns to the defaults.

Requires ODB\_VERSION=CY38R2.001 ODB\_API\_VERSION=0.9.17 prepIFS -o overlayCY38R2

#### *Files created(SCRIPTS):*

gen/add\_columns\_to\_sql.pl uniquecol.pl

#### *Files modified(ODB):*

bufr2odb/bufr2odb\_atovs.F90  
cma2odb/shuffle\_odb.F90

#### *Files modified(SCRIPTS):*

gen/archive\_obsgroup convert\_obsgroup odb2odb1  
sms\_an/archive\_obsgroup.sms clean\_an.sms convert\_obsgroup.sms gather\_endaodb.sms

#### *Files deleted(SCRIPTS):*

gen/mondb.sql mondb\_airs.sql mondb\_allsky.sql mondb\_conv.sql mondb\_gbrad.sql mondb\_-  
geos.sql mondb\_gpsro.sql mondb\_groupid=1.sql mondb\_groupid=10.sql mondb\_groupid=11.sql  
mondb\_groupid=12.sql mondb\_groupid=13.sql mondb\_groupid=14.sql mondb\_groupid=15.sql  
mondb\_groupid=16.sql mondb\_groupid=17.sql mondb\_groupid=18.sql mondb\_groupid=19.sql

mondb\_groupid=2.sql mondb\_groupid=20.sql mondb\_groupid=21.sql mondb\_groupid=22.sql  
mondb\_groupid=23.sql mondb\_groupid=24.sql mondb\_groupid=25.sql mondb\_groupid=26.sql  
mondb\_groupid=27.sql mondb\_groupid=28.sql mondb\_groupid=29.sql mondb\_groupid=3.sql  
mondb\_groupid=30.sql mondb\_groupid=31.sql mondb\_groupid=32.sql mondb\_groupid=33.sql  
mondb\_groupid=34.sql mondb\_groupid=35.sql mondb\_groupid=36.sql mondb\_groupid=37.sql  
mondb\_groupid=38.sql mondb\_groupid=39.sql mondb\_groupid=4.sql mondb\_groupid=5.sql  
mondb\_groupid=6.sql mondb\_groupid=7.sql mondb\_groupid=8.sql mondb\_groupid=9.sql mondb\_  
hirs.sql mondb\_iasi.sql mondb\_meris.sql mondb\_ralt.sql mondb\_resat.sql mondb\_resatak.sql  
mondb\_sat.sql mondb\_satob.sql mondb\_scatt.sql mondb\_tovs.sql ofb\_airs.sql ofb\_allsky.sql  
ofb\_conv.sql ofb\_gbrad.sql ofb\_generic.sql ofb\_geos.sql ofb\_gpsro.sql ofb\_groupid=1.sql  
ofb\_groupid=10.sql ofb\_groupid=11.sql ofb\_groupid=12.sql ofb\_groupid=13.sql ofb\_  
groupid=14.sql ofb\_groupid=15.sql ofb\_groupid=16.sql ofb\_groupid=17.sql ofb\_groupid=18.sql  
ofb\_groupid=19.sql ofb\_groupid=2.sql ofb\_groupid=20.sql ofb\_groupid=21.sql ofb\_groupid=22.sql  
ofb\_groupid=23.sql ofb\_groupid=24.sql ofb\_groupid=25.sql ofb\_groupid=26.sql ofb\_  
groupid=27.sql ofb\_groupid=28.sql ofb\_groupid=29.sql ofb\_groupid=3.sql ofb\_groupid=30.sql  
ofb\_groupid=31.sql ofb\_groupid=32.sql ofb\_groupid=33.sql ofb\_groupid=34.sql ofb\_  
groupid=35.sql ofb\_groupid=36.sql ofb\_groupid=37.sql ofb\_groupid=38.sql ofb\_groupid=39.sql  
ofb\_groupid=4.sql ofb\_groupid=5.sql ofb\_groupid=6.sql ofb\_groupid=7.sql ofb\_groupid=8.sql  
ofb\_groupid=9.sql ofb\_hirs.sql ofb\_iasi.sql ofb\_iras.sql ofb\_meris.sql ofb\_ralt.sql  
ofb\_resat.sql ofb\_resatak.sql ofb\_satob.sql ofb\_scatt.sql ofb\_smos.sql ofb\_surfconv.sql  
ofb\_tovs.sql revmatchup

## **Anne Fouilloux - stf\_SB38R1\_ODB\_cleaning\_for\_CY38R2 - BR**

### **Clean-up of ODB columns and Variable numbers**

#### *Files modified(ODB):*

cma2odb/initmdb.F90 ddl/body.h cma.h conv.h hdr.h robhdr\_mwave\_process\_smos.sql  
robhdr\_mwave\_update\_smos.sql robbody\_mwave\_process\_smos.sql  
robbody\_mwave\_update\_smos.sql robbody\_smos\_sekf.sql update\_modstep.sql varno.h

#### *Files modified(IFS):*

common/yomdb\_defs.h yomdb\_vars.h module/pardimo.F90 yomvnmb.F90  
op\_obs/exheiz2p\_lidar.F90 hop.F90 hoptl.F90 hretr.F90 setup/suvnmb.F90

## **Tomas Kral - datk\_CY38R1\_cope\_for\_38r2 - BR**

### **COPE**

Technical improvements and fixes. Implementation of new classes for more efficient in-memory representation of database tables.

#### *Files created(COPE):*

cope/columns/RetrievalType.h columns/SurfaceTypeIndicator.h core/DataRow.h  
core/DataRowState.h core/FilterChain.cc core/FilterChain.h  
core/PreprocessingTask.cc core/PreprocessingTask.h core/Task.cc core/Task.h  
core/TaskFactory.cc core/TaskFactory.h core/TaskRunner.cc core/TaskRunner.h  
data/DataColumn.cc data/DataColumn.h data/DataIndex.cc data/DataIndex.h  
data/DataLink.cc data/DataLink.h data/DataLinkFiller.cc data/DataLinkFiller.h

data/DataLoader.cc data/DataLoader.h data/DataRow.cc data/DataRow.h  
 data/DataSet.cc data/DataSet.h data/DataSetBuilder.cc data/DataSetBuilder.h  
 data/DataSetFiller.cc data/DataSetFiller.h data/DataSetLinks.cc  
 data/DataSetLinks.h data/DataSetTables.cc data/DataSetTables.h data/DataTable.cc  
 data/DataTable.h data/DataTableColumns.cc data/DataTableColumns.h  
 data/DataTableFiller.cc data/DataTableFiller.h data/DataTableRange.cc  
 data/DataTableRange.h data/DataView.cc data/DataView.h  
 filters/AmericanProfilerVerticalCoordinateAssigner.cc  
 filters/AmericanProfilerVerticalCoordinateAssigner.h  
 filters/BufrMissingValueConverter.cc filters/FinalChecker.cc  
 filters/FinalObsErrorAssigner.cc filters/HeightToPressureConverter.cc  
 filters/InitialValidator.cc filters/PrescribedObsErrorAssigner.cc  
 filters/SatobInstrumentTypeAssigner.cc filters/SatobInstrumentTypeAssigner.h  
 filters/WindComponentsAssigner.cc filters/WindProfilerCodeTypeModifier.cc  
 filters/WindProfilerCodeTypeModifier.h meteo/AlduchovEskridge1996.cc  
 meteo/AlduchovEskridge1996.h meteo/Buck1981.cc meteo/Buck1981.h  
 meteo/RelativeHumidity.h meteo/RelativeHumidityError.h  
 meteo/SolarElevationAngle.cc meteo/SolarElevationAngle.h utils/ByteSwap.h  
 utils/MakeMap.h utils/MakeVector.h utils/MissingValueHandling.h utils/Settings.cc  
 utils/Settings.h

**Files created(SCRIPTS):**

gen/convert\_mondb  
 sms\_an/ec2o\_aeolus.sms ec2o\_airs.sms ec2o\_amsre.sms ec2o\_amsua.sms ec2o\_amsua\_allsky.sms  
 ec2o\_amsub.sms ec2o\_atms.sms ec2o\_bufr.sms ec2o\_conv.sms ec2o\_geos.sms ec2o\_gpsro.sms  
 ec2o\_hirs.sms ec2o\_iasi.sms ec2o\_iras.sms ec2o\_merge.sms ec2o\_meris.sms ec2o\_mhs.sms  
 ec2o\_msu.sms ec2o\_mwhs.sms ec2o\_mwri.sms ec2o\_mwts.sms ec2o\_nexrad.sms ec2o\_ralt.sms  
 ec2o\_resat.sms ec2o\_resatak.sms ec2o\_satob.sms ec2o\_scatt.sms ec2o\_smos.sms ec2o\_-  
 ssmi.sms ec2o\_ssmis.sms ec2o\_ssu.sms ec2o\_surf\_conv.sms ec2o\_tmi.sms ec2o\_vtpr1.sms  
 ec2o\_vtpr2.sms ec2o\_windsat.sms ecfs2odb.sms ecfs2odb\_lag.sms

**Files modified(COPE):**

cope/columns/BufrType.h columns/CodeType.h columns/DatumEvent1.h  
 columns/DatumEvent2.h columns/DatumRdbFlag.h columns/DatumStatus.h  
 columns/GeoArea.h columns/InstrumentType.h columns/Level.h columns/ObsGroup.h  
 columns/ObsType.h columns/PressureCode.h columns/ReportRdbFlag.h  
 columns/ReportStatus.h columns/Sensor.h columns/StationType.h columns/VarNo.h  
 columns/VerticalCoordinateType.h core/Report.cc core/Report.h  
 core/ReportFilter.h core/ReportFilterFactory.cc core/ReportFilterFactory.h  
 core/ReportIterator.cc core/ReportIterator.h core/ReportReader.cc  
 core/ReportReader.h core/ReportReaderIterator.cc core/ReportReaderIterator.h  
 core/ReportWriter.cc core/ReportWriter.h core/ReportWriterIterator.cc  
 core/ReportWriterIterator.h filters/AirepPreprocessor.cc  
 filters/AirepPreprocessor.h filters/AmericanWindProfilerPreprocessor.cc  
 filters/AmericanWindProfilerPreprocessor.h filters/BiasCorrector.cc  
 filters/BiasCorrector.h filters/BufrMissingValueConverter.h  
 filters/ConvPreprocessor.cc filters/ConvPreprocessor.h  
 filters/DateTimeValidator.cc filters/DateTimeValidator.h  
 filters/DopplerWindLidarPreprocessor.cc filters/DopplerWindLidarPreprocessor.h  
 filters/DribuPreprocessor.cc filters/DribuPreprocessor.h  
 filters/DribuVerticalCoordinateAssigner.cc  
 filters/DribuVerticalCoordinateAssigner.h filters/EuroProfilerPreprocessor.cc  
 filters/EuroProfilerPreprocessor.h  
 filters/EuroProfilerVerticalCoordinateAssigner.cc

filters/EuroProfilerVerticalCoordinateAssigner.h filters/FinalChecker.h  
 filters/FinalObsErrorAssigner.h filters/HeightToPressureConverter.h  
 filters/InitialValidator.h filters/InstrumentTypeAssigner.cc  
 filters/InstrumentTypeAssigner.h filters/LandSynopPreprocessor.cc  
 filters/LandSynopPreprocessor.h filters/LandSynopVerticalCoordinateAssigner.cc  
 filters/LandSynopVerticalCoordinateAssigner.h filters/LatLonValidator.cc  
 filters/LatLonValidator.h filters/MetarPreprocessor.cc  
 filters/MetarPreprocessor.h filters/MetarVerticalCoordinateAssigner.cc  
 filters/MetarVerticalCoordinateAssigner.h  
 filters/MultiLevelWindComponentsAssigner.cc  
 filters/MultiLevelWindComponentsAssigner.h filters/PrecipitationSplitter.cc  
 filters/PrecipitationSplitter.h filters/PrescribedObsErrorAssigner.h  
 filters/RelativeHumidityAssigner.cc filters/RelativeHumidityAssigner.h  
 filters/ShipPreprocessor.cc filters/ShipPreprocessor.h  
 filters/ShipVerticalCoordinateAssigner.cc  
 filters/ShipVerticalCoordinateAssigner.h filters/WindComponentsAssigner.h  
 filters/WindProfilerPreprocessor.cc filters/WindProfilerPreprocessor.h  
 filters/WindProfilerWindComponentsAssigner.cc  
 filters/WindProfilerWindComponentsAssigner.h meteo/ErrorStatistics.cc  
 meteo/ErrorStatistics.h meteo/IcaoStandardAtmosphere.cc  
 meteo/IcaoStandardAtmosphere.h meteo/constants.h table/BufrTypeTable.cc  
 table/BufrTypeTable.h table/CodeTable.h table/CodeTypeTable.cc  
 table/CodeTypeTable.h table/GeoAreaTable.cc table/GeoAreaTable.h  
 table/InstrumentTypeTable.cc table/InstrumentTypeTable.h table/ObsGroupTable.cc  
 table/ObsGroupTable.h table/ObsTypeTable.cc table/ObsTypeTable.h  
 table/PressureCodeTable.cc table/PressureCodeTable.h table/SensorTable.cc  
 table/SensorTable.h table/StationTypeTable.cc table/StationTypeTable.h  
 table/VarNoTable.cc table/VarNoTable.h table/VerticalCoordinateTypeTable.cc  
 table/VerticalCoordinateTypeTable.h utils/Accessors.cc utils/Accessors.h  
 utils/FunctionLookupTable.h utils/GeoArea.cc utils/GeoArea.h utils/GeoPoint.cc  
 utils/GeoPoint.h utils/InterpolatorTraits.h utils/LinearInterpolator.cc  
 utils/LinearInterpolator.h utils/LookupTable.h utils/LookupTableIterator.h  
 utils/NearestNeighbourInterpolator.cc utils/NearestNeighbourInterpolator.h  
 utils/Whitelist.cc utils/Whitelist.h  
 tools/cope.cc

***Files modified(IFS):***

control/cnt4.F90  
 module/sats\_mix.F90  
 obs\_preproc/readoba.F90 screen.F90  
 op\_obs/hsatang.F90 radlcmis.F90  
 phys\_ec/callpar.F90  
 sinvect/cun2.F90  
 var/jbtomodel.F90 subjwavallo.F90 taskob.F90

***Files modified(SCRIPTS):***

build/Makefile.root.cope Makefile.root.odbdummy findbin\_mk.ksh  
 perl/rec\_depend\_bin.pl  
 def/an.def  
 gen/archive\_obsgroup chemarch\_ml cleanodb convert\_obsgroup cycle\_times ens\_cal  
 fc\_sens\_save fetchobs gather\_endaodb gems\_setup get\_exe getini getmars ifsmin  
 ifstraj mkabs\_black mkabs\_odbtools mklinks model modeleps modeleps\_nemo modelsv  
 mondb\_allsky.sql mondb\_gbrad.sql mondb\_geos.sql mondb\_gpsro.sql mondb\_scatt.sql

obstat obstat\_init odb1odb2 odb2odb1 odbshuffle ofb\_airs.sql ofb\_allsky.sql  
ofb\_gbrad.sql ofb\_geos.sql ofb\_gpsro.sql ofb\_iasi.sql ofb\_scatt.sql ofb\_smos.sql  
p4\_mklib prep\_coupl04 prep\_initcond prereo3 run\_parallel  
oce/em\_create\_veps extrafields\_veps\_create model\_nemoIFS model\_oceatm storm  
sms/createfws.sms eda\_mean.sms logfiles.sms  
sms\_an/4dvar.sms archive\_obsgroup.sms convert\_obsgroup.sms cope\_obsgroup.sms  
gather\_endaodb.sms odb2odb1.sms

**Files deleted(COPE):**

cope/meteo/Layer.cc meteo/Layer.h meteo/StandardPressureLayers.cc  
meteo/StandardPressureLayers.h meteo/StandardPressureLevels.cc  
meteo/StandardPressureLevels.h table/ObsTypeCodeTypesTable.cc  
table/ObsTypeCodeTypesTable.h utils/utils.h

**Files deleted(SCRIPTS):**

build/arch/Makefile.in.c2a arch/Makefile.in.c2b arch/Makefile.in.ibm\_power7  
gen/add\_fcldiagnostic\_to\_sql.pl fetchmarsodb groupid=1.tables groupid=10.tables  
groupid=11.tables groupid=12.tables groupid=13.tables groupid=14.tables  
groupid=15.tables groupid=16.tables groupid=17.tables groupid=18.tables  
groupid=19.tables groupid=2.tables groupid=20.tables groupid=21.tables  
groupid=22.tables groupid=23.tables groupid=24.tables groupid=25.tables  
groupid=26.tables groupid=27.tables groupid=28.tables groupid=29.tables  
groupid=3.tables groupid=30.tables groupid=31.tables groupid=32.tables  
groupid=33.tables groupid=34.tables groupid=35.tables groupid=36.tables  
groupid=37.tables groupid=38.tables groupid=39.tables groupid=4.tables  
groupid=5.tables groupid=6.tables groupid=7.tables groupid=8.tables  
groupid=9.tables mondb\_airs.sql mondb\_iasi.sql  
sms/fc\_sens\_save\_ralt.sms  
sms\_an/fetchmarsodb.sms gather\_endaodb\_airs.sms gather\_endaodb\_amsre.sms  
gather\_endaodb\_amsua.sms gather\_endaodb\_amsua\_allsky.sms  
gather\_endaodb\_amsub.sms gather\_endaodb\_atms.sms gather\_endaodb\_conv.sms  
gather\_endaodb\_cris.sms gather\_endaodb\_geos.sms gather\_endaodb\_gpsro.sms  
gather\_endaodb\_hirs.sms gather\_endaodb\_iasi.sms gather\_endaodb\_iras.sms  
gather\_endaodb\_meris.sms gather\_endaodb\_mhs.sms gather\_endaodb\_msu.sms  
gather\_endaodb\_mwhs.sms gather\_endaodb\_mwri.sms gather\_endaodb\_mwts.sms  
gather\_endaodb\_nexrad.sms gather\_endaodb\_ralt.sms gather\_endaodb\_resat.sms  
gather\_endaodb\_resatak.sms gather\_endaodb\_satob.sms gather\_endaodb\_scatt.sms  
gather\_endaodb\_simulobs.sms gather\_endaodb\_smos.sms gather\_endaodb\_ssmi.sms  
gather\_endaodb\_ssmis.sms gather\_endaodb\_ssu.sms gather\_endaodb\_surf\_conv.sms  
gather\_endaodb\_tmi.sms gather\_endaodb\_vtpr1.sms gather\_endaodb\_vtpr2.sms  
gather\_endaodb\_windsat.sms odb2odb1\_aeolus.sms odb2odb1\_airs.sms  
odb2odb1\_amsre.sms odb2odb1\_amsua.sms odb2odb1\_amsua\_allsky.sms  
odb2odb1\_amsub.sms odb2odb1\_atms.sms odb2odb1\_geos.sms odb2odb1\_gpsro.sms  
odb2odb1\_hirs.sms odb2odb1\_iasi.sms odb2odb1\_iras.sms odb2odb1\_meris.sms  
odb2odb1\_mhs.sms odb2odb1\_msu.sms odb2odb1\_mwhs.sms odb2odb1\_mwri.sms  
odb2odb1\_mwts.sms odb2odb1\_nexrad.sms odb2odb1\_resat.sms odb2odb1\_resatak.sms  
odb2odb1\_satob.sms odb2odb1\_scatt.sms odb2odb1\_smos.sms odb2odb1\_ssmi.sms  
odb2odb1\_ssmis.sms odb2odb1\_ssu.sms odb2odb1\_surf\_conv.sms odb2odb1\_tmi.sms  
odb2odb1\_vtpr1.sms odb2odb1\_vtpr2.sms odb2odb1\_windsat.sms

# SCRIPTS

**Gabor Radnoti - dag\_CY38r1\_esuite**

**Gabor Radnoti - dag\_CY38r1\_diag**

## 4D-Var diagnostics

Bit-identical changes to generate diagnostic output file with some 4D-Var diagnostics (condition number, final cost function values).

*Files created(IFS):*

module/yomdiagvar.F90

*Files modified(IFS):*

control/cva2.F90 forecast\_error.F90 utility/prtjo.F90 var/congrad.F90 evcost.F90  
suvar.F90

# BUGFIXES

**Alan Geer - stg\_CY38R1\_condition\_number\_fix - Not-BR**

**Bug fix for condition number problems in the 38r1 esuite Expts:T511 foj0 (control), fp89 (test); T1279 0058(control), fp87(test)**

The 38r1 esuite had greater difficulty converging than previous cycles, evidenced by larger condition numbers and the need for more iterations. The problem involved the all-sky microwave imager assimilation, where rare individual observations were exhibiting extremely large tangent linear (TL) sensitivities and hence getting enormous weight in the incremental costfunction. This was a bug and was the unintended consequence of merging two separate technical cleaning branches. The bug caused the wrong moist physics trajectory to be used in the all-sky observation operator. Because the moist physics trajectory is not stored, but instead regenerated on-the-fly from the clear-sky trajectory, there are a number of different physics ‘trajectories’ in use in different parts of the code:

1. the high resolution full-physics trajectory;
2. the low resolution full-physics trajectory;
3. the low resolution simplified physics trajectory.

The all-sky operator is supposed to work with 3. but was getting 2. by mistake. Further information can be found in an internal memo which will be issued shortly (July 2012).

*Files modified(IFS):*

control/cnt4.F90 cnt4tl.F90 gp\_model\_tl.F90 scan2m.F90 scan2mtl.F90  
phys\_ec/callpart1.F90 ec\_phys\_drv\_tl.F90 ec\_phys\_tl.F90  
setup/sudefo\_gflattr.F90

## **Tomas Wilhelmsson - nat\_CY38R1\_fix\_half\_step**

### **Fix so that ifsmin can run at half-timestep**

*Files modified(IFS):*

control/gp\_model\_ad.F90 gp\_model\_t1.F90 scan2m.F90

## **Nils Wedi - naw\_CY38R1\_NH - BR**

### **Bugfixes to NH with LPC\_FULL + LGRADSP and some optimizations**

**Expts: T511 forecast fox2 (control), foxc (test)**

- Bugfix with LPC\_FULL + LGRADSP (special treatment in gptf1.F90)
- potential OMP optimization in spcm.F90
- increased lengths in print statements (sump,slcset)
- idealized mountain setup default amplitude reduced (suspecg2.F90)
- fast transform bugfix found by George (only for  $\zeta = 2047$ )
- transform new optional switch LDSPSETUPONLY=.T. for the lightweight use of the transform package if only the spectral parallel distribution setup is required but not for example the Legendre polynomials or else.

*Files modified(IFS):*

adiab/cpg2lag.F90 cpg2lagt1.F90 cpglag.F90 cpglagad.F90 cpglagt1.F90 gptf1.F90  
control/spcm.F90  
parallel/slcset.F90  
setup/sump.F90 suspecg2.F90

*Files modified(TRANS):*

external/setup\_trans.F90  
interface/setup\_trans.h  
module/suleg\_mod.F90

## **Simon Lang - nesl\_CY38R1\_fix\_svsp2gp - BR**

### **Bug-Fix for svsp2gp**

**Expts: fp1c (control), fp1b (test)**

Set correct grid parameters for the output gaussian grid in svsp2gp. Fixes problem with singular vector resolution greater than T42.

*Files modified(PREPDATA):*

mc\_tools/svsp2gp.F90

## **Tomas Wilhelmsson - nat\_CY38R1\_rttov\_dealloc - BR**

### **Bug fix to RTTOV**

Bug fix to deallocation of traj

*Files created(SATRAD):*

interface/rttov\_ec\_alloc\_ad.h rttov\_ec\_alloc\_tl.h

*Files modified(IFS):*

op\_obs/radtr.F90 radtr\_ml.F90 radtr\_ml\_ad.F90 radtr\_ml\_tl.F90 radtrad.F90 radtrtl.F90

*Files modified(SATRAD):*

interface/rttov\_ec\_alloc.h  
programs/calc\_radiance\_fields.F90 gensatim.F90  
rttov/main/rttov\_check\_traj.F90

## **POWER7**

### **Deborah Salmond - das\_CY38R1\_NEW - BR**

#### **Migration to P7**

- Remove MPI from OpenMP loops
- Change HOT to HOT(NOVECTOR) to stop compiler from using vmass
- Safety Fix in SSA
- Remove Dr.Hook from uniform\_distribution

*Files modified(IFS):*

obs\_preproc/screen.F90 var/sujbwavallo.F90 op\_obs/mpobseql.F90

*Files modified(ALGOR):*

module/random\_numbers\_mix.F90

*Files modified(SSA):*

sub/conservint.F90

### **Mats Hamrud - nar\_CY38R1\_zero\_length\_rec\_buf - BR**

#### **Remove zero-length buffers for MPI\_RECV**

*Files modified(IFSAUX):*

module/mpi\_recv\_mod.F90



## **John Hague and Will Weir - ibj\_CY38R1\_P7bind - BR**

### **To bind on P7 - if required**

Routines are used by calling JFH\_BIND() in the program with

```
export JFH_BIND=map (as before)
export JFH_BMAP= (as before)
export JFH_RA_DET to detach resource association set by LL
export JFH_RA_PRT for print out of EC_det_ra effectiveness
```

in the run script

As before "grep CPUs" in stderr to see CPU usage

-DRS6K must be set for compilation

*Files modified(IFSAUX):*

support/EC\_check\_ra.c EC\_det\_ra.c jfh\_bind.F90 jfhc.c

## **John Hague - ibj\_CY38R1\_HPM\_P7 - BR**

### **HPM for P7**

Enable drhook to print MFLOPS correctly on the P7. It will still work correctly on P6. See rdx/HPM to get Mflops without Dr.Hook

*Files modified(IFSAUX):*

support/drhook.c

## **TECHNICAL, CLEANING and OOPS**

### **George Mozdzynski - mpm\_CY38R1\_inifger - BR**

#### **Fix to Inifger**

Fix to INIFGER to resolve a Floating Point Exception that occurred in SUHIFCE when using libs built with arrays initialised to NANS. The resolution was simply to initialise the offending array to 0.

*Files modified(IFS):*

obs\_preproc/inifger.F90

### **George Mozdzynski - mpm\_CY38R1\_wconst - BR**

#### **Optimise wconst**

**Expts: T1279 fc fnye (control), foug(test)**

This branch uses OpenMP to reduce the wall clock time for wconst (fc<sub>i</sub>make<sub>i</sub>const<sub>i</sub>wconst). This is particularly important when debugging or subscript checking where wconst can take over one hour to complete.

Timing (total elapsed time for job) using differing numbers of threads for a T159 model using noopt\_NANS\_C built libraries is as follows,

38R1 control (1 thread)	4535 secs (run1),	4893 secs (run2)
with this branch and 16 threads	574 secs (run1),	694 secs (run2)
32 threads	345 secs	
64 threads	288 secs	

It was decided to make the default 16 threads, noting that wconst runs in a shared parallel node. Of course users can increase the number of threads (by setting sms variable THREADS via xcdp) for wconst to get a reduced wall time (if needed).

## George Mozdzynski - mpm\_CY38R1\_allopts - BR

### Optimise wam message passing

**Expts: T1279 fc fnye (control), fo8k (test)**

This branch improves the message passing in the wave model when it is run on a large number of tasks (tested up to 50,000 cores on HECTOR) using 8 threads per tasks. This is a technical branch and produces bit identical results to a 38R1 control. At 50,000 cores the reduction in total IFS wall clock time has been measured at 20 percent with this branch.

Changes are to use both non-blocking recvs and sends in mpexchng.F and a MPI\_gatherv collective in ifs-towam.F.

*Files modified(IFS):*

utility/gstats\_label\_ifs.F90

*Files modified(WAM):*

Wam\_oper/ifstowam.F initialint.F mpexchng.F

## George Mozdzynski - mpm\_CY38R1\_slclean - BR

### Step towards externalisation of SL interpolation

**Expts: T1279 fc fnye (control), fou5 (test)**

*Files modified(IFS):*

adiab/call\_sl.F90 call\_sl\_ad.F90 call\_sl\_tl.F90 ladine.F90 ladinead.F90  
ladinetl.F90 lainor2.F90 lainor2ad.F90 lainor2tl.F90 lapinea.F90 lapinea5.F90  
lapineaad.F90 lapineatl.F90 lapineb.F90 lapinebad.F90 lapinebtl.F90 larcin2.F90  
larcin2ad.F90 larcin2tl.F90 larcina.F90 larcinaad.F90 larcinatl.F90 larcinha.F90  
larmes.F90 larmes2.F90 larmes25.F90 larmes2ad.F90 larmes2tl.F90 larmes5.F90  
larmesad.F90 larmestl.F90 lascaw.F90 lascaw\_cla.F90 lascaw\_cla\_ad.F90  
lascaw\_cla\_tl.F90 lascawad.F90 lascawtl.F90 rdscaw.F90

ald\_inc/interface/elascaw.intfb.h interface/elascawad.intfb.h  
interface/elascawtl.intfb.h interface/eslextpol.intfb.h  
control/gp\_model.F90 scan2m.F90  
fullpos/cpclimi.F90 fpmodprec.F90 sufppwide.F90  
module/eint\_mod.F90  
obs\_preproc/mkglobstab.F90  
oops/geometry\_mod.F90  
op\_obs/cobsall.F90 cobsallad.F90 cobsalltl.F90 slint.F90 slintad.F90 slinttl.F90  
parallel/slcset.F90 slextpol.F90 slextpolad.F90 slrset.F90  
phys\_ec/ec\_physg.F90 radintg.F90  
phys\_radi/suecrad.F90  
setup/sucoaphy.F90 suecphypo.F90 susc2b.F90

## **Mike Fisher - dai\_CY38R1\_hopjb - BR**

### **Disentangle HOP, HOPTL and HOPAD from Jb**

These routines were using a Jb variable to decide which aerosol observation operator to call. I introduced a switch in YOMOBS/NAMOBS for this.

#### *Files modified(IFS):*

module/yomobs.F90  
namelist/namobs.h  
obs\_preproc/defrun.F90  
op\_obs/hop.F90 hopad.F90 hoptl.F90

## **Mike Fisher - dai\_CY38R1\_ripskf - BR**

### **Remove the Simplified Kalman Filter code**

#### *Files modified(IFS):*

control/cnt4ad.F90 cnt4tl.F90 cval.F90  
dia/grib\_code\_message.F90 pregrbenc.F90 wrmlppg.F90 wroutspgb.F90  
fullpos/wrmlfp.F90  
module/yomjg.F90 yomoph.F90  
setup/su0yomb.F90 suoph.F90  
sinvect/cun3.F90 opk.F90 suforce.F90  
utility/deallo.F90  
var/cvar2.F90 cvar2ad.F90 cvar2in.F90 cvar2inad.F90 readvec.F90

#### *Files deleted(IFS):*

module/yomskf.F90  
namelist/namskf.h  
var/rokfcovar.F90 suskf.F90

## **Deborah Salmond - das\_CY38R1\_RIPI - BR**

### **Cleaning: replacement of RIPI0-2 by RIPI**

#### *Files modified(IFS):*

adiab/rdscaw.F90  
module/yom\_phys\_grid.F90 yomleg.F90 yomprad.F90  
phys\_ec/radintg.F90  
phys\_radi/suecrad.F90  
setup/suecphypo.F90 susc2b.F90  
utility/deallo.F90

## **Deborah Salmond and Oliver Treiber - das\_CY38R1\_MPL\_END - BR**

### **Remove automatic calls to MPL\_INIT and EC\_MPI\_ATEXIT**

This can cause jobs to hang.

#### *Files modified(IFSAUX):*

module/mpi\_init\_mod.F90

#### *Files modified(OBSTAT):*

src/obstat.F90

#### *Files modified(ODB):*

tools/Bufr2odb.F90 Create\_odb.F90 Odb2\_to\_Odb1\_ralt.F90 Odbtools.F90

#### *Files modified(WAM):*

Alt/urapre.F  
Wam\_oper/intwaminput.F rfl4wam.F90

## **Tomas Wilhelmsson - nat\_CY38R1\_cpg\_split - BR**

### **Remove LCPG\_SPLIT option**

#### *Files created(IFS):*

adiab/cpg\_drv.F90 cpg\_drv\_ad.F90 cpg\_drv\_tl.F90

#### *Files modified(IFS):*

adiab/cpg.F90 cpg\_gp.F90 cpgad.F90 cpgtl.F90  
control/gp\_model.F90 gp\_model\_ad.F90 gp\_model\_tl.F90  
namelist/nampar1.h  
phys\_dmn/mf\_phys\_prep.F90  
setup/sump0.F90  
utility/gstats\_label\_ifs.F90

#### *Files deleted(IFS):*

module/yomcpg.F90

## **Tomas Wilhelmsson - nat\_CY38R1\_remove\_nmi - BR**

### **Remove NMI option**

#### *Files modified(IFS):*

adiab/call\_sl.F90 cpg.F90 cpg5\_gp.F90 cpg\_dia.F90 cpg\_dyn.F90 cpg\_dyn\_ad.F90  
cpg\_dyn\_tl.F90 cpg\_end.F90 cpg\_gp.F90 cpg\_gp\_ad.F90 cpg\_gp\_tl.F90  
cpg\_zero\_ad.F90 cpgad.F90 cpglag.F90 cpgtl.F90 gp\_spv.F90 gp\_spvad.F90  
gp\_spvtl.F90 gpendtr.F90 postphy.F90  
control/cnt3.F90 cnt3ad.F90 cnt3tl.F90 cnt4.F90 gp\_model.F90 gp\_model\_ad.F90  
gp\_model\_tl.F90 scan2m.F90 stepo.F90  
dfi/sudfi.F90 suini.F90  
dia/supupdate.F90  
module/trajectory\_mod.F90 yomdim.F90 yomini.F90 yommp.F90 yomspt7.F90 yomtag.F90  
yomvar.F90  
namelist/namdim.h namini.h namvar.h  
oops/ifs\_constants.F90  
phys\_dmn/mf\_phys.F90  
phys\_ec/ec\_phys.F90 ec\_phys\_ad.F90 ec\_phys\_drv\_ad.F90 ec\_phys\_drv\_tl.F90  
ec\_phys\_tl.F90  
setup/su0phy.F90 su0yoma.F90 su0yomb.F90 suallo.F90 sualmp1.F90 sualmp2.F90  
suctrl\_gflattr.F90 sudim1.F90 sudim2.F90 sudyn.F90 sugem1a.F90 sump.F90  
susc2b.F90 susi.F90  
sinvect/suforce.F90 sulcz.F90  
utility/deallo.F90 dealsc2.F90 freemem.F90 updtim.F90  
var/cosjc.F90 evcost.F90 getmini.F90 savmini.F90 suallt7.F90 sujb.F90 suvar.F90 tlprop.F90  
upspec.F90

#### *Files modified(SCMEC):*

source/sudim1c.F90

#### *Files modified(SCRIPTS):*

eps/ifsnam.eps\_sv.h  
gen/ifsmin ifstraj mkidta mknam\_fp model modeleps modeleps\_nemo modelsv sekf\_sm  
sens/J1.sms J7.sms J9.sms

#### *Files modified(SURF):*

offline/setup/su0phy.F90

#### *Files deleted(IFS):*

control/cnmi.F90 cnmiad.F90 cnmitl.F90  
module/yomhoub.F90 yomnmi.F90 yomsphb.F90 yomsptt.F90  
namelist/namnmi.h  
nmi/dealltt.F90 fltmode.F90 fltmodead.F90 houspe3.F90 houspe3ad.F90 mo3dprj.F90  
mo3dprjad.F90 moprj.F90 moprjad.F90 moprjm.F90 moprjmad.F90 multf.F90  
multfad.F90 mvtend.F90 mvtendad.F90 nnmi2.F90 nnmi2ad.F90 nnmi2tl.F90 nnmi3.F90  
nnmi3ad.F90 nnmi3tl.F90 rdpinmi.F90 reord.F90 reordad.F90 reordo3.F90  
reordo3ad.F90 scinim.F90 scnorn.F90 spehou3.F90 spehou3ad.F90 speimp.F90  
speimpad.F90 sualltt.F90 sumode3.F90 sumode3e.F90 sumode3i.F90 sumode3l.F90  
sunmi.F90 vmodeenergy.F90 vtran.F90 vtranad.F90  
parallel/gatherfreq.F90 gatherjcvvert.F90 trmtov.F90 trvtoh.F90

```
utility/dealnmi.F90
var/nmicost.F90 nmijc.F90 nmijctl.F90
```

*Files deleted(SURF):*

```
offline/namelist/namdim.h
```

## **Deborah Salmond, Mike Fisher, Yannick Tremelet and Tomas Wilhelmsson - das\_CY38R1 - OOPS - BR**

### **Modifications for OOPS 3D-Var**

This branch contains the set of modifications that were needed to get OOPS-3DVar to run. Including:

#### **Code cleaning and memory-leak fixes**

The setup for Jb was being performed very early on in SUOYOMA in order to ensure that the array SIBI was allocated before it was filled (during the dynamics setup.) SIBI has been moved out of the Jb structure. This has allowed the Jb setup to be moved into SUOYOMB, and for it to be called only for configurations that require a background term.

DEALGES has been removed. The deallocates for Jb structures have been moved into module subroutines in the relevant modules, with separate deallocate routines for each structure. Keeping the deallocates close to the structure definitions will make it easier to ensure that all elements of a structure are deallocated.

The following construction was repeated over 350 times:

```
IF (ASSOCIATED(<pointer>)) DEALLOCATE (<pointer>)
```

Since this is common code, a new subroutine (DEALLOCATE\_IF\_ASSOCIATED) has been introduced, and most of the occurrences of the above construction have been replaced by:

```
CALL DEALLOCATE_IF_ASSOCIATED (<pointer>)
```

When calling IFS from OOPS, it is important to ensure that temporary arrays are deallocated on return to the OOPS layer, and that memory is deallocated when an object is destructed. A number of memory leaks of this sort have been fixed

*Files created(IFS):*

```
module/yomjbsibi_mod.F90
var/suanebuf.F90
```

*Files created(IFSAUX):*

```
module/deallocate_if_associated_mod.F90
```

*Files modified(ALGOR):*

```
module/spectral_fields_mod.F90
```

*Files modified(IFS):*

```
dia/preset_grib_template.F90 wrmlppg.F90
module/eint_mod.F90 gmv_subs_mod.F90 goms_mix.F90 gridpoint_fields_mix.F90
iostream_mix.F90 reglatlon_field_mix.F90 spectral_columns_mix.F90
```

surface\_fields\_mix.F90 type\_fprqdyns.F90 type\_fprqphys.F90 yemwavelet.F90  
 yomgc.F90 yomgem.F90 yomgfl.F90 yomgmv.F90 yomjbchvar.F90 yomjg.F90 yomleg.F90  
 yomskf.F90 yomsp.F90 yomwavelet.F90 yomwfpb.F90  
 oops/allobs\_mod.F90 error\_covariance\_3d\_mod.F90 fields\_io\_mod.F90 fields\_mod.F90  
 geometry\_mod.F90 gom\_setup.F90 obsvec\_mod.F90  
 op\_obs/hop.F90 hopad.F90 hopt1.F90  
 parallel/slcset.F90  
 setup/su0yoma.F90 su0yomb.F90 sualdyn.F90 suarg.F90 sudyn.F90 sunhsi.F90  
 susc2b.F90 susi.F90  
 utility/dealctv.F90 deallo.F90 dealmod.F90 dealspa.F90 dealxmo.F90 dotprod2.F90  
 dotprod3.F90 freemem.F90  
 var/deallt.F90 suinfce.F90 subj.F90 subjwavallo.F90 subjwavtrans.F90

*Files deleted(IFS):*

utility/dealges.F90

## Glenn Carver - nagc\_CY38R1\_extclean - BR

### Removal of redundant external/intrinsic statements

Redundant external/intrinsic statements removed from algor code. Means OpenIFS stripdown can assume external statements in IFS only declare subroutines passed as arguments.

*Files modified(ALGOR):*

external/lanczos/landr.F  
 internal/lanczos/angles.F lanczos/datx.F lanczos/i2x.F lanczos/lanso.F lanczos/machar.F  
 lanczos/ortbnd.F lanczos/prangl.F lanczos/prrule.F lanczos/purge.F lanczos/pythag.F  
 lanczos/random.F lanczos/ritvec.F lanczos/startv.F lanczos/stpone.F lanczos/tql2.F  
 lanczos/tqlb.F

## Karim Yessad - das\_CY38R1\_karim - BR

### Cleaning, step towards externalisation of interpolation and OOPS set-up modifications

- Split SUGEM1A into SUGEM\_NAML and SUGEM1A; call SUTRANS between SUGEM\_NAML and SUGEM1A; SUGEM\_NAML reads NAMGEM and computes NLOENG; SUGEM1A computes NMENG and NDGLU; call to SUGAWA has been removed. Gaussian weights and latitudes are now computed once (and not twice) via the transform package setup.
- SUFPG1 and GRID\_FROM\_GRIB: a new interface to "trans" version of SUGAW has been coded, and is called in these two routines; obsolescent calls to SUGAWA have been provisionally kept for the time being.
- YOMCVER variables have been spread among several modules:
  - RINTE,RDERI,RDERB,RDDERI have been moved in a new module YOMVERTFE.
  - RVSPTRI, RVSPC, RFAA to RFDD have been moved in EINT\_MOD; RFAA to RFDD have been replaced by RFVV.

- LSVTSM and RPRES\_SVTSM have been moved in YOMDYN.
  - LVSPLIP has been moved from YOMCVER/SUCTO to YOMDYNA/SUDYNA.
  - LVERTFE and NVSCH remain in YOMCVER but they go now in NAMCVER/SUCVER instead of NAMCT0/SUCT0.
  - LRNHC1 and LVFE... keys remain in YOMCVER but they go now in NAMCVER/SUCVER instead of NAMDYN/SUDYN.
  - NAMCVER and SUCVER are encapsulated in YOMCVER; SUCVER is called by SUDYNA.
- YOMGEM: Type TVSLETA and variable YRVSLETA have been moved in EINT\_MOD.
  - YOMLEG: - RIPI,RSLD,RSLDW,R3DTW have been moved in EINT\_MOD. - removal of RIPI0,RIPI1,RIPI2,RSLD1,RS...
  - LAPRXP has been moved from YOMCT0/NAMCT0/SUCT0 to YOMDYNA/NAMDYNA/SUDYNA.
  - NDLNPR,RHYDR0,NITPRHS,RC\_PD1 have been moved from YOMDYN/NAMDYNA/SUDYN to YOMDYNA/NAMDYNA/SUDYNA.
  - RCORPDF and RCORPDH have been moved from YOMDYN to YOMSTADLR.
  - Minor modifications have been done in routines called under SUSTADLR -> SUSTA\_CONV\_PRHS to replace call to GPRCP by use of dry air constant R\_d (standard atmosphere is a dry one).
  - use of NULOUT in externalisable interpolator routines: use YOMLUN\_IFSAUX instead of YOMLUN.
  - use of RA, RPI in externalisable interpolator routines: use YOMCST\_IFSAUX instead of YOMCST.
  - additionally (for the latest versions of lascaw..): remove KWIS=102, more concise rewriting of KWIS=103 to 105.
  - LASCAW + TL and AD Remove condition on NCURRENT\_ITER to activate SLHD: SLHD is now done at both predictor and corrector steps (recommendations of Filip Vana), remove useless KWIS=102, rewrite KWIS=103,104,105 in order to avoid code duplication.
  - Split SUHDF into EC and MF versions

*Files created(IFS):*

module/yomvertfe.F90  
 setup/sugem\_naml.F90 suhdf\_ec.F90

*Files created(TRANS):*

external/sugawc.F90  
 interface/sugawc.h

*Files modified(IFS):*

adiab/cpeuldyn.F90 gnh\_conv\_nhvar.F90 gnh\_conv\_prhs.F90 gnh\_tndlagadiab\_spd.F90  
 gnhdlra.F90 gnhpre.F90 gnhpreh.F90 gpgrxyb.F90 gpgrxybad.F90 gpgrxybtl.F90  
 gppread.F90 gppref.F90 gpprefad.F90 gppreftl.F90 gppretl.F90 gpxyb.F90  
 gpxybad.F90 gpxybtl.F90 laitvspcqm.F90 larcin2.F90 larcin2ad.F90 larcin2tl.F90  
 larcina.F90 larcinaad.F90 larcinatl.F90 larcinha.F90 larmes.F90 lascaw.F90  
 lascawad.F90 lascawtl.F90 lavent.F90 spnhsi.F90  
 fullpos/sufpg1.F90 vpos.F90



module/eint\_mod.F90 intdyn\_mod.F90 yomct0.F90 yomcver.F90 yomdyn.F90 yomdyna.F90  
yomgem.F90 yomleg.F90 yomstadlr.F90  
namelist/namct0.h namdyn.h namdyna.h  
op\_obs/slnt.F90 slntad.F90 slnttl.F90  
parallel/slcomm.F90 slcomm2.F90 slcomm2a.F90 slcset.F90 slextpol.F90 slrset.F90  
phys\_ec/radintg.F90  
setup/su0yomb.F90 suallo.F90 suct0.F90 suctrl\_gflatr.F90 sudim2.F90 sudyn.F90  
sudyna.F90 sugem1a.F90 suhdf.F90 sumpini.F90 sunh\_vertfeld.F90  
sunh\_vertfeldd.F90 sunh\_vertfe3d.F90 sunh\_vertfe3dbc.F90 sunh\_vertfe3dd.F90  
sunhsi.F90 susc2b.F90 suslb.F90 susta\_conv\_prhs.F90 sustadlr.F90 suvert.F90  
suvertdlr.F90 suvertfe.F90 suvertfel.F90 suvertfe3.F90 suvertfe3d.F90  
suvslip.F90  
utility/deallo.F90 grid\_from\_grib.F90 verdder.F90 verder.F90 verint.F90 verintad.F90  
vspltrans.F90  
*Files modified(TRANS):*  
external/trans\_inq.F90  
interface/trans\_inq.h