RESEARCH DEPARTMENT MEMORANDUM

To:	RD Scientific Staff and Consultants	
Copy:	DR, DO, HMD, HMAS, HMOS, John Hodkinson, François Bouttier, Claude Fischer, Ryad El Khatib, Karim Yessad, John Hague	
From:	Deborah Salmond et al.	
Date:	January 26, 2012	File: R48.3/DS/11165
Subject:	**IFS Memorandum Cycle CY38R1**	

Cycle 38r1 was created in December 2011-January 2012. Active contributions have been marked **ACTIVE**.

A new project *cope* has been included. Also *chem* and *nemo* have been included in *ifs*.

38r1 libraries on the IBM Power 6 are now made with xlf_13.1.0.4

Contributors:

Agathe Untch, Alan Geer, Angela Benedetti, Anne Fouilloux, Antje Inness, Ben Ruston, Bill Bell, Cristina Lupu, Deborah Salmond, Elias Holm, Enza Di Tomaso, Frederic Vitart, Gabor Radnoti, George Mozdzynski, Giovanna De Chiara, Hans Hersbach, Jean-Jacques Morcrette, Jean Bidlot, John Hague, Johannes Flemming, Kirsti Salonen, Kristian Mogensen, Luke Jones, Maike Ahlgrimm, Marco Matricardi, Martin Leutbecher, Massimo Bonavita, Mats Hamrud, Michael Rennie, Mike Fisher, Mohamed Dahoui, Niels Bormann, Nils Wedi, Patricia de Rosnay, Peter Towers, Pirkka Ollinaho, Qifeng Lu, Reima Eresmaa, Richard Engelen, Richard Forbes, Rosanna Dragani, Saleh Abdalla, Tim Stockdale, Tomas Kral, Tomas Wilhelmsson, Tony McNally, Yannick Trémolet

NUMERICAL ASPECTS

Agathe Untch - nau_CY38_L137

Modifications for 137-level model

Expts: fm2n test against fm2n control

Adjustment of sponge-layer horizontal diffusion and setup of neuroflux longwave radiation for the 137-level model.

Files modified(IFS):
`phys_radi/sulwneur.F90`
`setup/suhdf.F90`

Nils Wedi - naw_CY37R3_dealias - ACTIVE

Removal of aliasing noise and revised horizontal diffusion, introduction of NL diffusion (passive), and some cleaning

Expts: T511L91 analysis: (fkp0, fkcn), (fldf, fldk) T159L91 climate: fkqy , T1279 forecast only: fkph

The de-aliasing of the pressure gradient term is activated by the switch LGRADSP=T (and active by default for LSLAG=T and LECMWF=T). At every time-step the difference between a filtered and the unfiltered pressure gradient term is subtracted (but only the rotational component is filtered). This requires extra transforms at a cost of 5% increase at T1279. The filter effectively controls the accumulation of energy/enstrophy at the smallest resolved scales. The idea of the filter comes from the fact that on the linear grid, quadratic terms give rise to aliasing where the waves beyond 2/3 of the spectrum are aliased. This aliasing appears almost exclusively in the vorticity (which conveniently does not play a role in the semi-implicit system and does not effect divergence). The adiabatic tendencies entering the physics are notably less noisy, and so are the physical tendencies while the kinetic energy spectra are improved at all resolutions.

- As a result the time-scale of horizontal diffusion (outside the sponge and not in ifstraj/ifsmin) is relaxed for all resolutions and expressed as a function of the time-step with a default value of 6*TSTEP (LHDIFFM=T, NDIFFACT=6)
- The de-aliasing is applied also in the TL/AD of the dynamics and as a result the special filtering (diffusion) of the high resolution trajectories in the data assimilation ($>= 255$) is removed.
- Time is saved by removing the obsolete transform of vorticity (NCONF=1, LNHDYN=F). The meaning of LVOR has been changed to be independent of any requirements in the post-processing.
- As a result of the improved spectra the special filtering (diffusion) between legA and legB of the VarEPS has been removed.
- For future testing the switch LGPSTRESS (=F by default) has been introduced. It enables non-linear diffusion as an alternative to the existing hyper-viscosity or LSHD, but is not active by default.

In addition, the branch contains a memory saving for the inidata task (mknam_fp) and a small bugfix (traj_main_mod.F90).

Files created(IFS):

adiab/gpstress.F90 spfilt.F90

module/yomdyndiff.F90 yomspflt.F90

Files modified(IFS):

adiab/cpg.F90 cpg5_gp.F90 cpg_gp.F90 cpg_gp_ad.F90 cpg_gp_tl.F90 cpg_gpb_nhgeogw.F90 cpglag.F90 gpgrp.F90

control/cnt4.F90 gp_model.F90 gp_model_tl.F90 scan2mad.F90 spcm.F90 spcmad.F90

module/gmv_subs_mod.F90 traj_main_mod.F90 type_gmvs.F90 yomdyna.F90 yomvareps.F90

namelist/namdyn.h namdyna.h namvareps.h

pp_obs/pos.F90

setup/sudim1.F90 sudyn.F90 sudyna.F90 suhdf.F90 suvareps.F90

transform/transdir_mdl.F90 transdir_mdlad.F90 transinv_mdl.F90 transinv_mdlad.F90 transinvh.F90 transinvhad.F90

utility/dealspa.F90 sualspa.F90

Files modified(SCRIPTS):

gen/ifsmin ifstraj lowres_fp mknam_fp model modeleps modeleps_nemo modelsv sekf_sm

Files deleted(IFS):

setup/suhdfvareps.F90

Nils Wedi, Mats Hamrud and George Mozdzynski - naw_CY37R3_fast_leg

Fast Legendre transform

Expts: T511L91 forecasts: fm8i, fm9q

This modification introduces a fast Legendre transform based on the algorithms by Tygert (2008, 2010), and in particular the butterfly algorithm (butterfly_alg_mod.F90). This variant of the direct/inverse spectral transform is applied by default for resolutions > 1279, thus does not effect operations but any higher resolution simulations. In addition the use of mxmaop is replaced by a direct call to dgemm to streamline the transform code. The necessary pre-computations are in suleg_mod.F90 which includes the use of an alternative stable computation of the associated Legendre polynomials (supolf_mod.F90). New switches have been introduced in namelist namtrans.h to independently activate the fast transforms (LUSEFLT=T) and to control the pre-computations (LUSERPNM,LKEEPRPNM). The adjoint has been adjusted accordingly and tested.

Files created(ALGOR):

module/butterfly_alg_mod.F90 interpol_decomp_mod.F90

Files created(TRANS): supolf_mod.F90 tpm_flt.F90 tpm_pol.F90

Files modified(IFS):

module/yomtrans.F90

namelist/namtrans.h

setup/sutrans.F90

Files modified(SCRIPTS):

build/Makefile.root.trans

def/gen.def
gen/mkabs_prepdata

Files modified(TRANS):
external/setup_trans.F90 trans_end.F90 trans_inq.F90
interface/setup_trans.h
module/cpledn_mod.F90 gawl_mod.F90 ledir_mod.F90 ledirad_mod.F90 leinv_mod.F90 leinvad_mod.F90 ltdir_mod.F90 ltdirad_mod.F90 ltinv_mod.F90 ltinvad_mod.F90 set_resol_mod.F90 sugaw_mod.F90 suleg_mod.F90 sump_trans_preleg_mod.F90 supol_mod.F90 sutrle_mod.F90 tpm_distr.F90

PHYSICS

Merged branch - pas_CY37R3_esuite_for38r1_physics_v2

Contribution from Phsical Aspects Section

Expts: T511 analysis flt7 and flxg, T159 climate flro

Testing shows positive impacts in the tropical lower tropospheric temperature and winds, upper level geopotential height rms (particularly at 100hPa) and upper level relative humidity rms.

See http://datasvc.ecmwf.int/twiki/bin/view/Main/NewVerPB

for scorecards. flt7 (winter) and flxg (summer) are T511 analysis experiments with this branch. One year climate runs show good improvement to bias and rms for most fields, particularly tropospheric temperature, TOA radiation, clouds, precipitation and winds. Monthly forecasts show neutral to slightly positive impact on MJO skill.

Marta Janiskova - pan_CY37R3_surf_exch_TLAD - ACTIVE

Modifications for the linearized physics

Expts

- Introduction of perturbations for surface exchange coefficients used in the linearized, i.e. tangent-linear (TL) and adjoint (AD), physical parametrization
- Modified regularization for surface exchange coefficients
- Introduction security protection for leaf area index (LAI) in the linearized physics as done in the nonlinear one

Files modified(SURF):
surf/module/vexcsstl_mod.F90 vexcssad_mod.F90 vsurfstl_mod.F90 vsurfsad_mod.F90

Files modified(SCRIPTS):
sripts/gen/ifsmin

Peter Bechtold - pae_CY37R3_CONVIndex - ACTIVE

Convective downdraught changes + extra diagnostics

Expts: T511 assimilation: test=fl2t control=fkvq, climate run: fku3

Active Modifications:

- Increased downdraught entrainment to 3.e-4, and reduction from 0.35 to 0.3 of updraught mass fraction converted to downdraught, leading to reduction in tropical 1000-700 hPa cold biases and surface wind biases, and reduction in SW bias of 0.7 W/m2. Slight positive effect on extratropical scores for summer and slightly negative for winter.
- Switch off Rayleigh friction (reset LRFRIC to false) when number of vertical levels is exactly 137 and non-orographic gravity wave scheme active (LEGWWMS=true)
- Added 3 convective Indices as diagnostic variables as required by Member States: CIN(Grib=228001), TOTALX(260123), and KX(260121)
- Climplot: added T,U logarithmic plots, added rms error for Z500, added offline zonal fluxes

Passive Modifications:

- Coupling of convection to Cellular Automaton and preparation for possible operational implementation
- Preparation of namelists and modules for Parameter estimation project

Files created(SCRIPTS):

```
metview/eddy_corr.met plot_eddy_corr.met
```

Files modified(IFS):

```
adiab/cpedia.F90 postphy.F90
fullpos/hpos.F90 wrmlfp.F90 wrmlfpl.F90
module/parfpos.F90 surface_fields_mix.F90 yoe_cuconvca.F90 yoecumf.F90
yom_grib_codes.F90 yomafn.F90 yommwave.F90
mwave/mwave_obsop_traj.F90
namelist/namafn.h namcumf.h
phys_ec/callpar.F90 callparad.F90 cuancape2.F90 cuascn.F90 cuascnad.F90
cuascntl.F90 cubasen.F90 cucalln.F90 cuddrafn.F90 cumastrn.F90 cumastrnad.F90
diag_clouds.F90 ec_phys.F90 sucumf.F90 sugwwms.F90
setup/su_surf_flds.F90 suafn1.F90 suafn2.F90 suafn3.F90 supp.F90
```

Files modified(SCRIPTS):

```
def/an.def
gen/getini model modeleps modeleps_nemo mondb_conv.sql ofb_conv.sql
update_psbias update_rstrhbias
metview/Z500_bias_era_mm.met zondia_def_axes zondia_seas_icon_batch.met
```

Richard Forbes - pas_CY37R3_for38r1_cloud_vE_withesuite - ACTIVE

Cloud scheme changes to ice fallspeed and supersaturation

Expts: T511 analysis fllj and fllk, T159 climate flr0

- Modification of cloud ice fall speed formulation (ACTIVE)
  Decreases fall speed in upper troposphere, increases at lower levels. Also small increase in fall speed of precipitating rain and snow. Impact: Increases cloud ice and cloud cover in upper troposphere, warms upper troposphere. Big improvement in 100hPa geopotential RMS.
- Removes excessive clear-air supersaturations in partially cloudy grid boxes (ACTIVE)
  Impact: This removes unrealistic clear-air supersaturations and leads to a slightly reduced mean upper tropospheric relative humidity.
- Convert melting ice to rain rather than liquid (ACTIVE)
  If ice falls into warmer air, it melts to rain rather than create non-sedimenting water cloud. Impact: This removes unrealistic liquid water cloud generation at the melting level.
- Rain freezing timescale (ACTIVE)
  Put a timescale into the process of freezing rain when it falls into lower level temperature inversion with sub-zero temperatures. Impact: This allows the possibility of rain at sub-zero temperatures and the possibility of a freezing rain diagnostic in the future.
- Modifications to metview climplot scripts for cloud/precip plots and contours (PASSIVE)

Files modified(SCRIPTS):
`metview/monmeans_clim.met zondia_seas_icon_batch.met`

Files modified(IFS):
`phys_ec/cloudsc.F90 sltend.F90 sucldp.F90`

Maike Ahlgrimm - pag_CY37R3_ddh3dR - PASSIVE

Updates to DDH output

Expts: T511 test=fl4w, control=flep

- Add prognostic rain and snow to DDH output
- If PEXTRA is defined in callpar.F90, this variable is automatically written to DDH output as well

Files modified(IFS):
`adiab/cpg.F90 cpg_dia.F90 cpg_gp.F90 cpg_gp_tl.F90 gpinislb.F90 postphy.F90`
`dia/cpdyddh.F90 cpphddhe.F90 ppeddhec.F90 ppfidh.F90 sunddh.F90`
`module/yomtddh.F90`
`phys_ec/callpar.F90 cloudsc.F90 ec_phys.F90 radintg.F90`

Maike Ahlgrimm - pag_CY37R3_swclearR - PASSIVE

New diagnostics: downward clear-sky LW and SW radiation at the surface

Expts: T511 test=fl6a, control=flf8

The two new surface variables should be archived operationally. Grib codes 212001 and 212002. These should be treated like the existing net clear-sky surface fluxes (SSRC, STRC or param 210,211).

Files modified(IFS):

```
adiab/cpedia.F90 postphy.F90
control/reresf.F90 restart_cnt3.F90
dia/sucddh.F90 sunddh.F90
fullpos/hpos.F90
module/parfpos.F90 surface_fields_mix.F90 yom_grib_codes.F90 yomafn.F90
yomppc.F90 yomradf.F90
namelist/namafn.h
phys_ec/callpar.F90 ec_phys.F90 ec_phys_drv.F90 ec_physg.F90 raddrv.F90
radheatn.F90 radintg.F90 radlswr.F90
phys_radi/suecrad.F90
setup/su_surf_flds.F90 suafn1.F90 suafn2.F90 suafn3.F90 supp.F90
utility/deallo.F90 dealmod.F90 wrresf.F90
```

Maike Ahlgrimm - pag_CY37R3_esuite3

Fix for DDH

Files modified(IFS):

```
adiab/cpg_dia.F90 dia/cpdyddh.F90 sucddh.F90 sunddh.F90 module/yomppc.F90
phys_ec/callpar.F90 cucalln.F90 cucalln2.F90 setup/supp.F90
```

Souhail Bousetta - pa1_CY37R3_CTESSEL_for38r1 - PASSIVE

Changes to CO2 respiration coefficients.

The ecosystem respiration coefficients R0 have been optimized for MACC. The calculation of snow cover in the ecosystem respiration routine was corrected. A limit to Q10 was added to avoid positive soil respiration in the case of very high soil temperature.

Files modified(SURF):

```
module/sucotwo_mod.F90 srfcotwo_mod.F90
```

Philippe Lopez - pah_CY37R3_cleaning_lin_convec - PASSIVE

Cleaning of linearised convection

Expts: flkg

Deletion of old linearised convection routines. Removal of switch LECUMFS2 from namelist NAMCUMFS. No effect in operations.

Files modified(IFS):

```
module/yomcumfs.F90 yophnc.F90
```

namelist/namcumfs.h namtrajp.h
phys_ec/callparad.F90 callpartl.F90 cuctracerad.F90 cuctracertl.F90 sucumf2.F90
setup/su0phy.F90

Files modified(SCRIPTS):
gen/ifsmin modelsv
sens/J1.sms

Files deleted(IFS):
phys_ec/cuascnad.F90 cuascntl.F90 cubasenad.F90 cubasentl.F90 cubasmcnad.F90 cubasmcntl.F90
cucallnad.F90 cucallntl.F90 cuddrafnad.F90 cuddrafntl.F90 cudlfsnad.F90 cudlfsntl.F90
cudtdqnad.F90 cudtdqntl.F90 cududvad.F90 cududvtl.F90 cuentrad.F90 cuentrtl.F90 cuflxnad.F90
cuflxntl.F90 cuininad.F90 cuinintl.F90 cumastrnad.F90 cumastrntl.F90

Philippe Lopez - pah_CY37R3_rttov_for_simim

Changes in RTTOV

Expts: fljw

The following changes have been made in RTTOV to reduce the strong overestimation of infrared brightness temperatures found in convective regions in operational simulated satellite images:

- Reduced threshold for cloud streams: 0.05 to 0.001.
- Sum up cloud ice and snow contents, to be treated as ice in RTTOV.
- New optional argument for CAPE field in the call to rttov_ec (incl. TL and AD versions), to be used for cloud type discrimination (cumulus/stratus).
- Use Wyser (2003) effective radius formulation instead of McFarquhar et al. (2003).

Files modified(IFS):
op_obs/radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrtl.F90

Files modified(SATRAD):
interface/rttov_ec.h rttov_ec_ad.h rttov_ec_tl.h
module/rttov_types.F90
programs/gensatim.F90
rttov/ifs/rttov_ec.F90 ifs/rttov_ec_ad.F90 ifs/rttov_ec_tl.F90 main/rttov_profaux.F90
main/rttov_profaux_ad.F90 main/rttov_profaux_k.F90 main/rttov_profaux_tl.F90

Files modified(SCRIPTS):
gen/satimsim

Jean-Jacques Morcrette - pam_CY37R3_Mod_for_Rad_in_EPS - PASSIVE

Modifications to the ECMWF radiation for possible future use in EPS

Expts: T159 test=fljj, control=fljh, T511 test=fljv, control=fljj

The branch includes modifications to the radiation interface and radiation schemes, which would allow half the

present number of pseudo-monochromatic computations in both RRTM_LW and _SW, and different frequencies for calling the full radiation schemes within a given forecast.

Files created(IFS):

```
module/yoerrtm.F90 yoesrtm.F90
phys_radi/surrtmcf.F90 susrtmcf.F90
```

Files modified(IFS):

```
module/parrrtm.F90 parsrtm.F90 yoerad.F90 yoerrtftr.F90 yoerrtrwt.F90
yoesrtwn.F90
namelist/naerad.h
phys_dmn/surdi15.F90
phys_ec/aer_phy2.F90 radlswr.F90
phys_radi/rrtm_gasabs1a_140gp.F90 rrtm_init_140gp.F90 rrtm_rrtm_140gp.F90
rrtm_rrtm_140gp_mcica.F90 rrtm_rtrn1a_140gp.F90 rrtm_rtrn1a_140gp_mcica.F90
rrtm_taumol1.F90 rrtm_taumol10.F90 rrtm_taumol11.F90 rrtm_taumol12.F90
rrtm_taumol13.F90 rrtm_taumol14.F90 rrtm_taumol15.F90 rrtm_taumol16.F90
rrtm_taumol2.F90 rrtm_taumol3.F90 rrtm_taumol4.F90 rrtm_taumol5.F90
rrtm_taumol6.F90 rrtm_taumol7.F90 rrtm_taumol8.F90 rrtm_taumol9.F90
srtm_cmbgb16.F90 srtm_cmbgb17.F90 srtm_cmbgb18.F90 srtm_cmbgb19.F90
srtm_cmbgb20.F90 srtm_cmbgb21.F90 srtm_cmbgb22.F90 srtm_cmbgb23.F90
srtm_cmbgb24.F90 srtm_cmbgb25.F90 srtm_cmbgb26.F90 srtm_cmbgb27.F90
srtm_cmbgb28.F90 srtm_cmbgb29.F90 srtm_init.F90 srtm_spcvrt.F90
srtm_spcvrt_mcica.F90 srtm_taumol16.F90 srtm_taumol17.F90 srtm_taumol18.F90
srtm_taumol19.F90 srtm_taumol20.F90 srtm_taumol21.F90 srtm_taumol22.F90
srtm_taumol23.F90 srtm_taumol24.F90 srtm_taumol25.F90 srtm_taumol26.F90
srtm_taumol27.F90 srtm_taumol28.F90 srtm_taumol29.F90 srtm_vrtqdr.F90
suecrad.F90 surrtftr.F90 susrtm.F90
utility/updtim.F90
```

DATA ASSIMILATION

Yannick Trémolet - day_CY37R3_for_38r1

Overlapping 4D-Var windows

Expts: T255 test=flk0, control=flkm

This branch contains technical modifications, mostly in the scripts, for running 4D-Var with overlapping windows. Most of the time-related variables for a given assimilation cycle are computed in one place (gen/cycle_times). That file is included in other scripts to avoid repeating the same code in many scripts. The variables defined in this script should be used as much as possible instead of being recomputed to ensure consistency throughout an assimilation cycle. Many instances where PERIOD_4D was used instead of WINDOW_LENGTH_4D (and vice-versa) have been fixed since these variables can now have different values.

Files created(OBSTAT):

```
src/obstat_create_dumgrib.F90 obstat_grib_dump.F90 obstat_warn_plot.F90
```

Files created(ODB):

```
ddl.ECMA/obstat_radar.sql
```

ddl/obstat_radar.sql

Files created(SCRIPTS):

gen/cycle_times

Files modified(IFS):

namelist/namjo.h nammoderr.h
obs_preproc/defrun.F90
setup/sudim1.F90 sump.F90
utility/prtjo.F90

Files modified(OBSTAT):

module/bufrcodes.F90 dataqc.F90 globvar.F90 mod_obstat_plot.F90 obsdata.F90
statsoft.F90
src/addstat.F90 allocsoft.F90 enlstatarray.F90 genopt.F90 inibufr.F90 iniglob.F90
iniitemloc.F90 inisoftdef.F90 inisoftflag.F90 inisoftinstr.F90 inisoftstream.F90 mergesoft.F9
mpsoft.F90 obstat_add_grib.F90 obstat_geo_plot.F90 obstat_grib_merge.F90 obstat_-
hist_plot.F90 obstat_hov_plot.F90 obstat_normalize_scat.F90 obstat_overview_hist_-
plot.F90 obstat_scat_plot.F90 odb2read.F90 odbread.F90 odbscaling.F90 odbscatamb.F90
outcoverage.F90 plothis.F90 plotrms.F90 plotrmsbias.F90 plotsoft.F90 plotusage.F90
updhard.F90 updsoft.F90 user_data_read.F90 winditem.F90 writealarm.F90 writegribs.F90
writesoft.F90 wrsoftdef.F90

Files modified(ODB):

ddl/getairepid.sql obstat_geos.sql robhdr_screen.sql

Files modified(SCRIPTS):

def/an.def enkf.def
gen/aeolus_auxmet aeolus_l2b anil anml anpl ansfc anwave archive_obs
archive_obsgroup biassave cleanodb convert_mondb convert_obsgroup eda_err_save
ens_cal ens_errors ens_stats fdbksave feedback fetcherr fetchmars fetchobs
fetchorbpre forceinv2clim getgrbe getgrbme getini getoverlap getsmon gtt ifsmin
ifstmerge ifstraj ifstsave ifsvar lowres_fp mergebufr mkabs_b2otools mklinks
model obstat obstat_init odb2bufr odbshuffle pre1crad_iasi_split pre1crad_screen
preCleanFDB preaeolus pregbrad pregeos premwimg preobs prep_couplo4 prereo3
prescat presmos restart_999 revmatchup satmon_monitor sekf_sm smon soilana
ssaana sstana var_include vardata
sms/cleanfc.sms
sms_an/anil.sms anml.sms anpl.sms ansfc.sms
sms_era/get_obtime.sms obtime.sms
wav/wave_setup_4v wave_setup_an

Files deleted(ODB):

ddl.ECMA/obstat_radhure.sql obstat_radrefl.sql obstat_radwd.sql
ddl/obstat_radhure.sql obstat_radrefl.sql obstat_radwd.sql

Elias Holm - dae_CY37R3_NEWB - ACTIVE

New background error covariance matrices

Expts: T511 test=fm2i, control=fjv5 and test=fm1l, control=fkvq

New background error covariance matrices and balance operators have been calculated using the 37R2 EDA. The samples used are EDA forecast differences from 39 days from the 0053 EDA, spaced 3.5 days apart in the period January-May 2011. The forecast difference samples used for B are less under-dispersive than in the previous B, so new values are used for the global scaling of B: REDNMC=1.0 (was 1.4), humidity background error standard deviations FQSIGMA multiplied by 0.7 in fjbchvar.F90 (was 1.0). The tolerance used to cut off non-significant elements of the covariance matrix has been reduced, WJBCONF%%SKYLINE_TOL=0.05 (was 0.1).

Files modified(IFS):
`function/fjbchvar.h`

Files modified(SCRIPTS):
`gen/ifsmin`

Massimo Bonavita - dav_CY37R3_for_38R1 - ACTIVE

Objective filtering of EDA-derived errors

Expts: T799 test=fjkd, control=fiqr

This branch contains:

- The implementation of a new objective filtering of the EDA-derived background errors (active);
- Code and script changes for the computation of the EDA-derived background errors of the unbalanced components of the control vector (passive);
- Script changes to reduce execution times.

Files created(PREPDATA):
`programs/unbal_eda.F90`

Files modified(PREPDATA):
`programs/Spectral_Filter.F90`

Files modified(SCRIPTS):
`build/Makefile.root.prepdata`
`def/an.def`
`gen/ens_cal ens_errors mkabs_prepdata`

Patricia de Rosnay - dap_CY37R3_for_38r1

Monthly varying ASCAT soil moisture CDF matching parameters

ASCAT soil moisture bias correction was revised for IFS cycle 38r1 to account for the seasonal cycle, A set of new monthly CDF matching parameters are used instead of annual mean parameters used in previous cycles. Accounting for the seasonal cycle in the bias correction improves the match of ASCAT to ECMWF soil moisture compared to previous cycle, at short term, seasonal and annual scales. Monitoring results obtained when using the seasonally corrected bias correction show a much improved agreement, compared to annual

BC, in terms of standard deviation of soil moisture first guess departure. Results are detailed in de Rosnay et al., ECMWF Research Memorandum 11100, 2011. The implementation of the monthly CDF matching relies on: A set of monthly CDF matching parameters that was derived for all resolutions and that needs to replace the annual mean parameters at:

`/home/rd/rdx/data/38r1/climate/${RESOL}${GTYPE}/`

This set of parameters is currently available at:

`ec:/dap/archive/cdfpar/38r1`

At each resolution, the ASCAT soil moisture CDF matching parameters GRIB file contains 24 fields (2 parameters, 12 months).

Modified ifstraj script that uses the date to extract the appropriate set of CDF matching parameters from the CDF parameters GRIB file.

Files modified(SCRIPTS):
`gen/ifstraj`

Mike Fisher - dai_CY38_jc

Fix for synop surface pressure fit to obs over Europe

Fix for the problems drawing to synop pressures over Europe. The fix includes surface pressure in the fields penalised by Jc. (Since 2003, we have only penalised divergence.)

Files modified(IFS):
`dfi/sudfi.F90`
`module/yomjcdfi.F90`
`namelist/namdfi.h`
`var/congrad.F90 evjcdfi.F90 supavarc.F90 suprepjcdfi.F90 suqnorm.F90`

SATELLITE

Rossana Dragani - st3_CY37R3_fgchk - ACTIVE

O3 first-guess check upgrade

Expts: fksp (passive), fkxh (active)

Tighten the first-guess for ozone data (in both operations and MACC system) to avoid outliers: observations that lead to first-guess departures larger than 30DU fail the check.

This change is expected to give eventually a small positive impact on the ozone analyses only. Currently, the fg check hardly filters any ozone observation out, and that might sometimes include outliers that can clearly degrade the ozone analyses. By filtering out all observations that lead to 30DU or more first-guess departures, the number of used ozone observations slightly reduces (0.4% reduction of OMI data, 0.2% reduction

of SCIAMACHY, 0.1% (1.25%) in the case of SBUV when the instrument is operated in nominal (cathode) mode.).

Files modified(IFS):

`obs_preproc/fgchk.F90`

Rossana Dragani - st3_CY37R3_o3_varbc_config

O3 VarBC config

Expts: T159 flcq , flko

Reorganisation of the O3 VarBC config subroutine. Split Oper and MACC yconfig definitions to simplify implementation of future data.

Files modified(IFS):

`module/varbc_to3.F90`

Niels Bormann, Anne Fouilloux, Massimo Bonavita, Philipp Lopez, Marco Matricardi, Cristina Lupu - str_CY37R3_for_CY38R1

Radiance spread from the EDA, FASTEM-5, updates for ATMS, updates to cloudy IR RT, removal of RT-subtype concept and other simplifications

Expts: T511 test=fm0e, control=flys

This branch contains a number of modifications primarily related to the use of satellite radiance data:

EDA spread as ODB variable

The new EDA variable eda_spread@errstat now provides the unscaled spread from the EDA (ES field in MARS) at observation locations for all observations for which the fg_error@errstat variable is set to estimates of the background error based on the SES or EF fields (ie most conventional observations as well as some satellite data). This allows easy diagnostics of the spread of the EDA in observation space, and prepares the replacement of the EF field with EDA-based values for radiances.

For radiances, the required ES fields are now calculated in grid-point space for clear-sky conditions for AMSU-A, HIRS, MHS, SSU, MSU and SSMI for a fixed zenith and azimuth angle, using the new program calc_radiance_fields (in the satrad project) and a modified version of Ensemble_Stats. They are archived in MARS, along with the already existing ES fields for more conventional geophysical parameters. They follow the same channel-numbering convention as the current EF fields that are calculated during the first minimisation using the randomisation method.

FASTEM-5

The latest attempt to improve the microwave fast ocean surface emissivity model (FASTEM-5) has been added in RTTOV. This is based on pre-release code and the exact interfacing may change in subsequent updates of RTTOV. The RTTOV coefficient files control which FASTEM version is actually used for the respective sensors.

Updates for ATMS

- Correction of bufr2odb_atms
- Filling of fg_error word in the ODB with values taken from equivalent AMSU-A/B/MHS channels;
- Capability to spatially average FOVs: this can be done in the bufr2odb task, and is activated through scripts changes by providing a text file describing the averaging.

Updates to cloudy IR simulations

The cloudy IR simulations with RTTOV have been updated. The changes affect the simulation of geostationary satellite images and the (experimental) assimilation of cloudy IR radiances. The latter is currently not included in operations, so in operations there is no impact on the analysis. The changes are:

- Reduced threshold for cloud streams: 0.05 to 0.001
- Use Wyser (2003) effective radius formulation instead of McFarquhar et al. (2003).
- New optional argument for CAPE in the call to rttov_ec (incl. TL and AD versions), to be used for cloud type definition (cumulus / stratus). This distinction is now used for the satellite image simulation.
- Sum up cloud ice and snow contents for the satellite image simulation, to be treated as ice in RTTOV.

Removal of "RT-subtype" concept and update of IFS/RTTOV interface

The RT-subtype concept has been removed from the IFS project. It dates from the early days of radiance assimilation and was also integral to the Harris & Kelly bias correction. It is now obsolete. As a result, the routine getsatid could be significantly simplified and many arrays in yomtvrad could be removed.

The interface between the IFS and RTTOV has been revised, primarily to remove some obsolete concepts that date from pre-RTTOV-8 days. Many parameters previously set and duplicated in the satrad module mod_cparam have been removed, as they are either not required or are better set on the IFS side. The number of profiles per RTTOV call are now set in yomtvrad in the IFS project. The parameters used to dimension various arrays in the interface have been removed, and assumed-shape arrays are used instead; or some arrays combining several variables have been replaced in the interface with separate arrays. As a result, interface blocks have to be used when rttov_ec routines are called (same for tl/ad). The argument list to rttvi was significantly simplified as a result of the changes, as the clumsy retrieval of settings from the satrad project is not required anymore.

While doing the changes, several adjustments had to be made in routines not called at ECMWF and usually maintained at Météo France (e.g., phrtsetup, mts_phys, co2cldairs, co2cldiasi). These have been done on a reasonable-effort basis, but could not be tested at ECMWF. The same is true for the option of calling RTTOV without using the RTTOV interpolation (ie interpolation to fixed pressure levels performed on the IFS side). For this option, the number of levels (NLSAT) still has to be the same for all instruments, but the setting of the value has been moved to the IFS side (module sats_mix). The default (44) can be over-written through the namelist NAMSATS.

Files created(ODB):

```
cma2odb/create_averaged_values.F90
ddl.CCMA/set_active.sql
ddl.ECMA/count_orbit.sql count_scanpos.sql max_values.sql radiance_averaging.sql
satellite_identifier_list.sql set_active.sql
ddl/count_orbit.sql count_scanpos.sql max_values.sql radiance_averaging.sql
satellite_identifier_list.sql set_active.sql
```

interface/create_averaged_values.h

Files created(SATRAD): rttvi.h

module/mod_rttov_fastem5_coef.F90

programs/calc_radiance_fields.F90

rttov/main/rttov_fastem5.F90 main/rttov_fastem5_ad.F90 main/rttov_fastem5_k.F90 main/rttov_-
fastem5_tl.F90

Files modified(IFS):

common/yomdb_defs.h yomdb_vars.h

control/gp_model.F90 gp_model_ad.F90 gp_model_tl.F90 scan2mad.F90

module/sats_mix.F90 yomdb.F90 yomdimo.F90 yomfger.F90 yomlimb.F90 yommwave.F90
yomtvrad.F90

mwave/mwave_obsop_traj.F90

namelist/namsats.h

obs_preproc/gefger.F90 inifger.F90 new_thinn.F90

op_obs/bgobs.F90 co2cldairs.F90 co2cldiasi.F90 hop.F90 hop_rad.F90 hopad.F90
hoptl.F90 hradp.F90 hradpad.F90 hradptl.F90 hretr.F90 hretr_aeolus.F90 radtr.F90
radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrtl.F90

phys_dmn/mts_phys.F90

utility/dealshu.F90

var/getsatid.F90 rtsetup.F90 suamv.F90 sujbwavtrans.F90 sulimb.F90 surad.F90

Files modified(IFSAUX):

module/grib_api_interface.F90

Files modified(ODB):

bufr2odb/bufr2odb_205.F90 bufr2odb_aeolus.F90 bufr2odb_aircraft.F90
bufr2odb_airs.F90 bufr2odb_amsre_1d.F90 bufr2odb_ascat.F90 bufr2odb_atms.F90
bufr2odb_atovs.F90 bufr2odb_fy3.F90 bufr2odb_gch1.F90 bufr2odb_gch2.F90
bufr2odb_gch3.F90 bufr2odb_gch4.F90 bufr2odb_gch5.F90 bufr2odb_grad.F90
bufr2odb_iasi.F90 bufr2odb_iscat.F90 bufr2odb_meris.F90 bufr2odb_metar.F90
bufr2odb_modisaer.F90 bufr2odb_msg.F90 bufr2odb_mwri_1d.F90 bufr2odb_oscat.F90
bufr2odb_paob.F90 bufr2odb_pgps.F90 bufr2odb_qscat.F90 bufr2odb_radio.F90
bufr2odb_radio_lat_long.F90 bufr2odb_rain_rates.F90 bufr2odb_reo3.F90
bufr2odb_satob.F90 bufr2odb_scat.F90 bufr2odb_smos.F90 bufr2odb_snow.F90
bufr2odb_ssmi.F90 bufr2odb_ssmis_1d.F90 bufr2odb_synop.F90 bufr2odb_temp.F90
bufr2odb_tmi_1d.F90 bufr2odb_windprofiler.F90 bufr2odb_windsat.F90
get_varindex.F90

cma2odb/ctxinitdb.F90 initmdb.F90 map_reportype.F90 shuffle.F90 shuffle_odb.F90

ddl/body.h errstat.h pre_thinn_robhdr_4.sql pre_thinn_robhdr_5.sql
pre_thinn_robhdr_9.sql pre_thinn_robody_2.sql pre_thinn_robody_3.sql
pre_thinn_robody_4.sql pre_thinn_robody_5.sql pre_thinn_robody_9.sql radiance.h
sufger_robody_1.sql

interface/shuffle_odb.h

Files modified(PREPDATA):

programs/Ensemble_Stats.F90

Files modified(SATRAD):

interface/getcparam.h rttov_ec.h rttov_ec_ad.h rttov_ec_tl.h

module/cparam.F90 mod_cparam.F90 rttov_types.F90

programs/gensatim.F90

rttov/ifs/getcparam.F90 ifs/phrtsetup.F90 ifs/rttov_ec.F90 ifs/rttov_ec_ad.F90 ifs/rttov_-
ec_tl.F90 ifs/rttvi.F90 main/rttov_calcemis_mw.F90 main/rttov_calcemis_mw_ad.F90 main/rttov_-
calcemis_mw_k.F90 main/rttov_calcemis_mw_tl.F90 main/rttov_profaux.F90 main/rttov_-
profaux_ad.F90 main/rttov_profaux_k.F90 main/rttov_profaux_tl.F90

Files modified(SCRIPTS):

def/an.def

gen/bufr2odb ens_stats fetcherr fetchmars getgrbe getini ifstraj mkabs_satrad
model modeleps_nemo mondb.sql mondb_allsky.sql mondb_conv.sql mondb_gbrad.sql
mondb_geos.sql mondb_gpsro.sql mondb_hirs.sql mondb_meris.sql mondb_resat.sql
mondb_resatak.sql mondb_sat.sql mondb_satob.sql mondb_tovs.sql ofb_airs.sql
ofb_allsky.sql ofb_conv.sql ofb_gbrad.sql ofb_generic.sql ofb_geos.sql
ofb_hirs.sql ofb_iasi.sql ofb_iras.sql ofb_meris.sql ofb_resat.sql
ofb_resatak.sql ofb_satob.sql ofb_tovs.sql satimsim sstana update_psbias
update_rstrhbias

sms_an/bufr2odb.sms

wav/wave_getrst

Files deleted(IFS):

op_obs/radtrk.F90

Files deleted(SATRAD):

bias/getbias.F90 getpred.F90 suadvar.F90

emiss/scan_bias.F90

rttov/ifs/get_extra_top_levels.F90

Cristina Lupu, Tony McNally, Anne Fouilloux - stc_CY37R3_asr_met9_for_CY38R1 - ACTIVE

Assimilation of all-sky radiances product from SEVIRI onboard Meteosat-9

Expts: T511 test=flmt, control=fkvl and test=fllfu, control=fl4n

Code and script changes to allow the assimilation of Meteosat-9 SEVIRI radiance data from the EUMETSAT new ”All Sky Radiance” product (ASR), replacing the use of data from the older ”Clear Sky Radiance” product (CSR). The switch to this new ASR product allows the additional assimilation of overcast radiances, estimating cloud parameters simultaneously with temperature and humidity. In cloud free locations just 2 channels from the ASR are used (6.2 and 7.3 microns, as was done for the previous CSR data)), but for overcast scenes four channels are assimilated (6.2, 7.3, 10.8 and 13.4 microns), the extra channels being required to determine the cloud conditions.

Observation counts and cost are identical for all observation types in the Jo-table except for Meteosat-9 SEVIRI. With this change, completely overcast scenes in four channels will be assimilated additionally to WV clear-sky MET-9 SEVIRI radiances.

Files modified(IFS):

common/yomdb_defs.h yomdb_vars.h

module/sats_mix.F90 varbc_rad.F90

obs_preproc/black.F90 blinit.F90

op_obs/cloud_estimate.F90 hradp_ml.F90 hretr.F90

setup/su_events.F90

Files modified(ODB):

bufr2odb/get_odb2bufr_varindex.F90 get_varindex.F90

cma2odb/buf2cmat_new.F90 initmdb.F90 map_reportype.F90 subuoctp.F90

ddl/black_robhdr_4.sql radiance.h sat_atovs.sql sathdr_screen_atovs.sql type_definitions.h varno.h

module/getval_module.F90 odb2bufr_varindex_module.F90 varindex_module.F90 yomboctp.F90

tools/Bufr2odb.F90

Files modified(SCRIPTS):

def/an.def

gen/fetchobs mondb_geos.sql pregeos

Files deleted(ODB):

bufr2odb/bufr2odb_asr.F90 geosangl.F90

Qifeng Lu - stu_CY37R3_fy3b_NonL

Update for FY3B

- Update FY3 MWTS instrument bufr value from 964 to 934 to be consistent with data stream. subroutine: odb/bufr2odb/bufr2odb_fy3.F90
- Update non-linearity bias correction coefficients for FY3B MWTS. subroutine: odb/bufr2odb/fy3_corrections.F90

Files modified(ODB):

bufr2odb/bufr2odb_fy3.F90 fy3_corrections.F90

Kirsti Salonen and Niels Bormann - sts_CY37R3_goes15_AMVs

Preparation for GOES-15 AMVs

Expts: T255 fl9i, fl9j, fl9k and flzl, flzk with GOES-15

GOES-15 will replace GOES-11 on December 6, 2011. The system is prepared for AMV data from GOES-15. It is planned that the disseminated data will include an additional quality indicator, expected error, at some point. The system is able to handle data with or without the expected error.

Files modified(IFS):

common/yomdb_defs.h yomdb_vars.h

Files modified(ODB):

bufr2odb/bufr2odb_satob.F90 get_varindex.F90 satobfreq.F90

cma2odb/initmdb.F90

ddl/satob.h

module/varindex_module.F90

Ben Ruston - st1b_CY37R3_tskin_patch

Patch to properly store tskin at radiance sink variable

Expts: T511 test=flkz, control=fkvq

Properly store tskin sink variable in ODB at the end of each inner loop, and use updated value at the beginning of each subsequent loop

Effect on forecast scores is neutral to positive of particular note is improvement in the Tropical vector winds for day 5+, also of note is significant reduction in the increments seen for t/vw/z in the polar regions.

Files modified(IFS):

`op_obs/hradp.F90 hradp_ml.F90 hradp_ml_tl.F90 hradptl.F90`

Alan Geer - stg_CY37R3_amsua_allsky

Fine-tuning the assimilation of AMSU-A in the all-sky route

These are minor revisions to the assimilation of AMSU-A through the all-sky route. This includes new observation errors with a scan-dependent error model (which becomes a function of zenith angle), a revised liquid water path regression, and a revised blacklist.

These changes are bit reproducible if LAMSUA_ALLSKY is off. Operationally the aim is to passively monitor AMSU-A channels 1-6 and 15 in the all-sky route. Channels 4 and 5 on Metop-A and NOAA-19 will be passively monitored with VarBC spinup as well.

Files created(SCRIPTS):

`sms_an/archive_amsua_allsky.sms convert_amsua_allsky.sms`

Files modified(IFS):

`module/get_lwpcoeff_mix.F90 varbc_allsky.F90 yommwave.F90`

`mwave/mwave_cloud.F90 mwave_lwp.F90 mwave_obsop.F90 mwave_obsop_ad.F90 mwave_obsop_tl.F90 mwave_obsop_traj.F90`

`obs_preproc/gefger.F90`

Files modified(ODB):

`bufr2odb_atovs.F90`

`sufger_allsky.sql`

Files modified(SCRIPTS):

`def/an.def`

`mklinks varconsts`

`odb_prepare.sms`

Enza Di Tomaso and Niels Bormann - stt_CY37R3_for_38r1 - ACTIVE

Tuning of the emissivity atlas and assimilation of MHS channel 5 over land

Expts: T511 test=fkys, control=fkvl and test=flcr, control=fkvq

Activate the assimilation of MHS channel 5 over land, and provide updates to the Kalman Filter emissivity atlas.

Blacklist change description: Assimilation of MHS channel 5 over land; FG-departure quality control applied to channels used for emissivity calculations.

Branch includes a revision of the quality control for the update of the atlas emissivities, the use of atlas emissivities for channels used for dynamic emissivities calculations, and the use of only data from the global datastream in the atlas update.

Files modified(IFS):

`op_obs/hretr.F90`

Files modified(ODB):

`ddl/emiskf_amsua.sql emiskf_amsub.sql emiskf_mhs.sql`

Files modified(SATRAD):

`emiss/emiskf_update_atlas.F90`

Tony McNally - ste_CY37R3_cris_modifications

NPP-CRIS

Expts: fm4i

Code / script / blacklists / and prepIFS changes to allow the processing (initially monitoring, but later assimilation) of infrared radiances from the CRIS instrument on NPP.

Files created(IFS):

`obs_preproc/read_crischans.F90`

Files created(ODB):

`bufr2odb/bufr2odb_cris.F90`

Files created(SATRAD):

`programs/bufr_screen_cris.F90`

Files created(SCRIPTS):

`gen/mondb_groupid=37.sql ofb_groupid=37.sql`

`sms_an/archive_cris.sms b2o_cris.sms convert_cris.sms obstat_archive_cris.sms obstat_-cris.sms pre1crad_cris.sms`

Files modified(IFS):

`module/sats_mix.F90 varbc_rad.F90 yomiasi.F90 yomtvrad.F90 yomvarbc.F90`

`obs_preproc/black.F90 cloud_detect_setup.F90 defrun.F90 fgchk.F90 new_thinn.F90 new_thinner_no_sq.F90 pre_thinner.F90 rad1cin.F90`

`op_obs/hretr.F90 hsatang.F90 rad1cemis.F90 rad1cobe.F90 radtr.F90 radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrk.F90 radtrtl.F90`

`var/rtsetup.F90 surad.F90`

Files modified(ODB):

`bufr2odb/bufr2odb_atms.F90`

`cma2odb/buf2cmat_new.F90 map_reportype.F90 subuoctp.F90`

module/yomboctp.F90

tools/Bufr2odb.F90

Files modified(SCRIPTS):

def/an.def

gen/bufr2odb cleanodb fdbksave fetchobs mkabs_satrad mklinks obstat pre1crad_screen varconsts

sms_an/convert_obsgroup.sms makeodb.sms

Reima Eresmaa - ste_CY37R3_o3xband

Cross-band cloud detection on ozone channels of AIRS

Expts: T511 test=flrv, control=fkvq

Due to conflicting branches that were included earlier in Cy37r3, cloud flagging of ozone-sensitive AIRS channels was unintentionally made independent of other spectral bands of AIRS spectrum. The new contribution is set up to fix the inconsistency in Cy38r1.

Files modified(SCRIPTS):

gen/mklibs

Bill Bell - stw_CY37R3_cloudyir

Cloudy IR radiance Assimilation

Expts: T42_debug test=fm70 and T511 test=fmcv

These code changes enable the simulation of cloudy IR radiances and testing of the assimilation of these radiances in 4D-Var. The capability is controlled by variables in ifstraj:

LIRCLD_SCREEN_HIRS
LIRCLD_SCREEN_AIRS
LIRCLD_SCREEN_IASI

and in ifsmin:

LIRCLD_ASSIM_HIRS
LIRCLD_ASSIM_AIRS
LIRCLD_ASSIM_IASI

These are set to false in the branch provided, resulting in no change to the existing output from ifsmin / ifstraj.

Files modified(IFS):

obs_preproc/defrun.F90 sugoms.F90

op_obs/cobsad.F90 hretr.F90 preint.F90

var/rtsetup.F90

Files modified(SATRAD):

`rttov/ifs/rttov_ec.F90 ifs/rttov_ec_ad.F90 main/rttov_opdpscattir.F90`

Files modified(SCRIPTS):

`gen/ifsmin ifstraj`

OBSTAT

Mohamed Dahoui - mo3_CY37R3_forCY38R1

Obstat updates

- Cleaning and optimizing of the code. This concern a large number of routines
- Implementation of Reportype (when available) as an alternative identification of data. The code will still work with old ODB files
- Usage by default of MFB files archived in MARS.
- Add support of NPP data (CrIS and ATMS)
- Updated parts of the code using ODB bitfields that have been updated by Anne for 38r1.
- Adaptation to Yannick's needs to monitor data in 4D-Var long window. The procedure has been made generic to monitor selected time slots
- Allow flexible definition of the vertical binning for GPSRO (by default is 1 km).
- Allow the production of classical obstat plots according the the land sea mask
- Allow time steps below 1 hour (by default the time step is the assimilation window)
- Allow the optional usage of reportype in the stat.ref files to identify the data to be monitored. Currently we exclusively use a composite number based on the satellite, sensor and version of the data.
- Optimize the plotting routines by making the read of grib files done in one routine for all plotting programs
- Add more option to control the production of gridded statistics in GRIB format
- improve obtime series (VarBC, condition numbers and time series). This was done with the help of Paul Poli.

Dominique PUECH from Météo-France contributed to the cleaning of the code.

Files created(OBSTAT):

`module/obstat_funcs.F90`

`src/obstat_create_dumgrib.F90 obstat_grib_dump.F90 obstat_warn_plot.F90`

Files created(ODB):

`ddl.ECMA/obstat_radar.sql`

`ddl/obstat_radar.sql`

Files created(SCRIPTS):

`era/varbc_merge_sort.py`

Files modified(OBSTAT):

`module/bufrcodes.F90 dataqc.F90 globvar.F90 mod_obstat_plot.F90 obsdata.F90 statsoft.F90`

`src/addstat.F90 allocsoft.F90 calcairspop.F90 enlstatarray.F90 genopt.F90 inibufr.F90 iniglob.F90 iniitemloc.F90 inisoft.F90 inisoftdef.F90 inisoftflag.F90 inisoftinstr.F90 inisoftstream.F90 mergesoft.F90 mpsoft.F90 obstat_add_grib.F90 obstat_geo_plot.F90 obstat_grib_merge.F90 obstat_hist_plot.F90 obstat_hov_plot.F90 obstat_normalize_scat.F90 obstat_overview_hist_plot.F90 obstat_scat_plot.F90 odb2read.F90 odbread.F90 odbscaling.F90 odbscatamb.F90 outcoverage.F90 plotcov.F90 plothis.F90 plotime.F90 plotrms.F90 plotrmsbias.F90 plotsoft.F90 plotusage.F90 updhard.F90 updsoft.F90 user_data_read.F90 winditem.F90 writealarm.F90 writegribs.F90 writesoft.F90 wrsoftdef.F90`

Files modified(ODB):

`ddl/getairepid.sql obstat_geos.sql`

Files modified(REANAL):

`Mon/obstat_timeseries.F90 plot_curves.F90`

Files modified(SCRIPTS):

`def/an.def`
`gen/mkabs_obstat mkabs_reanal obstat obstat_init`
`sms_an/perltools.sms`
`sms_era/get_obtime.sms obtime.sms`

Files deleted(OBSTAT):

`module/funcs.F90`

Files deleted(ODB):

`ddl.ECMA/obstat_radhure.sql obstat_radrefl.sql obstat_radwd.sql`
`ddl/obstat_radhure.sql obstat_radrefl.sql obstat_radwd.sql`

MACC

MACC Contribution

Merged branch - Richard Engelen - stj_CY37R3_MACC_new

Component branches:

Johannes Flemming - stj_CY37R3_JohannesF, naj_CY37R3_plus_CIFS

Antje Inness - std_CY37R3_IAGOS_clean

Angela Benedetti - stj_CY37R3_Angela_new, paz_CY37R3_MACC_for_38R1

Luke Jones - Streamline surface fields setup logic

Expts: T159L91 fluk, T255L60+MACC fm1z

This contribution adds a new observation type (ISAC; in-situ atmospheric composition), new observation operators for the Calipso lidar instrument, a new directory with routines for the integrated chemistry based on the TM5 CTM (chem), dual control vector for aerosol (total aerosol and fine-mode aerosol), simplifying of the tracer surface fluxes in the physics, and clean-up in various places.

Integration of chemistry in IFS (C-IFS)

- new GFL-group YCHEM introduced
- new namelist NAMCHEM introduced to control the chemistry
- TYPE GFL extended (TYPE_GFL_COMP and TYPE_GFL_NAML)
- routines for the chemical scheme CBM4 added in new directory ifs/chem
- interface to chemistry (chem_main.F90) in callpar.F90
- new routine to calculate lighting activity (culight.F90)
- new routines for calculation of dry and wet deposition (chem_drydep.F90, chem_scav.F90)
- global diagnostics of mass and all source and sink terms (chem_massdia.F90)

Global mass fixer for GFL variables with option for proportional and additive fixing of global tracer mass (tracmf.F90)

Streamline surface fields setup logic

Remove the need to specify the number of times SETUP_SFLP2/3 are called as an argument to INI_SFLP2/3. This removes the possibility that the wrong number is specified and also removes one of the needs to duplicate the set-up logic. This is achieved by creating the new routines: FINALISE_SFLP2/3. Since these are called after all the fields are set up, they know automatically how many fields are set up and can set information that requires this number accurately.

Replace YSx_ACT_xx.Lxx with YSx_xx%Yxx%LSET.

New procedure for setup of surface fields:

```
! Initialise the group
CALL INI_SFLP2(YSD_VFD,YSD_VF%YVF, ...)
YSD_VF%YLSM   => YSD_VF%YVF(JPMAXSFLDS)

! Set up the fields
IF (COMPLICATED_LOGIC) THEN
YSD_VF%YLSM => YSD_VF%YVF(YSD_VFD%IPTR)
CALL SETUP_SFLP2(YSD_VFD,YSD_VF%YLSM , ... )
ENDIF

! Finalise the group
CALL FINALISE_SFLP2(...)
```

Files created(IFS):

chem/chem_decay.F90 chem_drydep.F90 chem_emi3d.F90 chem_inext.F90 chem_init.F90 chem_main.F90 chem_massdia.F90 chem_mocage.F90 chem_mozart.F90 chem_negat.F90 chem_noxadv.F90 chem_scav.F90 chem_tm5.F90 tm5_boundary_ch4.F90 tm5_boundary_hno3.F90 tm5_budg.F90 tm5_calrates.F90 tm5_chem_ini.F90 tm5_cloud_info.F90 tm5_do_ebi.F90 tm5_eqsam.F90 tm5_fparam.F90 tm5_getextra.F90 tm5_incbud.F90 tm5_noy.F90 tm5_photolysis_rates.F90 tm5_reacbud.F90 tm5_sundis.F90

control/tracmf.F90

module/chem_mix.F90 tm5_chem_module.F90 tm5_photolysis_mix.F90 yoe_aervole.F90 yoeaervol.F90

namelist/naevol.h namchem.h

obs_preproc/isac_ob.F90

op_obs/aer_lidsimad.F90 aer_lidsimop.F90 aer_lidsimtl.F90 aod_dualcv_ad.F90 aod_dualcv_op.F90 aod_dualcv_tl.F90 exheiz2p_lidar.F90 isac_grg.F90 isac_grgad.F90 isac_grgtl.F90 rao_ad.F90 rao_op.F90 rao_tl.F90

phys_ec/aer_volce.F90 culight.F90 radvis.F90 su_aervole.F90

setup/sucpicgfl.F90

var/aerlid_setup.F90

Files created(SCRIPTS):

gen/chem_ifsnam.pl chem_setup chemarch_ml get_fire_emis_ctm get_tablecol get_tm5_initcond prep_flux prep_initcond

sms/prep_chem.sms

Files modified(IFS):

adiab/postphy.F90

climate/updo3ch.F90

control/cnt4.F90 gp_model.F90

dia/ppeddhec.F90 pregrbenc.F90 sucddh.F90 sunddh.F90

fullpos/endpos.F90 endpos_prepgfl.F90 endvpos.F90 hpos.F90 specfitg.F90 vpos_prep.F90

module/gfl_subs_mod.F90 goms_mix.F90 iostream_mix.F90 pardimo.F90 parfpos.F90 surface_fields_mix.F90 type_gems_profiles.F90 type_gflflds.F90 type_gfls.F90 varbc_setup.F90 varbc_to3.F90 yoeaeratm.F90 yoeaerlid.F90 yoeaermap.F90

yoeaersnk.F90 yoeaersrc.F90 yoerad.F90 yom_grib_codes.F90 yom_ygfl.F90 yomafn.F90 yomcoctp.F90 yomcosjo.F90 yomcst.F90 yomgrb.F90 yomjg.F90 yommp.F90 yomvnmb.F90

namelist/naeaer.h naerad.h namgfl.h

obs_preproc/blackhat.F90 defrun.F90 fgchk.F90 first.F90 pre_prsta.F90 reo3sin.F90 sugoms.F90

op_obs/aod_ad.F90 aod_op.F90 aod_tl.F90 bgobs.F90 cod_op.F90 hdepart.F90 hop.F90 hopad.F90 hoptl.F90 hretr.F90 hvnmtlt.F90 mpobseqad_unpck.F90 preint.F90 preinttl.F90

phys_dmn/surdi15.F90

phys_ec/aer_bdgtmss.F90 aer_cld.F90 aer_diag1.F90 aer_drydep.F90 aer_phy1.F90 aer_phy2.F90 aer_phy3.F90 aer_rad.F90 aer_rrtm.F90 aer_sedimnt.F90 aer_so2so4.F90 aer_src.F90 aer_tau.F90 callpar.F90 callparad.F90 callpartl.F90 cuascn.F90 cucalln.F90 cumastrn.F90 cumastrnad.F90 ec_phys.F90 ec_phys_ad.F90 ec_phys_tl.F90 gems_dealloc.F90 gems_init.F90 gems_tend.F90 m7_emi.F90 m7_interface.F90 radaca.F90 radina.F90 radinaad.F90 radinatl.F90 radlswr.F90 su_aerop.F90 su_aerp.F90 su_aerw.F90

phys_radi/suecrad.F90 uvradi.F90

pp_obs/pos.F90 pos_prepgfl.F90 ppobsa.F90 ppobsaad.F90 ppobsatl.F90

prism/couplo4_definitions.F90 couplo4_exchange.F90 couplo4_grg_input.F90

setup/cmoctmap.F90 cmoctmap_inv.F90 su0phy.F90 su_events.F90 su_surf_flds.F90 suafn1.F90 suafn2.F90 suafn3.F90 sualmp2.F90 sucst.F90 suctrl_gflattr.F90 sudefo_gflattr.F90 sudim1.F90 sudyn_setgflattr.F90 sugfl.F90 sugridug.F90 sump.F90 susc2b.F90 suvnmb.F90

utility/deallo.F90 prtgom.F90 updtim.F90

var/ecset.F90 ecset_thsafe.F90 estsig.F90 rdfpinc.F90 sujb.F90 sujbwavelet.F90 surad.F90 vec2gp.F90 writesd.F90

Files modified(ODB):

cma2odb/getdb.F90

ddl/black_robhdr_1.sql black_robody_1.sql obstype.h varno.h

module/getval_module.F90

Files modified(SCRIPTS):

def/an.def fc.def gen.def ifs_ctm.def

gen/gems_ifsnam.pl gems_setup get_gems_surface getgrb getinigems mkabs_an mkabs_fc mklinks model prep_couplo4

sms/getfcdata.sms ml.sms model.sms prep_couplo4.sms

AEOLUS

Michael Rennie - da7_CY37R3_Oct24_for_submit_2 - PASSIVE

Doppler wind lidar assimilation

Expts: test=fli0, control=flhy and AEOLUS test=flen

Further technical development (no meteorological impact) for Aeolus processing and assimilation tasks.

IFS: Changes to accommodate a new obstype=NLIDAR (number 15) and to move Aeolus to be under this obstype. This obstype is intended for future use by any LIDAR data, not just Doppler-wind lidar. Allowing Aeolus to be under obstype=NLIDAR reduces the risk of conflicts with conventional observations, e.g. those encountered when Aeolus was under obstype=NPILOT particularly as regards SQL requests. Such a conflict caused Aeolus processing to fail in CY37R3. Also, changes to convert the Aeolus AUX_MET production vertical co-ordinate to geometric height (above geoid).

ODB: Modifications to accommodate new obstype=NLIDAR. Change vertical co-ordinate type to geopotential height in bufr2odb_aeolus (N.B. still missing a geometric height to geopotential height conversion).

SCRIPTS: Modification to accommodate new obstype=NLIDAR in gtt2simulobs. mkabs_aeolus improved to stop it causing fails in other scripts - put all executables directly into an aeolus directory. Temporary fix for aeolus_auxmet for ODB usage.

AEOLUS: Remove conversion from geopotential to geopotential height given new AUX_MET output.

Files modified(AEOLUS):

`auxiliary/auxiliarymodule.F90`

Files modified(IFS):

`module/aeolus_getamd_mod.F90 yomcoctp.F90`

`obs_preproc/blackhat.F90 defrun.F90 redml.F90 suobarea.F90`

`op_obs/hop.F90 hopad.F90 hoptl.F90 hretr.F90 hretr_aeolus.F90 mpobseqad_unpck.F90`

`setup/cmoctmap.F90 cmoctmap_inv.F90`

`var/ecset.F90 ecset_thsafe.F90 taskob.F90`

Files modified(ODB):

`bufr2odb/bufr2odb_aeolus.F90`

`cma2odb/buf2cmat_new.F90 getdb.F90`

`ddl/black_robhdr_1.sql black_robody_1.sql obstype.h sat_aeolus.sql`

Files modified(SCRIPTS):

`gen/aeolus_auxmet gtt2simulobs mkabs_aeolus`

`sms/get_aeolus.sms`

RE-ANALYSIS

Hans Hersbach - er9_CY37R3_new_odb_columns

Introduction of two columns in the conv table for the purpose of Reanalysis.

Expts: T1279 test=fm6b, control=fm6a

In the Reanalysis group, a number of historical archives of conventional data are being imported into ODB-2 and archived into MARS. Examples are the International Surface Pressure Databank (ISPD), containing 1.4 Billion surface and sea-level pressure observations from 1768-2008, and the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), containing 260 Million maritime observations (pressure, wind, waves, humidity, ..) from 1662-2007.

Data from these archives will be assimilated in the ERA-CLIM project.

Each archive is identified by the existing ODB source@hdr column.

The historical archives are usually a collation of a number of data collections. To identify a collection within an archive a new ODB column has been created: collection_identifier@conv.

Not all meta information of these historical archives is ingested into ODB-2. A new column, unique_identifier@conv, uniquely identifies a specific report, which allows access to non-ingested meta data, if necessary.

Files modified(IFS):

`common/yomdb_defs.h yomdb_vars.h`

Files modified(ODB):

`cma2odb/initmdb.F90`

`ddl/conv.h`

MARINE ASPECTS

Jean Bidlot - wab_CY37R3_for_CY38R1 - ACTIVE

Revised input and dissipations sources terms and added exchange of momentum and energy fluxes for ocean mixed modelling

Expts: T511 test=flhg, control=fkvl and test=flhh, control=fkvq

- The wind source term was modified to limit its impact towards low frequencies and the whitecapping dissipation source term was retuned accordingly.
- The bottom dissipation coefficient was reset to its pre-CY37R2 value.
- Bug fix in the maximun value used for the wave induced stress in the computation of the total stress table. As a consequence, the drag coefficient is not any longer artificially bounded for winds above 30 m/s.
- Bug fixes to allow runs at 0.1x0.1 degree global resolution.
- New parameters are returned to the IFS that will be useful when an update of the ocean mixed layer model is introduced (energy flux to the oceans, energy flux to the waves, momentum flux to the ocean, wave variance, mean wave period). The actual extra calculation of the 3 fluxes is controlled by LWFLUX. Three flux parameters are also new output parameters of the wave model (see (10) below).
- New ocean TKE based ocean mixed layer option in the ifs. It is currently switched off (LOCMLTKE = false in namelist NAEPHY))
- Fine tuning of the second order correction scheme applied to for the spectra used to compute all integrated parameters.
- The old option to run WAM in multi-nested configurations has been properly made parallel.
- Script change to make use of the hourly output of the operational forecast winds in the stand alone configurations.

- Bug fix in altas to defined properly the maximum distance DMAX over which data are kept by each MPI sub-areas.
- Multiple minor bug fixes.
- Model numbers are now 109 for the global models and 209 for the limited area one.

Files modified(IFS):

```
module/surface_fields_mix.F90 yoephy.F90 yoewcou.F90
namelist/naephy.h
obs_preproc/new_thinn.F90
phys_ec/callpar.F90 ec_phys.F90 suphec.F90 vdfmain.F90 vdfouter.F90 wvcouple.F90
setup/su0phy.F90 su_surf_flds.F90 sudim1.F90 suinif.F90
```

Files modified(ODB):

```
cma2odb/map_reportype.F90
ddl/pre_thinn_robhdr_4.sql pre_thinn_robhdr_5.sql pre_thinn_robhdr_9.sql pre_thinn_-
robody_2.sql pre_thinn_robody_3.sql pre_thinn_robody_4.sql pre_thinn_robody_5.sql
pre_thinn_robody_9.sql
```

Files created(SURF):

```
module/oc_mlm_mod.F90 ocean_ml_driver_v2_mod.F90 source_e_mod.F90 sugridmlm_mod.F90
tridag_mod.F90 yos_mlm.F90
```

Files created(WAM):

```
Wam_oper/bouint.F mpgatherbc.F uibou.F
Wam_setup/run_bouint run_preproc.fine run_preset.fine run_wamodel.fine
```

Files modified(SURF):

```
external/surfpp.F90 surftstp.F90 susurf.F90
interface/surfpp.h surftstp.h susurf.h
module/surfpp_ctl_mod.F90 surftstp_ctl_mod.F90 susocean_ml_mod.F90 susurf_ctl_mod.F90
```

Files modified(WAM):

```
Wam_oper/abort1.F altas.F bouinpt.F cal_second_order_spec.F chief.F
create_wam_bathymetry.F current2wam.F dummy_eclib.F dummy_no_assimil.F
file_transfer.F frcutindex.F getspec.F gsfile_new.F headbc.F implsch.F initmdl.F
intpol.F inwgrib.F kgribsize.F mbounc.F mbounf.F mintf.F mpabort.F mpdecomp.F
mppewithindist.F mpuserin.F mubuf.F out_onegrdpt.F outbc.F outbs.F outcom.F
outgrid.F outint.F preproc.F propags.F propags1.F readbou.F readstress.F
readwind.F sbottom.F sdissip.F sinput.F stress.F stresso.F tauhf.F uiprep.F
updatewd.F userin.F wamassi.F wamodel.F wavemdl.F wposnam.F wvalloc.F
wvdealloc.F
Wam_setup/create_wam_library create_wamassi_library extract_WAMASSI_code
extract_WAM_code readme run_preproc run_preset run_wamodel
to_do_list_to_extract_wam
module/yowcoup.F yowcout.F yowcpbo.F yowfpbo.F yowgribhd.F yowintp.F yowmean.F yowstat.F
yowtabl.F yowunit.F yowwind.F
```

Files deleted(WAM):

```
Wam_oper/outubuf.F
```

module/yowcbou.F yowfbou.F

Files modified(SCRIPTS):

gen/ifstraj mknam_fp modeleps_nemo sstana

sms/wconst.sms

wav/archive_wave wam_input wave_bsdcol wave_create_bathymetry wave_getrst wave_getwave wave_getwind wave_set_config wave_set_tstep wave_setgflag

Giovanna De Chiara - dig_CY37R3_oscatmerge_test - ACTIVE

Changes to Oceansat-2 Scatterometer data processing

Expts: T511: test=fm4j, control=esuite branch=fm57

In CY37R3 the system was modified in order to extract, and assimilate, wind speed and direction from the Oceansat-2 Scatterometer L2B products delivered by the OSI-SAF. OSCAT assimilation was put under passive monitoring. Now a wind speed bias correction is applied to the L2B winds in order to compensate for the differences with the FG winds. Also a high speed threshold is applied to OSCAT winds: winds over 25m/s are rejected. Active assimilation will be achieved by a blacklist change.

Files created(SCAT):

oretrieve/read_speed_bias.F

Files modified(IFS):

module/yomthlim.F90 obs_preproc/fgwnd.F90 sufglim.F90

Files modified(SCAT):

module/oscat_wind.F oretrieve/invert_owind.F programs/oscat_filter.F

Files modified(SCRIPTS):

gen/getbias prescat

Kristian Mogensen - ne1_CY38_nemoforCY38R1

Preparation for integrated IFS/NEMO coupling

Source code of the NEMO model and a few minor changes to the IFS model to allow it to call NEMO via a regridding library (included in the NEMO code).

The output is attached. There is quite a lot of changes due to the inclusion of the NEMO model, but very few to the IFS code.

Files created(IFS):

module/yomnemo.F90

nemo/couplnemo.F90 getnemo.F90 ininemo.F90

setup/sudim1.F90.contrib sumpioh.F90.contrib

Files created(NEMO):

long-list

Files created(SCRIPTS):

sms/libnemocoup.sms libnemodummy.sms nemo_tools.sms

Files modified(IFS):
`adiab/cpg25.F90`
`climate/updclie.F90`
`control/cnt3.F90 cnt4.F90 gp_model.F90`
`module/disgrid_mod.F90 elbc0b_mod.F90 yoe_cuconvca.F90 yommcc.F90`
`namelist/nammcc.h`
`obs_preproc/mkglobstab.F90`
`op_obs/hjo.F90`
`setup/suctrl_gflattr.F90 sudim1.F90 sumcc.F90`
`utility/updtim.F90`

Files modified(SCRIPTS):
`build/findbin_mk.ksh`
`def/eps_nemo.def fc.def gen.def`
`gen/mkabs_an mkabs_fc`
`sms/p4setup.sms`

PROBABLISTIC FORECASTING

Martin Leutbecher - nel_CY37R3_papert

Accelerated generation of EPS initial conditions and scripts cleaning

Expts:T255 flsy, control=flsu, with EDA(control) test=flt1, control=flt0, with EDA(mean) test=flt3, control=flt2

The computation of the perturbed analyses in the EPS from the EDA now uses Fortran programs (comp_mean_pert.F90, scale_pert.F90 and add_pert.F90) instead of MARS. The generation of perturbed initial conditions using EDA and singular vectors has been accelerated. This has been achiev+ed through changes to the dependencies in family inigroup and the use of OpenMP parallelisation directives. In operations, the start time of the EPS forecasts should be at least three minutes earlier. In addition, the suite definition (eps_nemo.def) and the scripts have been cleaned.

Technical details

- Program `add_pert.F90` has two new options: With option `-a` (used for EDA), all fields in the perturbation file will be added to the respective fields in the control file. Without option `-a` (used for SVs), only temperature, vorticity, divergence and log(surface pressure) will be added. With option `-m`, the perturbation is subtracted instead of being added.
- The new program `comp_mean_pert.F90` computes the ensemble mean and the ensemble perturbations efficiently. Results do not depend on the order of the fields in the file. Previously, MARS has been used to compute the mean and the perturbations. The computation of the EDA perturbations has been moved from task trans_an to task eda_mean. The latter task does not need to wait for the high-resolution analysis while the former depends on it.
- OpenMP directives have been inserted into add_pert.F90, comp_mean_pert.F90, aev_norm.F90, sv_lin_combi.F90, svgg.F90. Tasks eda_mean and rot have been updated to permit the use of multiple threads.

It has been checked that the grib output files do not depend on the number of threads used.

- The SMS definition file has been optimized and cleaned. Only experiment type eps_nemo has been updated; support for experiment types eps_varfc and eps_fc is discontinued from CY38R1.
  1. Family get_eda_centre_ic has been split into families an (retrieval and interpolation of deterministic analysis) and get_eda (retrieval and interpolation of EDA analyses and computation of EDA mean and EDA perturbations).
  2. The part of the suite definition that deals with the EPS configuration that uses EDA perturbations has been merged with the part of the suite definitions that generates initial perturbations with singular vectors only. This removes a lot of duplicate parts from the suite definition file in family inigroup and should ease the maintenance of the suite in the future.
  3. Family persSST and tasks wavini, wcold, wavfcdata have been removed from the get_eda family as all data for waves and persisted SST anomalies is taken from the deterministic analysis.
  4. The generation of pairs of plus-minus-symmetric perturbed analyses in task trans_an has been replaced by two seperate tasks trans_an, one for each member. The SMS-variable LEDA_PERT_MINUS controls whether a perturbation is added (false) or subtracted (true). This change results in an acceleration and has the benefit that the plus-minus symmetry of the EDA perturbations is not hard-coded any more (switch LEDAPERT_PLUSMINUS).
  5. FSCALE can still be used to scale the perturbations if additionally EDAPERT_USE_FSCALE=true
  6. Variable N_AN_TRANS_METHOD has been removed. Now EDAPERT_USE_MEAN determines whether the EDA perturbations are computed using the EDA mean (true) or the EDA control (false). Variable RECENTRE determines whether the perturbations are added to the high resolution analysis (true) or the EDA mean (false).
- The directory containing the high-resolution analysis has been renamed from an_011 to an_centre. Variables INIEXPVERCON, INICLASSCON, INISTREAMCON and ININUMBERCON have been removed. If the EDA control is used, it is always assumed to be member number 0 of the experiment specified by INICLASSENDA, INIEXPVERENDA, INITYPEENDA.

Files created(PREPDATA):

`mc_tools/comp_mean_pert.F90 scale_pert.F90`

Files modified(PREPDATA):

`mc_tools/add_pert.F90 aev_norm.F90 sv_lin_combi.F90`

`module/svgg.F90`

Files modified(SCRIPTS):

`def/eps_nemo.def eps_varfc.def`

`gen/config_dep.h mkabs_mctools sample_svs`

`sms/check_edamemberok.sms eda_mean.sms geticp.sms getiniLeg.sms pertinic.sms rot.sms trans_an.sms`

Files deleted(SCRIPTS):

`def/eps_fc.def`

Martin Leutbecher, Pirkka Ollinaho, Peter Bechtold - nel_CY37R3_papert

Parameter perturbation

Expts: VarEPS T639/319 test=flu6, control=flqz

The branch allows EPS to be run with perturbed parameter values. Perturbations are done with program eppes_routine.F90 (run via gen_partpar sms-task) and the results are communicated to the model via namelists generated with gen_pertpar_nam.sms task.

When starting the perturbation run from the default parameter values the input files for eppes_routine (parameter values, standard deviation, physical bounds, and information about how well the default values are known) are generated with program eppes_ini_form.F90 run via ini_pertpar.sms task.

At each date, model forecasts done with perturbed parameter values are valued according to a set of arbitrary metrics defined in EPPES_costfunct.met (currently one of the 5 proposed metrics is chosen in gen_pertpar.sms but the user might define himself what are "good" and "bad" result model forecasts). These values are then used to update the distribution from which the perturbed parameters are drawn from. Finally a new set of parameters is drawn from this updated parameter distribution.

For the algorithm to work, no new date can be run before the forecasts of current date have been evaluated!

Technical details

- The new program `eppes_routine.F90` samples parameter values from given distribution. The input files needed are defined in eppesconf.nml. The program uses modules `eppes.F90` and `matutils.F90` (which in turn uses modules `mcmcprec.F90` and `mcmcrand.F90`).
- The new program `eppes_ini_form.F90` generates most of the input files needed by `eppes_routine.F90`. It contains the default values for 8 convection scheme parameters, 3 cloud scheme parameters and 4 radiation scheme parameters, and any number (and combination) of these parameters may be used for perturbation runs. The parameters to be perturbed can be chosen via prepIFS and are communicated to `eppes_ini_form.F90` via namelist.
- The SMS definition file has been modified to activate parameter perturbation only when it is switched on via prepIFS (LPARPERT in parampert). On default none of the sms-tasks related to parameter perturbation will be activated, i.e. the experiment is run as normal eps_nemo.

Files modified(IFS):

`module/yoecumf.F90`

`namelist/namcldp.h namcumf.h`

`phys_ec/cuascn.F90 radlswr.F90 sucumf.F90`

Files created(PREPDATA):

`programs/eppes.F90 eppes_ini_form.F90 eppes_nam_ini.h eppes_routine.F90 eppes_vars_ini.F90 eppes_version.h pf_routine.F90`

`module/lapack_inc.h matutils.F90 mcmcprec.F90 mcmcrand.F90`

Files modified(SCRIPTS):

`def/eps_nemo.def`

`gen/mkabs_prepdata modeleps modeleps_nemo`

Files created(SCRIPTS):

`gen/set_nam_pert_par_defaults.h`

`metview/EPPES_costfunct.met`

`sms/compute_pp_cost.sms eppes_logs.sms gen_pertpar.sms gen_pertpar_nam.sms ini_pertpar.sms`

Expts:T255 flsy, control=flsu, with EDA(control) test=flt1, control=flt0, with EDA(mean) test=flt3, control=flt2

Frederic Vitart - nec_CY37R3_for38r1

Tropical storm tracking

Expts: Changes only affect monthly forecasts

Just a few minor changes in scripts and prepdata.

- In prepdata, I have modified some tropical storm tracking fortran files to allow tracking in decadal runs.
- Fix a problem with post-processing rainfall weekly probabilities over desert areas
- In scripts, I have changed eps_nemo.def and added a new task prep_tcyc.sms to avoid crashed when 2 tcyc.sms tasks were running in parallel.

Files created(SCRIPTS):

`sms/prep_tcyc.sms`

Files modified(PREPDATA):

`programs/prob_perc.F90 signi.F90`

`tcyc/traj_atl.F90 traj_nin.F90 traj_shem.F90`

Files modified(SCRIPTS):

`def/eps_nemo.def`

`oce/storm`

Tim Stockdale - net_CY37R3_longrange_for_38r1

Bug-fix in an output routine of wam

There is no impact on anything except runs for which stream=MMSF (ie seasonal forecast). The bugfix is needed for the model to work correctly in this stream.

Files modified(WAM):

`Wam_oper/wstream_strg.F`

ODB+COPE

Anne Fouilloux - stf_CY38_Fix_odb_for_checker

Preparation for ODB Checker

Removed unused ODB columns as well as their corresponding MDB pointer in order to be able to use the new odb_checker tool.

To use the new odb_checker tool (available on your desktop only): (run in the root directory of your branch i.e. /var/tmp/tmpdir/stf/p4w/stf_CY38_bbbb)

```
export ODB_VERSION=CY37R3.001   (or setenv ODB_VERSION CY37R3.001)
use odb
odb_checker
```

If you get no output, it means your branch is OK and compliant with the ODB governance but if you have defined any unknown (not known from the ODB governance) ODB columns you will get messages such as:

```
Unknown column: track@aeolus_hdr Contact the ODB governance
odb_governance@lists.ecmwf.int
```

Any new ODB columns has to be approved by the ODB governance group prior to their utilization in IFS.

Files modified(IFS):

`common/yomdb_defs.h yomdb_vars.h`

Files modified(ODB):

`cma2odb/initmdb.F90`

Anne Fouilloux - stf_CY37R3_dynamic_library_for_blacklist

Introduction of dynamic libraries for the blacklists

This allows to remove the rebuild_ifs task: ifsMASTER is built only once with a dummy blacklist (in the bins family) and the appropriate blacklists are compiled in the an family. In addition some cleaning was done to remove obsolete odb2bufr conversion (was not working anymore since CY37R3).

Files created(SCRIPTS):

`build/Makefile.blackdummy Makefile.root.blackcompiler Makefile.root.blackdummy`
`sms/libblackcompiler.sms libblackdummy.sms`

Files modified(BL):

`compiler/bl95.c generate.c`

Files modified(IFS):

`common/yomdb_defs.h yomdb_vars.h`
`module/yommwave.F90`
`mwave/mwave_obsop_traj.F90`

Files modified(ODB):

```
bufr2odb/bufr2odb_205.F90 bufr2odb_aeolus.F90 bufr2odb_aircraft.F90
bufr2odb_airs.F90 bufr2odb_amsre_1d.F90 bufr2odb_ascat.F90 bufr2odb_atms.F90
bufr2odb_atovs.F90 bufr2odb_fy3.F90 bufr2odb_gch1.F90 bufr2odb_gch2.F90
bufr2odb_gch3.F90 bufr2odb_gch4.F90 bufr2odb_gch5.F90 bufr2odb_grad.F90
bufr2odb_iasi.F90 bufr2odb_iscat.F90 bufr2odb_meris.F90 bufr2odb_metar.F90
bufr2odb_modisaer.F90 bufr2odb_msg.F90 bufr2odb_mwri_1d.F90 bufr2odb_oscat.F90
bufr2odb_paob.F90 bufr2odb_pgps.F90 bufr2odb_qscat.F90 bufr2odb_radio.F90
bufr2odb_radio_lat_long.F90 bufr2odb_rain_rates.F90 bufr2odb_reo3.F90
```

bufr2odb_satob.F90 bufr2odb_scat.F90 bufr2odb_smos.F90 bufr2odb_snow.F90
bufr2odb_ssmi.F90 bufr2odb_ssmis_1d.F90 bufr2odb_synop.F90 bufr2odb_temp.F90
bufr2odb_tmi_1d.F90 bufr2odb_windprofiler.F90 bufr2odb_windsat.F90
get_varindex.F90

build/build_odb.functions

cma2odb/ctxinitdb.F90 getatdb.F90 initmdb.F90 map_reportype.F90 putatdb.F90
update_obsdb.F90

ddl/cma.h hdr.h type_definitions.h

module/varindex_module.F90

scripts/makefile makefile.small odbshuffle

Files modified(SCRIPTS):

build/Makefile.root.bl

def/an.def enkf.def fsobs.def gen.def

gen/get_exe mkabs_an mkabs_b2otools mkabs_black mkabs_obstat mkabs_ssa
ofb_generic.sql

sms/ifs.sms libs.sms

sms_an/b2otools.sms black.sms

Files deleted(BL):

compiler/muldefs.c

Files deleted(ODB):

bufr2odb/get_odb2bufr_varindex.F90 odb2bufr_dep_001.F90 odb2bufr_dep_021.F90
odb2bufr_dep_049.F90 odb2bufr_dep_054.F90 odb2bufr_dep_057.F90
odb2bufr_dep_059.F90 odb2bufr_dep_065.F90 odb2bufr_dep_082.F90
odb2bufr_dep_089.F90 odb2bufr_dep_091.F90 odb2bufr_dep_101.F90
odb2bufr_dep_110.F90 odb2bufr_dep_122.F90 odb2bufr_dep_127.F90
odb2bufr_dep_129.F90 odb2bufr_dep_135.F90 odb2bufr_dep_137.F90
odb2bufr_dep_139.F90 odb2bufr_dep_142.F90 odb2bufr_dep_156.F90
odb2bufr_dep_164.F90 odb2bufr_dep_189.F90 odb2bufr_dep_206.F90
odb2bufr_dep_240.F90 odb2bufr_dep_250.F90 odb2bufr_dep_250_displaced_data.F90
odb2bufr_fos_001.F90 odb2bufr_fos_021.F90 odb2bufr_fos_049.F90
odb2bufr_fos_054.F90 odb2bufr_fos_057.F90 odb2bufr_fos_059.F90
odb2bufr_fos_065.F90 odb2bufr_fos_082.F90 odb2bufr_fos_089.F90
odb2bufr_fos_091.F90 odb2bufr_fos_101.F90 odb2bufr_fos_110.F90
odb2bufr_fos_122.F90 odb2bufr_fos_127.F90 odb2bufr_fos_129.F90
odb2bufr_fos_135.F90 odb2bufr_fos_137.F90 odb2bufr_fos_139.F90
odb2bufr_fos_142.F90 odb2bufr_fos_156.F90 odb2bufr_fos_164.F90
odb2bufr_fos_189.F90 odb2bufr_fos_206.F90 odb2bufr_fos_240.F90
odb2bufr_fos_250.F90 odb2bufr_fos_250_displaced_data.F90 odb2bufr_qc_001.F90
odb2bufr_qc_021.F90 odb2bufr_qc_049.F90 odb2bufr_qc_054.F90 odb2bufr_qc_057.F90
odb2bufr_qc_059.F90 odb2bufr_qc_065.F90 odb2bufr_qc_082.F90 odb2bufr_qc_089.F90
odb2bufr_qc_091.F90 odb2bufr_qc_101.F90 odb2bufr_qc_110.F90 odb2bufr_qc_122.F90
odb2bufr_qc_127.F90 odb2bufr_qc_129.F90 odb2bufr_qc_135.F90 odb2bufr_qc_137.F90
odb2bufr_qc_139.F90 odb2bufr_qc_142.F90 odb2bufr_qc_156.F90 odb2bufr_qc_164.F90
odb2bufr_qc_189.F90 odb2bufr_qc_206.F90 odb2bufr_qc_240.F90 odb2bufr_qc_250.F90
odb2bufr_qc_250_displaced_data.F90 odb2bufr_summary.F90
odb2bufr_summary_displaced_data.F90

ddl.ECMA/bufrdata_presence.sql fb_getatovs_pred.sql fb_getbody.sql
fb_getbufr.sql fb_geterrstat.sql fb_gethdr.sql fb_getresat.sql fb_getsatob.sql
fb_getscatt.sql fb_getscatt_body.sql fb_gettypes.sql fb_getupdate_1.sql
fb_getupdate_10.sql fb_getupdate_2.sql fb_getupdate_3.sql fb_getupdate_4.sql

fb_getupdate_5.sql fb_getupdate_6.sql fb_getupdate_7.sql fb_getupdate_8.sql fb_getupdate_9.sql

ddl/bufrdata_presence.sql fb_getatovs_pred.sql fb_getbody.sql fb_getbufr.sql fb_geterrstat.sql fb_gethdr.sql fb_getresat.sql fb_getsatob.sql fb_getscatt.sql fb_getscatt_body.sql fb_gettypes.sql fb_gettypes_sat.sql fb_getupdate_1.sql fb_getupdate_10.sql fb_getupdate_2.sql fb_getupdate_3.sql fb_getupdate_4.sql fb_getupdate_5.sql fb_getupdate_6.sql fb_getupdate_7.sql fb_getupdate_8.sql fb_getupdate_9.sql fetchbufr.sql

module/bufr_module1.F90 odb2bufr_varindex_module.F90

tools/Fbnew2old.F90 Odb2bufr.F90

Files deleted(SCRIPTS):

gen/odb2bufr

sms_an/feedback.sms o2b_aeolus.sms o2b_airs.sms o2b_amsre.sms o2b_amsua.sms o2b_amsub.sms o2b_conv.sms o2b_geos.sms o2b_gpsro.sms o2b_hirs.sms o2b_iasi.sms o2b_meris.sms o2b_mhs.sms o2b_msu.sms o2b_nexrad.sms o2b_resat.sms o2b_resatak.sms o2b_satob.sms o2b_scatt.sms o2b_ssmi.sms o2b_ssmis.sms o2b_ssu.sms o2b_surf_conv.sms o2b_tmi.sms o2b_vtpr1.sms o2b_vtpr2.sms o2b_windsat.sms odb2bufr.sms odb_prepare.sms

Anne Fouilloux - stf_SB37R3_COPE_v2

Clean ODB flags in preparation for COPE

remove unused bitfields from events and status ODB flags. In the framework of the COPE project status and event flags will have to be re-think (and extended). As a first step, we reviewed (both internally and with Météo-France) the current list of status and events and removed unused bitfields. It also contains up-to date ODB governance map_reportype (SURFCONV group has been removed and as a consequence there is no snow data in ODBs)

Files modified(IFS):

function/fcobs.h

gbrad/gbrad_put.F90

module/yomnmev.F90

mwave/mwave_put.F90 mwave_put_tl.F90

obs_preproc/addoer.F90 ascatin.F90 black.F90 dribuin.F90 dupli.F90 dupli_no_sq.F90 dwlin.F90 ersin.F90 fgchk.F90 fgwnd.F90 flgdco.F90 gefger.F90 lndsyin.F90 new_thinn_rad_reflec.F90 new_thinn_radar.F90 new_thinner.F90 new_thinner_no_sq.F90 oscatin.F90 paobin.F90 pilotin.F90 post_thinner.F90 prech.F90 qscatin.F90 redmo.F90 redprof.F90 redrp.F90 redrp1.F90 redrp1_no_sq.F90 redrp_no_sq.F90 redsl.F90 redts.F90 rejmv.F90 repra.F90 scaqc.F90 selec.F90 shipin.F90 tempin.F90 upecma.F90 verco.F90

op_obs/amv_oberr.F90 exheiz2p.F90 hjo.F90 hoptl.F90 hretr.F90 rtl_screen.F90

setup/su_events.F90

smos/smos_update.F90

var/gp_ssmi_inv.F90 setqccma.F90

Files modified(ODB):

cma2odb/map_reportype.F90

ddl/type_definitions.h

Files modified(SCRIPTS):

`def/an.def`

Anne Fouilloux - stf_SB37R3_MARS_archive

ODB MARS archive

- Archive ODBs in marsrd instead of marsodb [dev] for all RD experiments.
- remove the possibility to store ECMAs in ECFS and allow users to choose which MARS observation group to archive for OFB (as before with ECMAs in ECFS)
- Delete obsolete scripts/sms tasks
- Update map reportype to the last ODB governance
- Clean the way we set-up the ODB in our scripts/prepIFS (preparation for COPE): this is now done like for any standard library such as grib-api; with the possibility to set the ODB version (odb-1 and odb-2) in prepIFS. (Gabor: when you merge other branches, you have to be careful not to re-introduce any "module load odb" or use odb in any scripts).

Files modified(IFS):

`control/scan2mad.F90`
`module/yommwave.F90`
`mwave/mwave_obsop_traj.F90`
`obs_preproc/new_thinn.F90`
`var/sujbwavtrans.F90`

Files modified(IFSAUX):

`module/grib_api_interface.F90`

Files modified(ODB):

`bufr2odb/bufr2odb_205.F90 bufr2odb_aeolus.F90 bufr2odb_aircraft.F90 bufr2odb_airs.F90 bufr2odb_amsre_1d.F90 bufr2odb_ascat.F90 bufr2odb_atms.F90 bufr2odb_atovs.F90 bufr2odb_fy3.F90 bufr2odb_gch1.F90 bufr2odb_gch2.F90 bufr2odb_gch3.F90 bufr2odb_gch4.F90 bufr2odb_gch5.F90 bufr2odb_grad.F90 bufr2odb_iasi.F90 bufr2odb_iscat.F90 bufr2odb_meris.F90 bufr2odb_metar.F90 bufr2odb_modisaer.F90 bufr2odb_msg.F90 bufr2odb_mwri_1d.F90 bufr2odb_oscat.F90 bufr2odb_paob.F90 bufr2odb_pgps.F90 bufr2odb_qscat.F90 bufr2odb_radio.F90 bufr2odb_radio_lat_long.F90 bufr2odb_rain_rates.F90 bufr2odb_reo3.F90 bufr2odb_satob.F90 bufr2odb_scat.F90 bufr2odb_smos.F90 bufr2odb_snow.F90 bufr2odb_ssmi.F90 bufr2odb_ssmis_1d.F90 bufr2odb_synop.F90 bufr2odb_temp.F90 bufr2odb_tmi_1d.F90 bufr2odb_windprofiler.F90 bufr2odb_windsat.F90`
`cma2odb/map_reportype.F90`
`ddl/pre_thinn_robhdr_4.sql pre_thinn_robhdr_5.sql pre_thinn_robhdr_9.sql pre_thinn_robody_2.sql pre_thinn_robody_3.sql pre_thinn_robody_4.sql pre_thinn_robody_5.sql pre_thinn_robody_9.sql`
`scripts/bufr2odb`

Files modified(SCRIPTS):

```
def/an.def enkf.def fsobs.def
gen/aeolus_l2c_getodb archive_obs archive_obsgroup bufr2odb convert_mondb
convert_obsgroup fdbksave fetchmars getgrbe getini ifstraj mergeodb mkabs_obstat
model modeleps_nemo mondb.sql mondb_allsky.sql mondb_conv.sql mondb_gbrad.sql
mondb_geos.sql mondb_gpsro.sql mondb_hirs.sql mondb_meris.sql mondb_resat.sql
mondb_resatak.sql mondb_sat.sql mondb_satob.sql mondb_tovs.sql obstat
odb_cracker_aeolus_auxmet odbmerge ofb_airs.sql ofb_allsky.sql ofb_conv.sql
ofb_gbrad.sql ofb_generic.sql ofb_geos.sql ofb_hirs.sql ofb_iasi.sql
ofb_iras.sql ofb_meris.sql ofb_resat.sql ofb_resatak.sql ofb_satob.sql
ofb_tovs.sql sstana update_psbias update_rstrhbias
sms_an/4dvar.sms bufr2odb.sms convert_obsgroup.sms mergeodb.sms pobstat.sms
wav/wave_getrst
```

Files deleted(SCRIPTS):

```
gen/addsql feedback matchup matchupsink mkabs_odbsql odb_compress odbsql
revmatchup
sms_an/addsql.sms feedback.sms matchup.sms odb_prepare.sms odbsql.sms revmatchup.sms
```

Anne Fouilloux and Saleh Abdalla - stf_SB37R3_WAVE_COPE

Preliminary work for the use of ODB for WAVE model

Introduction of ODB for the WAVE model.

- For now, the wave model does not make fully use of ODB but ODB is used to store some feedback information. ODB feedbacks are not stored in MARS yet because the MARS group needs to decide whether we need to define a new stream (specific for wave); this will be answered later as part of the ODB governance. ODB feedbacks are saved in ecfs.
- A MARS group (WAVE integrated Parameters), new obstype (obstype=12) and codetype (codetype=123) have been introduced. The corresponding reportypes have been defined and approved by the ODB governance (see http://data-portal.ecmwf.int/odbgov/FullReportType)
- There is no bufr2odb for WAVE data. The original BUFR is decoded and quality controlled as well as superobbing is applied. An ODB-2 file is created and from it an ODB-1 ECMA.ralt is created to be used in IFS.
- This branch contains a fix in order to ignore the ENVISAT altimeter rain flag which contains wrong information. The wrong information is responsible for the rejection of about 1-5% of valid ENIVSAT RA2 data if the rain flag is used.
- This branch also contains a proper fix (a merge problem occurred in CY37R3 and was spotted only recently) for some allsky observations (tmi and ssmis) in bufr2odb (a separate fix has been given for the current operational cycle CY37R3) to make sure we keep radiances only (varno=119).
- This branch also contains a fix for an_sens_obs. The content of this ODB column is updated in the analysis and stored in CCMA but has never been properly reported to ECMA. The change made in CY37R3 where we make use of ECMAs only highlighted this problem (an_sens_obs was never kept and archived in MARS). This change does not affect the current operational runs (because we do not compute an_sens_obs in operation).

- We changed ODB2_VERSION from 0.9.6 to 0.9.7 (this new version contains an important fix, necessary for the WAVE group).

Files created(COPE):

```
Long list
```

Files created(ODB):

```
ddl.ECMA/init_update_1.sql init_update_2.sql init_update_3.sql ralt.sql
ralt_wam.sql
ddl/init_update_1.sql init_update_2.sql init_update_3.sql ralt.sql ralt_wam.sql
include/bufr2odb.h
module/odbi.F90
tools/Bufr_to_odb.F90 Odb2_to_Odb1.F90
```

Files created(SCRIPTS):

```
build/Makefile.root.cope
gen/mkabs_cope mondb_groupid=38.sql mondb_groupid=39.sql mondb_ralt.sql odb1odb2
odb2odb1 ofb_groupid=38.sql ofb_groupid=39.sql ofb_ralt.sql
sms/copetools.sms libcope.sms
sms_an/archive_ralt.sms b2o_ralt.sms convert_ralt.sms cope_conv.sms cope_obsgroup.sms
ec2o_ralt.sms odb1odb2.sms odb1odb2_conv.sms odb2odb1.sms odb2odb1_conv.sms odb2odb1_-
ralt.sms
```

Files created(WAM):

```
Wam_oper/altas.F90 combine_odb_txt.F grfield.F90 rfl4wam.F90
```

Files modified(IFS):

```
control/scan2mad.F90
module/pardimo.F90 yomcmddr.F90 yomcoctp.F90 yommkodb.F90 yommwave.F90
mwave/mwave_obsop_traj.F90
obs_error/fixerr.F90 suobserr.F90
obs_preproc/blackhat.F90 conventional_ob.F90 defrun.F90 dribuin.F90 lndsyin.F90
new_thinn.F90 obinstp.F90 readoba.F90 shipin.F90 suobs.F90 synopin.F90
op_obs/mpobseqad_unpck.F90
setup/cmoctmap.F90 su_events.F90 sucmad1.F90 sucmahop.F90 sucmbdtp.F90
suvnmb.F90
var/ecset.F90 ecset_thsafe.F90 sujbwavtrans.F90
```

Files modified(IFSAUX):

```
module/grib_api_interface.F90
```

Files modified(ODB):

```
cma2odb/ctxinitdb.F90 init_odb_tables.F90 initmdb.F90 map_reportype.F90
update_obsdb.F90
ddl/black_robhdr_1.sql black_robody_1.sql obstype.h pre_thinn_robhdr_4.sql
pre_thinn_robhdr_5.sql pre_thinn_robhdr_9.sql pre_thinn_robody_2.sql
pre_thinn_robody_3.sql pre_thinn_robody_4.sql pre_thinn_robody_5.sql
pre_thinn_robody_9.sql varno.h
module/getval_module.F90 varindex_module.F90
tools/Bufr2odb.F90
```

Files modified(SCRIPTS):

build/Makefile Makefile.root.odb Makefile.root.odbmain Makefile.root.odbport Makefile.root.wam arch/Makefile.in.ibm_power5 arch/Makefile.in.ibm_power6 arch/Makefile.in.p690 perl/dependanal.pl

def/an.def enkf.def fsobs.def gen.def wam.def

gen/aeolus_l2c_getodb archive_obsgroup bufr2odb convert_mondb convert_obsgroup create_ioassign fdbksave fetchmars fetchobs getgrbe getini ifstraj mkabs_b2otools mkabs_obstat mkabs_odbtools mkabs_wam model modeleps_nemo mondb.sql mondb_allsky.sql mondb_conv.sql mondb_gbrad.sql mondb_geos.sql mondb_gpsro.sql mondb_hirs.sql mondb_meris.sql mondb_resat.sql mondb_resatak.sql mondb_sat.sql mondb_satob.sql mondb_tovs.sql obstat odb_cracker_aeolus_auxmet odbmerge ofb_airs.sql ofb_allsky.sql ofb_conv.sql ofb_gbrad.sql ofb_generic.sql ofb_geos.sql ofb_hirs.sql ofb_iasi.sql ofb_iras.sql ofb_meris.sql ofb_resat.sql ofb_resatak.sql ofb_satob.sql ofb_tovs.sql p4_mklib preobs sstana update_psbias update_rstrhbias

sms/libs.sms

sms_an/bufr2odb.sms convert_obsgroup.sms mergeodb.sms pobstat.sms

wav/wam_input wave_data_dates wave_getrst wave_run wave_setup_3v wave_setup_4v wave_-setup_an

Files modified(WAM):

Alt/uraqrd.F

Wam_oper/grdata.F mpuserin.F userin.F

module/yowaltas.F

Files deleted(OBSTAT):

module/odb_c_binding.F90

Files deleted(SCRIPTS):

sms_an/odb_prepare.sms

Files deleted(WAM):

Wam_oper/altas.F grfield.F rfl4wam.F

Tomas Kral - datk_CY37R3_cope_aeolus

Observation preprocessing bug-fixes

Expts: T511 test=fjjc, control=fim7

Collection of bug-fixes related to observation preprocessing. Includes bug-fix for Huber observation error statistics (suobs.F90, suobserr.F90, defrun.F90), uninitialized 'ppcode' values of passive observations (shipin.F90, lndsyin.F90), mixup of ship speed and ship direction (shipin.F90), fix for interpolation of observation errors in case of missing vertical coordinate (fixerr.F90, dribuin.F90). *Files modified(IFS):*

obs_error/fixerr.F90 suobserr.F90 obs_preproc/conventional_ob.F90 defrun.F90 dribuin.F90 lndsyin.F90 shipin.F90 suobs.F90 synopin.F90

Tomas Kral - datk_CY37R3_cope_aeolus

Preprocessing of conventional observations using the COPE framework

Expts: T511 test=flgh, control=flgg

Introduction of the new COPE project with the aim to externalize observation processing from the core of IFS into a separate standalone library. Allows preprocessing of conventional observations outside IFS. Also includes tools to convert between ODB-1 and ODB-2 formats and modifications in the compilation and linking scripts allowing to build C++ sources.

Files created(COPE):
`Complete new library`

Files created(ODB):
`ddl.ECMA/init_update_1.sql init_update_2.sql init_update_3.sql`
`ddl/init_update_1.sql init_update_2.sql init_update_3.sql`
`module/odbi.F90`
`tools/Table_tree.F90`

Files created(SCRIPTS):
`build/Makefile.root.cope`
`gen/mkabs_cope odb1odb2 odb2odb1`
`sms/copetools.sms libcope.sms`
`sms_an/cope_conv.sms cope_obsgroup.sms odb1odb2.sms odb1odb2_conv.sms odb2odb1.sms odb2odb1_conv.sms`

Files modified(IFS):
`obs_error/fixerr.F90 suobserr.F90`
`obs_preproc/conventional_ob.F90 defrun.F90 dribuin.F90 lndsyin.F90 shipin.F90 suobs.F90 synopin.F90`

Files modified(ODB):
`cma2odb/ctxinitdb.F90 init_odb_tables.F90 update_obsdb.F90`

Files modified(SCRIPTS):
`build/Makefile Makefile.root.odb Makefile.root.odbmain Makefile.root.odbport arch/Makefile.in.ibm_power5 arch/Makefile.in.ibm_power6 arch/Makefile.in.p690 perl/dependanal.pl`
`def/an.def gen.def`
`gen/ifstraj mkabs_obstat mkabs_odbtools p4_mklib`
`sms/libs.sms`
`sms_an/mergeodb.sms`

Files deleted(COPE): `dummy`

Michael Rennie - datk_CY37R3_cope_aeolus

Aeolus processing under COPE

Further technical development (no meteorological impact) for Aeolus processing by moving tasks to COPE.

AEOLUS: Upgrade to L2B processor v2.00. Many modifications for continuous mode data.

SCRIPTS: A rearrangement of Aeolus processing tasks from lag to cope. New task to run ifstraj in the Aeolus processing as needed to produce the AUX_MET data.

IFS: Some tidying of Aeolus code.

Files modified(AEOLUS):

`Many changes with the upgrade to L2BP v2.00`

Files modified(SCRIPTS):

`def/an.def gen/ifstraj aeolus_auxmet aeolus_l2b mkabs_aeolus fetchorbpre gtt gtt2simulobs_preproc`

`build/Makefile.root.aeolus`

Files modified(IFS):

`op_obs/hretr.F90 hretr_aeolus.F90 module/aeolus_l2bp_wrapper_mod.F90`

Files added(SCRIPTS):

`sms_an/Aeolus_AMD_ifstraj.sms aeolus_l2c.sms L2BEEtoODB.sms gen/aeolus_l2c l2b_ee_to_odb`

SCRIPTS

Gabor Radnoti - dag_CY37R3_esuite

Esuite branch

- Some bit-reproducible technical contributions, fixes related to odb mars archiving, cleanings;
- Alan Geer's elimination of erroneously large T-increments in the SH oceanic cold-air outbreaks by applying TCWV thresholds to usage of allsky microwave imager data.
- Fixing bug related to mixture of EDA-based upper air error fields and randomization based radiance space error fields. Bug affected non-operational resolution runs. Its effect was to use uninitialized background error limits in first guess check for radiances.
- Fixes effecting T42 debug mode runs

Files modified(IFS):

`control/scan2mad.F90`
`module/yommwave.F90`
`mwave/mwave_obsop_traj.F90`
`obs_preproc/new_thinn.F90`
`var/sujbwavtrans.F90`

Files modified(IFSAUX):

`module/grib_api_interface.F90`

Files modified(ODB):

`bufr2odb/bufr2odb_205.F90 bufr2odb_aeolus.F90 bufr2odb_aircraft.F90 bufr2odb_airs.F90 bufr2odb_amsre_1d.F90 bufr2odb_ascat.F90 bufr2odb_atms.F90 bufr2odb_atovs.F90 bufr2odb_fy3.F90 bufr2odb_gch1.F90 bufr2odb_gch2.F90 bufr2odb_gch3.F90 bufr2odb_gch4.F90 bufr2odb_gch5.F90 bufr2odb_grad.F90 bufr2odb_iasi.F90 bufr2odb_iscat.F90 bufr2odb_meris.F90 bufr2odb_metar.F90`

bufr2odb_modisaer.F90 bufr2odb_msg.F90 bufr2odb_mwri_1d.F90 bufr2odb_oscat.F90 bufr2odb_paob.F90 bufr2odb_pgps.F90 bufr2odb_qscat.F90 bufr2odb_radio.F90 bufr2odb_radio_lat_long.F90 bufr2odb_rain_rates.F90 bufr2odb_reo3.F90 bufr2odb_satob.F90 bufr2odb_scat.F90 bufr2odb_smos.F90 bufr2odb_snow.F90 bufr2odb_ssmi.F90 bufr2odb_ssmis_1d.F90 bufr2odb_synop.F90 bufr2odb_temp.F90 bufr2odb_tmi_1d.F90 bufr2odb_windprofiler.F90 bufr2odb_windsat.F90

cma2odb/map_reportype.F90

ddl/pre_thinn_robhdr_4.sql pre_thinn_robhdr_5.sql pre_thinn_robhdr_9.sql pre_thinn_robody_2.sql pre_thinn_robody_3.sql pre_thinn_robody_4.sql pre_thinn_robody_5.sql pre_thinn_robody_9.sql

Files modified(SCRIPTS):

def/an.def

gen/bufr2odb fetchmars getgrbe getini ifstraj model modeleps_nemo mondb.sql mondb_allsky.sql mondb_conv.sql mondb_gbrad.sql mondb_geos.sql mondb_gpsro.sql mondb_hirs.sql mondb_meris.sql mondb_resat.sql mondb_resatak.sql mondb_sat.sql mondb_satob.sql mondb_tovs.sql ofb_airs.sql ofb_allsky.sql ofb_conv.sql ofb_gbrad.sql ofb_generic.sql ofb_geos.sql ofb_hirs.sql ofb_iasi.sql ofb_iras.sql ofb_meris.sql ofb_resat.sql ofb_resatak.sql ofb_satob.sql ofb_tovs.sql sstana update_psbias update_rstrhbias

sms_an/bufr2odb.sms

wav/wave_getrst

TECHNICAL, CLEANING and pre-OOPS

George Mozdzynski - mpm_CY37R3_hoslinterp

Support for higher order semi-Lagrangian interpolation

This is enabled by a new namelist (namdim) variable NSTENCILWIDE (default=2), which controls the maximum stencil requirement for semi-Lagrangian interpolation. With a value of 2, this is exactly the same as used in 37R3, providing bit identical results for model and 4D-Var experiments. In the latitudinal direction this equates to 1 grid point to the west and 2 to the east, unchanged from the 37R3 control.

The only other acceptable setting for NSTENCILWIDE (today) is 3. In the latitudinal direction this supports 2 westerly points and 3 easterly points. With a NSTENCILWIDE setting of 3, again bit identical results are achieved for model runs, for the existing interpolation methods used in 37R3. For 4D-Var, and using NSTENCILWIDE=3, this will now give different results, as some latitudes in the halo region for some tasks will now be complete latitudes resulting in different ORDER of summations compared to partial latitudes where adjoint summations are performed within SLCOMM2. Of course, when using LREPRO4DVAR=T and NSTENCILWIDE=3, bit identical results (compared with 37R3 controls) are achieved for 4D-Var experiments.

Some more technical bits.

- LASCAW and LASCAWTL on-demand MASKs are now completly recorded in these routines (no more setting of mask values 2, 4 and updating in SLCOMM2A).
- LNEW_MASK_SL optimisation removed.
- Masks MASK_SL2A, MASK_SL3, MASK_SL2AT and MASK_SL3T removed. These changes were

required primarily to provide support for future higher order interpolation methods (Sylvie/Karim), and in the process improve maintainability in this code area.

Files created(IFS):

```
parallel/check_sl_struct.F90
```

Files modified(IFS):

```
adiab/call_sl.F90 call_sl_ad.F90 call_sl_tl.F90 lascaw.F90 lascawtl.F90
rdscaw.F90
control/cnt0.F90
module/eint_mod.F90 yomct0.F90 yomdim.F90 yommask.F90 yommp.F90 yomslrep.F90
namelist/namdim.h nampar1.h
parallel/slcomm2.F90 slcomm2a.F90 slcset.F90 slextpol.F90 slextpolad.F90
phys_radi/suecrad.F90
prism/couplo4_inimpi.F90
programs/master.F90
setup/sudim1.F90 sudim2.F90 sump0.F90 suslad1.F90 suslb.F90
```

George Mozdzynski - mpm_CY37R3_sldebug

Debugging aids

Diagnostics have been added to aid debugging of Semi-Lagrangian halos. These diagnostics and extra data structures required by these diagnostics are enabled under a new namelist switch in NAMPAR1 called LSLDEBUG (default=FALSE). When LSLDEBUG is set to TRUE, code is executed to calculate how close to the halo edge grid columns are being used in all instances of active halos. The reported diagnostics are both in terms of grid points on the latitude closest to the halo edge and separately the geographic distance in KM. This branch is a technical branch and produces bit identical results to 37R3 controls. It has been tested for both model and 4D-Var configurations at T159 and T1279. It has also been tested with LREPRO4DVAR=T.

Files created(IFS):

```
parallel/check_sl_struct.F90
```

Files modified(IFS):

```
control/cnt0.F90
module/eint_mod.F90 yommp.F90 yomslrep.F90
namelist/nampar1.h
parallel/slcomm2.F90 slcomm2a.F90 slcset.F90 slextpol.F90 slextpolad.F90
setup/sump0.F90 suslad1.F90
```

George Mozdzynski - mpm_CY37R3_remove_noopt

Removes IBM @PROCESS NOOPTIMIZE directives

This branch removes IBM @PROCESS NOOPTIMIZE directives and similar directives for other compilers for the routines where data files are now being used to read data where previously IFS had some 600K assignment statements.

Files modified(IFS):

phys_ec/su_ghgclim.F90

phys_radi/rrtm_kgb1.F90 rrtm_kgb10.F90 rrtm_kgb11.F90 rrtm_kgb12.F90 rrtm_kgb13.F90 rrtm_kgb14.F90 rrtm_kgb15.F90 rrtm_kgb16.F90 rrtm_kgb2.F90 rrtm_kgb3.F90 rrtm_kgb4.F90 rrtm_kgb5.F90 rrtm_kgb6.F90 rrtm_kgb7.F90 rrtm_kgb8.F90 rrtm_kgb9.F90 srtm_kgb16.F90 srtm_kgb17.F90 srtm_kgb18.F90 srtm_kgb19.F90 srtm_kgb20.F90 srtm_kgb21.F90 srtm_kgb22.F90 srtm_kgb23.F90 srtm_kgb24.F90 srtm_kgb25.F90 srtm_kgb26.F90 srtm_kgb27.F90 srtm_kgb28.F90 srtm_kgb29.F90 su_c11clim.F90 su_c12clim.F90 su_c22clim.F90 su_ccl4clim.F90 su_ch4clim.F90 su_co2clim.F90 su_gch4clim.F90 su_gco2clim.F90 su_gozoclim.F90 su_mcica.F90 su_n2oclim.F90 su_no2clim.F90 su_ozoclim.F90 suecozc.F90

George Mozdzynski and Peter Towers - mpm_CY37R3_raps_fixes

Fixes for RAPS12

Minor corrections found during the preparation of the RAPS12 IFS benchmark. lwcad.F90 - fix SEGV on Linux cluster by lowering Intel compiler optimisation (compiler comment directive must appear after subroutine statement). Replace REAL :: NPARAM_COMP by INTEGER :: NPARAM_COMP.

Files modified(IFS):

module/varbc_eval.F90 phys_radi/lwcad.F90

John Hague - ibj_CY37R3_newbind

Update to jfh_bind

John Hague - ibj_CY37R3_stack_overwrite

Check for stack overwriting

Tomas Wilhelmsson - nat_CY37R3_shape

Improvement for POINTERs

Branch nat_CY37R3_shape reverts assumed shape array section arguments which was introduced by nat_CY37R2_oops as the arguments had gained the POINTER attribute. This caused problems with the NEC compiler at Mto-France, and may possibly generate unnecessary copying of the array arguments with other compilers. The affected arrays are now passed from the routine above, becoming standard non-pointer arrays, so that the original Fortran 77 style of passing the array sections can be used again.

Files created(IFS):

phys_ec/ec_phys_drv_ad.F90 ec_phys_drv_tl.F90

Files modified(IFS):

adiab/call_sl.F90 call_sl_tl.F90 cpg.F90 cpg_end.F90 cpg_gp.F90 cpgad.F90 cpglag.F90 cpglagad.F90 cpglagtl.F90 cpgtl.F90

```
control/gp_model.F90 gp_model_ad.F90 gp_model_tl.F90 scan2h.F90 scan2m.F90
fullpos/cpclimi.F90 hpos.F90 sufpsuw.F90 vpos.F90
phys_ec/ec_phys_drv.F90
var/rdfpinc.F90 symtransin.F90
```

Tomas Wilhelmsson - nat_CY37R3_grib2_fixes

Provide better support for GRIB2

- Update prepdata/programs/vod2uv.F90 to support GRIB2.
- Replace GRIBEX with GRIB_API in prepdata/programs/uvtovod.F90 for GRIB2 support.
- Introduce GRIB2 output for new surface fields with with paramId $>$ 256000.
- Remove unused arguments from some routines in ifs/dia and ifs/fullpos.

The branch is not bit-reproducible as GRIB packing differs slightly between GRIBEX and GRIB_API.

Files modified(IFS):

```
dia/preset_grib_template.F90 wrmlppg.F90 wrmlpplg.F90 wroutgpgb.F90
fullpos/wrmlfp.F90 wrmlfpl.F90 wrplfp.F90 wrpvlfp.F90 wrthlfp.F90
module/iostream_mix.F90
setup/su_grib_api.F90
```

Files modified(PREPDATA):

```
programs/uvtovod.F90 vod2uv.F90
```

Tomas Wilhelmsson - nat_CY37R3_rttov

Convert the mie-tables from ASCII to binary format

The new version has a similar calling sequence to RTTOV's other conversion tool rttov_conv_coef:

```
rttov_ascii2bin_scattcoef.x --coef-in mietable_fy3_mwri.dat  \
             --coef-out mietable_fy3_mwri.bin
```

Files modified(SATRAD):

```
programs/rttov_ascii2bin_scattcoef.F90 rttov/coef_io/rttov_opencoeff.F90
rttov/mw_scatt/rttov_read_scattcoeffs.F90
```

Tomas Wilhelmsson - nat_SB38_NEW_clean and nat_CY38R1_clean

Code cleaning

This branch provides some code cleaning as suggested in Karim Yessad's document "Proposal of cleanings in Arpege/IFS in 2011-2012", version 7d.

- Appendix E: inconsistencies between namelist naming and module naming:

  * Rename modules YOMIASI to YOMCLDDET, YOMGRB to YOMGRIB, YOMMODEL_ERROR to YOMMODERR, YOMNMIA to YOMNMI, YOMOP to YOMOPH, YOMTVRAD to YOMSATS, and YOMTRSL to YOMVWRK.

  * Rename namelists NAMJO to NAMCOSJO and COLUD_DETECT_COEFFS to NAMCLDDET.

  * Rename files in odb/include; nammatchup.h to nam_matchup.h, namsort.h to nam_sort.h, namstdin.h to nam_stdin.h and namwt.h to nam_wt.h.

- Appendix G: Obsolete variables in arp/module.

  * From PARCMA remove JPMXGICL, JPMXGRCL, JPMXICRL, JPMXICHL, JPMXICBL, JPMXICDL, JPMXOCRL, JPMXOCHL, JPMXOCBL, JPMXOCDL, JPMXDEPL, JPMXLID, JPMXRDF, JPMXDDF, JPMXADF, JPMXSSCH, JPMXTRCH and JPMXCMA.

  * From PARDIMO remove JPXDEP, JPUPD and JPXDEL.

  * From PARERSCA remove JPERS1, JPERS2, JPQBODYS0, and JPIBODYS0.

  * From PARFPOS remove JPPOSLIS.

  * Remove module YOMGEMS.

  * From YOMVAREPS remove NRES_MA and NRES_MB.

  * From YOMDB remove NPOOLS_CCMA, NPOOLS_ECMA and NPOOLS_ECMASCR.

  * From YOMONEDVAR remove RCOR_R, RLIMIT_RR and RLIMIT_LS.

  * From YOMSCREE remove NGLSHI, NGLAIR, NGLDRI, NGLTOV, NGLGEO, NGLSSM, NGLSAT, NGLSAM, NCDYTL, NCDSTL, NCDATL, NCDDTL, NCDTTL, NCDGTL, NCDITL, NCDWTL, NCDWMTL, and NA1DQS.

  * From ELBC0A_MOD remove NBICOQ.

- Appendix I: Modules which can be gathered with other ones

  * Remove YOMGEMS. It contained NCO2SFC which is not used.

  * Remove YOMMUL. It contained N which is moved to YOMNMIB and renamed NMNV.

  * Remove PARLVLY. It contained JPMXSTLV and JPMXLAYE which is moved to YOMLVLY.

  * Remove YOMVFP. It contained LSPINT which has been moved to YOMVAR. Correspondingly NAMVFL is removed and LSPINT moved to NAMVAR.

  * Remove YOMCT0B. It contained LECMWF which is moved to YOMCT0.

  * Remove YOMALIM. It contained NFLLIM which is moved to YOMSCREE.

  * Remove YDUALM_TKE. It contained RCCSTAT which is made a local to VDFHGHNHL.

  * Remove YOMTLEVOL. It contained LTLEVOL which is moved to YOEPHLI. Correspondingly namelist NAMTLEVOL is renamed NAEPHLI.

- Appendix L: Routines having unused arguments

  * Remove unused arguents from routines POSTPHY, CPPHDDHE, CUMCOE, PTENDCOR, SETCOMOD, SLCOMM2A, EC_PHYS, HELDSUAREZ, RADOZV, EMPTB, FILLB, and OPDIS.

  * Fix intent for arguments in routines AMV_OBERR and MOPITT_AK_OP.

Files modified(IFS):

adiab/call_sl.F90 call_sl_ad.F90 call_sl_tl.F90 cpg2.F90 cpg25.F90 cpg2tl.F90
cpg5.F90 cpg_dyn.F90 cpg_dyn_tl.F90 gprh.F90 gprh_2d.F90 gprhad.F90 gprhtl.F90
lacdynshwtl.F90 postphy.F90 c9xx/cseaice.F90 csstbld.F90 canari/caeincw.F90
caissedm.F90 calice.F90 canife.F90 caohis.F90 climate/updcli.F90 updclie_aer.F90
updclie_co2.F90 control/adjotest.F90 cdsta.F90 cfcsens2obs.F90 cgr1.F90 cnmi.F90
cnmiad.F90 cnmitl.F90 cnt0.F90 cnt1.F90 cnt2.F90 cnt3.F90 cnt3ad.F90 cnt3tl.F90
cnt4.F90 cnt4ad.F90 cnt4tl.F90 cprep1.F90 cprep4.F90 ctl1.F90 cva1.F90 cva2.F90
forecast_error.F90 gp_model.F90 gp_model_ad.F90 gp_model_tl.F90 reresf.F90
scan2mad.F90 scan2mtl.F90 sim4d.F90 stepo.F90 stepoad.F90 stepotl.F90 tesadj.F90
testli.F90 testlievol.F90 dfi/sudfi.F90 suini.F90 dia/aro_surf_diagh.F90
chkevo.F90 cpphddhe.F90 cumcoe.F90 grib_code_message.F90 inifaout.F90 posddh.F90
ppfidh.F90 pregrbenc.F90 prepfdb.F90 preset_grib_template.F90 suechk.F90
sunddh.F90 suofname.F90 suppdate.F90 wrbudg.F90 wrcfupp.F90 wrmlppa.F90
wrmlppg.F90 wrmlpplg.F90 wrmoderr.F90 wroutgpgb.F90 wroutspgb.F90 wrradcoef.F90
wrsltraj2.F90 wrxfupp.F90 fullpos/fpiniphy.F90 hpos.F90 ini3wrfp.F90
specfitg.F90 su4fpos.F90 sualfpos.F90 sufpc.F90 sufpdyn.F90 sufpg1.F90
sufpgrib.F90 updvpos.F90 wrmlfp.F90 wrmlfpl.F90 wrplfp.F90 wrpvlfp.F90
wrthlfp.F90 io_serv/io_serv_suiosctmpl.F90 module/control_vectors_comm_mod.F90
elbc0b_mod.F90 get_lwpcoeff_mix.F90 goms_mix.F90 grib_header_mix.F90
gridpoint_fields_mix.F90 iostream_mix.F90 module_obb1_mix.F90 parcma.F90
pardimo.F90 parersca.F90 parfpos.F90 pargen.F90 parlvly.F90 parmwave.F90
paronedvar.F90 parsekf.F90 perdim.F90 sats_mix.F90 spectral_columns_mix.F90
traj_main_mod.F90 traj_semilag_mod.F90 traj_surface_mod.F90 trajectory_mod.F90
varbc_allsky.F90 varbc_pred.F90 varbc_rad.F90 varbc_tcwv.F90 varbc_to3.F90
ydualm_tke.F90 yoe_cuconvca.F90 yoeclop550.F90 yoephli.F90 yoesw.F90 yomalim.F90
yomclddet.F90 yomcosjo.F90 yomct0.F90 yomct0b.F90 yomemis.F90 yomgems.F90
yomgrb.F90 yomgrib.F90 yomiasi.F90 yomlvly.F90 yommodel_error.F90 yommoderr.F90
yommul.F90 yommwave.F90 yomnmi.F90 yomnmia.F90 yomnmib.F90 yomop.F90 yomoph.F90
yomsats.F90 yomscc.F90 yomscree.F90 yomsekf.F90 yomtlevol.F90 yomtnewt.F90
yomtrsl.F90 yomtvrad.F90 yomvar.F90 yomvarbc.F90 yomvareps.F90 yomvfp.F90
yomvrtl.F90 yomvwrk.F90 mwave/mwave_lwp.F90 mwave_obsop.F90 mwave_obsop_ad.F90
mwave_obsop_tl.F90 mwave_obsop_traj.F90 mwave_screen.F90 mwave_setup.F90
namelist/naephli.h namclddet.h namcosjo.h namjo.h namtlevol.h namvar.h
namvareps.h namvfp.h nmi/fltmode.F90 fltmodead.F90 mo3dprj.F90 mo3dprjad.F90
moprj.F90 moprjad.F90 moprjm.F90 moprjmad.F90 nnmi2.F90 nnmi2ad.F90 nnmi2tl.F90
nnmi3.F90 nnmi3ad.F90 nnmi3tl.F90 rdpinmi.F90 reordo3.F90 reordo3ad.F90
sumode3.F90 sumode3e.F90 sumode3l.F90 sunmi.F90 vmodeenergy.F90
obs_preproc/biascor.F90 black.F90 blackhat.F90 cloud_detect_setup.F90 decis.F90
defrun.F90 fgchk.F90 fgwnd.F90 flgdco.F90 flgdmx.F90 flgtst.F90 gefger.F90
hirs_cld.F90 level1cgeos_ob.F90 lndsyin.F90 mkglobstab.F90 movpl.F90
movpl_no_sq.F90 new_thinn.F90 new_thinner.F90 new_thinner_no_sq.F90 obadat.F90
pertobs.F90 post_thinner.F90 pre_thinner.F90 ptendcor.F90 rad1cin.F90
read_crischans.F90 read_iasichans.F90 readoba.F90 redun.F90 reini.F90
scat_ob.F90 setcom.F90 setcomod.F90 setup_tovscv.F90 shipin.F90 sudimo.F90
sugoms.F90 suobarea.F90 suobscor.F90 suobsort.F90 suscre0.F90 upecma.F90
ocean/wrcom.F90 onedvar/onedvar_get_bgsig.F90 op_obs/aerosol_detect.F90
amv_oberr.F90 amv_reassign.F90 bgobs.F90 cf_digital.F90 cloud_detect.F90
cloud_estimate.F90 co2cldairs.F90 co2cldairs_ml.F90 co2cldiasi.F90
co2cldiasi_ml.F90 cobsall.F90 cobsallad.F90 cobsalltl.F90 emis_atlas.F90
emis_mw.F90 emis_mw_n.F90 exchco.F90 exchcoad.F90 exchcotl.F90 gpsro_oberror.F90
hdepart.F90 hinth.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 hsatang.F90 mopitt_ak_op.F90 mpobseq.F90 mpobseq_pack.F90

mpobseqad_unpck.F90 mpobseqtl.F90 mpobseqtl_pack.F90 obsv.F90 obsvad.F90
obsvtl.F90 preints.F90 preintsad.F90 preintstl.F90 rad1cemis.F90 radtr.F90
radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrk.F90 radtrtl.F90
surbound.F90 surboundad.F90 surboundtl.F90 parallel/commjbbal.F90 commjbdat.F90
dot_product_ctlvec.F90 gathereigmd.F90 gathergpf.F90 read_spec_fromfa.F90
slcomm2a.F90 trmtov.F90 trvtoh.F90 phys_dmn/mts_phys.F90 suphy0.F90 suphy1.F90
suphy2.F90 suphy3.F90 sutoph.F90 vdfhghtnhl.F90 writemusc.F90
phys_ec/ec_phys.F90 ec_phys_drv.F90 ec_physg.F90 gems_init.F90 gems_init_tl.F90
gems_tend_ad.F90 heldsuarez.F90 radintg.F90 radozv.F90 su_clop550.F90 suphli.F90
wvcouple.F90 wvxf2gb.F90 phys_radi/suecrad.F90 suswn.F90 swni.F90
programs/merge_varbc.F90 setup/modgrin.F90 su0phy.F90 su0yoma.F90 su0yomb.F90
su1yom.F90 su_surf_flds.F90 suafn1.F90 sualdyn.F90 suallo.F90 suarg.F90
suarpio.F90 sucfu.F90 suct0.F90 suctrl_gflattr.F90 sudefo_gflattr.F90 sudim1.F90
sudyn.F90 sudyna.F90 sueframe.F90 suemis_conf.F90 sufa.F90 sugem1a.F90 sugfl.F90
sugpqlim.F90 sugrib.F90 sugrida.F90 sugridg.F90 sugrido.F90 sugridug.F90
sugridug2.F90 sugridva.F90 suhdf.F90 suhdir.F90 suinif.F90 suinimoderr.F90
suios.F90 sulap.F90 sumcc.F90 sump.F90 sump0.F90 sumpini.F90 sunhsi.F90
suoph.F90 supp.F90 suppvi.F90 surand1.F90 sures.F90 surip.F90 susc2b.F90
susi.F90 suspec.F90 suspecb.F90 suspecg.F90 suspecg2.F90 suspsdt.F90 susta.F90
sutrans.F90 suvareps.F90 suvert.F90 suxfu.F90 sinvect/balanced_reduction.F90
chsymeig.F90 cun1.F90 cun2.F90 cun3.F90 nalan1.F90 nalan2.F90 opk.F90 opm.F90
rdtllcz.F90 suforce.F90 sulcz.F90 wrtllcz.F90 transform/transdir_wavelet.F90
transdir_waveletad.F90 transinv_wavelet.F90 transinv_waveletad.F90
utility/addbgs.F90 addfgs.F90 dealctv.F90 dealfpos.F90 dealges.F90 deallo.F90
dealnmi.F90 dealsc2.F90 emptb.F90 fillb.F90 interp_gp.F90 mod_ini.F90
model2moderr.F90 modeltojb.F90 modeltojbad.F90 opdis.F90 openfa.F90 pkgrida.F90
pkspeca.F90 pksurfa.F90 prt_ctlvec_max.F90 prt_ctlvec_norms.F90
random_ctlvec.F90 rdmoderr.F90 rdradcoef.F90 rdsltraj2.F90
read_surfgrid_traj_fromfa.F90 reset_accfie_vareps.F90 save_merr_tend.F90
save_test4dinc.F90 savmoderr.F90 sbsbgs.F90 sbsfgs.F90 sc2rdg.F90 sc2wrg.F90
sualspa.F90 sualspa1.F90 sualspajb.F90 write_ctlvec_grib.F90 write_grid_grib.F90
write_wavelet_initcv_grib.F90 wrresf.F90 var/add_modbias_ad.F90
add_modbias_tl.F90 add_moderr_ad.F90 add_moderr_tl.F90 adtest.F90 balvert.F90
balvertad.F90 balverti.F90 balvertiad.F90 bgevecs.F90 bgvecs.F90 cain.F90
cainad.F90 cainin.F90 caininad.F90 chavarin.F90 congrad.F90 cvar2.F90
cvar2ad.F90 cvar2in.F90 cvar2inad.F90 cvar3.F90 cvar3ad.F90 cvar3in.F90
cvar3inad.F90 cvarbc.F90 cvarbcad.F90 cvarbcin.F90 cvargpad.F90 cvargptl.F90
cvaru2ad.F90 cvaru2i.F90 cvaru2iad.F90 cvtest.F90 deallt.F90 djbdy.F90 djcdy.F90
ecset.F90 ecset_thsafe.F90 estsig.F90 estsiga.F90 evjq.F90 fltbgcalc.F90
fltbgerr.F90 fltbgvarens.F90 getmini.F90 getmini2.F90 getsatid.F90
inflation_pert.F90 jbchvar.F90 jbchvarad.F90 jbchvari.F90 jbchvariad.F90
jbtomodel.F90 jbtomodelad.F90 jbvcoord_interpolate.F90
jbvcoord_interpolate_ad.F90 jbvcor_wavelet.F90 jbvcor_waveletad.F90
jbvcor_waveletin.F90 jbvcor_waveletinad.F90 jbvcorg.F90 jgcor.F90 jgcorad.F90
jgcori.F90 jgcoriad.F90 jghcor.F90 jghcori.F90 jghcos.F90 jghcosad.F90 jgnr.F90
jgnrad.F90 jgnri.F90 jgnriad.F90 jgnrs.F90 jgnrsi.F90 jgvcor.F90 jqvcor.F90
litest.F90 nmijc.F90 nmijctl.F90 objtrunc.F90 pregprh.F90 preppcm.F90
rdfpinc.F90 rdnhtrajm.F90 rdphtrajm.F90 rdphtrajtm.F90 rdphtrsf.F90 readvec.F90
rokfcovar.F90 rtsetup.F90 savmini.F90 scalefe.F90 scaljgg.F90 scaljgs.F90
sqrtb.F90 sqrtbad.F90 sqrtbin.F90 sqrtbinad.F90 sqrtfe.F90 sualcos.F90
sualctv.F90 sualges.F90 suallr.F90 suallt.F90 suallt7.F90 suamv.F90 suecges.F90
suinfce.F90 suiomi.F90 sujb.F90 sujbbal.F90 sujbchvar.F90 sujbcor.F90
sujbcosu.F90 sujbcov.F90 sujbcovnoise.F90 sujbcovsignal.F90 sujbdat.F90
sujbstd.F90 sujbtest.F90 sujbvarens.F90 sujbvcoord.F90 sujbwavallo.F90

sujbwavalls.F90 sujbwavelet.F90 sujbwavelet0.F90 sujbwavgen.F90 sujbwavstats.F90
sujbwavtrans.F90 sujbwavvc.F90 sujbwavwri.F90 sujq.F90 sujqdata.F90 sujqstd.F90
sumdfce.F90 sumoderr.F90 suprffce.F90 surad.F90 sureo3.F90 surinc.F90 suscal.F90
suscalmerr.F90 susepfce.F90 sushfce.F90 suskf.F90 suvar.F90 suvazx.F90
suvwrk.F90 symtransin.F90 taskob.F90 taskobad.F90 taskobtl.F90 tlprop.F90
tltest.F90 troplev.F90 upspec.F90 vec2gp.F90 vec2gpfe.F90 wavxform.F90
weak_constraint.F90 weak_constraint_ad.F90 weak_constraint_tl.F90 writeoba.F90
writesd.F90 writestd.F90 wrnhtrajm.F90 wrphtrajm.F90 wrphtrajtm.F90 wrphtrsf.F90
xformev.F90

Files modified(ODB):

cma2odb/ctxinitdb.F90 distribute_odb.F90 dump_namelist.F90 init_odbtools.F90
matchupdb.F90 obsproc_init.F90 putatdb.F90 read_namelist.F90 revmatchupdb.F90
setcomcm.F90 setup_obsort.F90 shuffle.F90 shuffle_odb.F90 shuffle_rest.F90
tslotindex.F90 update_ddr_odb.F90 update_obsdb.F90 wtfunc_obsort.F90
include/nam_matchup.h nam_sort.h nam_stdin.h nam_wt.h nammatchup.h namsort.h
namstdin.h namwt.h module/yomstdin.F90

Files modified(PREPDATA):

programs/unbal_eda.F90

Files modified(SATRAD):

emiss/emiskf_delete_sensor.F90 emiskf_estimate_emissivity.F90 emiskf_init.F90
emiskf_init_sensor.F90 emiskf_prep_h.F90 emiskf_update_atlas.F90
emiskf_write_sensor.F90 module/mod_emiskf.F90 programs/calc_radiance_fields.F90
emiskf_update_amsua.F90 emiskf_update_amsub.F90 emiskf_update_mhs.F90
rttov/ifs/getcoef_field.F90 rttov/ifs/phrtsetup.F90

Files modified(SCRIPTS):

gen/ifsmin ifstraj sekf_sm

Files modified(SURF):

offline/module/yoesw.F90 phys_ec/suswn.F90

Yannick Trémolet, Mike Fisher, Deborah Salmond, John Hague and Tomas Wilhelmsson - das_-CY38_OOPS

Code reorganisation for OOPS

Files created(IFS):

module/yomgfl5.F90 yomgmv5.F90 yomsp5.F90 yomsurf.F90

oops/allobs_mod.F90 error_covariance_3d_mod.F90 fields_interp_mod.F90
fields_io_mod.F90 fields_mod.F90 geometry_mod.F90 gom_setup.F90
ifs_constants.F90 ifs_init.F90 locations_mod.F90 model_mod.F90 obstraj_mod.F90
obsvec_mod.F90 variables_mod.F90

setup/susc2c.F90

utility/dotprod2.F90 dotprod3.F90

Files modified(IFS):

adiab/cpeuldynad.F90 cpeuldyntl.F90 cpg5_gp.F90 cpg_dyn_ad.F90 cpg_dyn_tl.F90
cpg_gp_ad.F90 cpg_gp_tl.F90 cpgad.F90 cpgtl.F90 lacdynad.F90 lacdyntl.F90
lassiead.F90 lassietl.F90 latte_kappaad.F90 latte_kappatl.F90 lattesad.F90
lattestl.F90 specrt.F90

canari/cabine.F90 caissedm.F90 calice.F90 calife.F90 canari.F90
control/cdsta.F90 cnt4ad.F90 cnt4tl.F90 gp_model_ad.F90 gp_model_tl.F90
scan2m.F90 scan2mad.F90 scan2mtl.F90
dia/wrspeca.F90
module/gfl_subs_mod.F90 gmv_subs_mod.F90 goms_mix.F90 surface_fields_mix.F90
traj_main_mod.F90 traj_surface_mod.F90 type_gfls.F90 yomgfl.F90 yomgmv.F90
yomjg.F90 yomsp.F90 yomtrans.F90 yomwavelet.F90
namelist/namtrans.h
nmi/nnmi2ad.F90 nnmi2tl.F90 nnmi3ad.F90 nnmi3tl.F90
obs_preproc/suobs.F90
op_obs/cobs.F90 cobsad.F90 cobsall.F90 cobsallad.F90 cobsalltl.F90 cobstl.F90
hop.F90 hopad.F90 hoptl.F90 laidliobsad.F90 mpobseq_pack.F90 mpobseqad_unpck.F90
mpobseqtl.F90 mpobseqtl_pack.F90 obshor.F90 obshorad.F90 obshortl.F90
post_obshortl.F90 rousea.F90 slint.F90 slint_canari.F90 slintad.F90 z0sea.F90
phys_dmn/mf_physad.F90 mf_phystl.F90
phys_ec/ec_phys_ad.F90 ec_phys_tl.F90
setup/su0yomb.F90 su_surf_flds.F90 suarg.F90 sugfl.F90 susc2b.F90 sutrans.F90
sinvect/lcnorad.F90 lcnortl.F90
transform/transinvh.F90
utility/add3to5.F90 add5to3.F90 addfgs.F90 dealges.F90 deallo.F90 dealspa.F90
save_test4dinc.F90 sbs5to3.F90 sbsfgs.F90 swap53.F90
var/bgevecs.F90 bgvecs.F90 cosens.F90 cosjc.F90 cosjl.F90 cosjr.F90 deallt.F90 jbchvar.F90
jbchvarad.F90 jbchvari.F90 jbchvariad.F90 jbtomodel.F90 jbtomodelad.F90 rd801.F90
rtsetup.F90 sualges.F90 suallt.F90 suecges.F90 suinfce.F90 sujb.F90 sujbwavtrans.F90
sumoderr.F90 taskob.F90 vec2gp.F90 xformev.F90

Files deleted(IFS):

module/qasset.F90

Alan Geer - stg_CY37R3_mwave2hop

All-sky observation operator moved from CALLPAR to HOP

Calling observation operators from the model physics has been a long-standing anomaly. It is not modular, so it is incompatible with OOPs, and it is not load-balanced. This change moves the all-sky microwave radiance operator to the normal place, HOP, and the hope is that other anomalous operators (e.g. Rain radar and SMOS) will follow in the future. Technical changes were:

- 8 new cloud and precipitation GFLs have been defined and are available in HOP via the GOM arrays. These GFLs have a new attribute, LDIAG, which indicates they are diagnostic, i.e. they get filled when grid point model runs and they are not stored in the GRIB trajectory files.
- The interpolation (COBSALL) is called both before and after GP_MODEL. The first call is necessary to pick up surface variables before they get updated by GP_MODEL. The second is needed to get the diagnostic GFLs. (It doesn't matter when the normal GFLs are picked up, as they are kept on two timesteps).
- Nearest-neighbour interpolation (LAIDLIC) is enabled in the TL and AD. The GOM interpolation strategy is now configurable by obstype as well as by variable.

- A new obstype (16) has been defined for all-sky data, to allow the appropriate configuration of GOMs and interpolation while not affecting other data types. Uniquely, all-sky uses nearest-neighbour interpolation for all variables.

There are some extremely minor "scientific" effects (equating to a maximum of 0.2K in brightness temperature) that come from:

- the use of U and V wind components on the lowest model level (in common with other satellite radiances) rather than the true 10m winds (as previously).
- the use of skin temperature from the beginning of the timestep, rather than the incremented version in CALLPAR.

Apart from these effects, brightness temperatures are reproducible to around 0.0005K. T511 experiments confirm there is no scientific impact on analysis or forecasts.

The change is bit-reproducible:

- in the first trajectory except for the all-sky observations
- in the analysis if all-sky observations are turned off
- otherwise, the analysis cost function changes by no more than about 0.1

The blacklist needs a small change to reflect the new obstype:

```
"const allsky=16;"
and
"elif (OBSTYP in (satem,allsky)) then"

ec:/stg/blacklists/38r1/black_ds2006091200_17jan_allsky
ec:/stg/blacklists/38r1/external_allsky.b.
```

Anne Fouilloux and Alan Geer - stg_CY38R1_mwave2hop

Modernising QC event flags

The current way of setting QC event flags using hardcoded numbers, e.g. "ND1EVENT(27)" is cumbersome and dangerous. These are replaced with meaningful names taken from a derived type, e.g. "ND1EVENT

Files created(IFS):
`mwave/mwave_wrapper.F90`
`var/surad_jot.F90`

Files modified(IFS):
`adiab/laidlicad.F90`
`canari/caratk.F90`

control/gp_model.F90 gp_model_ad.F90 gp_model_tl.F90 scan2m.F90 scan2mad.F90 scan2mtl.F90

fullpos/specfitg.F90

gbrad/gbrad_put.F90

module/gfl_subs_mod.F90 goms_mix.F90 pardimo.F90 type_gfls.F90 varbc_allsky.F90 yom_ygfl.F90 yomcoctp.F90 yommwave.F90 yomnmev.F90

mwave/mwave_emis.F90 mwave_get.F90 mwave_get_ad.F90 mwave_get_tl.F90 mwave_obsop.F90 mwave_obsop_ad.F90 mwave_obsop_test.F90 mwave_obsop_tl.F90 mwave_obsop_traj.F90 mwave_put.F90 mwave_put_tl.F90 mwave_screen.F90

namelist/namgfl.h

obs_preproc/addoer.F90 ascatin.F90 black.F90 blackhat.F90 defrun.F90 dribuin.F90 dupli.F90 dupli_no_sq.F90 ersin.F90 fgchk.F90 fgwnd.F90 flgdco.F90 flgtst.F90 gefger.F90 lndsyin.F90 mkglobstab.F90 new_thinn.F90 new_thinn_radar.F90 new_thinner.F90 new_thinner_no_sq.F90 obatabs.F90 oscatin.F90 paobin.F90 pilotin.F90 post_prsta.F90 post_thinner.F90 pre_prsta.F90 prech.F90 qscatin.F90 rd_obs_boxes.F90 readoba.F90 redmo.F90 redprof.F90 redrp.F90 redrp1.F90 redrp1_no_sq.F90 redrp_no_sq.F90 redsl.F90 redts.F90 rejmv.F90 repra.F90 scaqc.F90 selec.F90 shipin.F90 sugoms.F90 suobarea.F90 suobs.F90 tempin.F90 upecma.F90 verco.F90

oops/fields_interp_mod.F90 gom_setup.F90

op_obs/cobs.F90 cobsad.F90 cobsall.F90 cobsallad.F90 cobsalltl.F90 cobstl.F90 exheiz2p.F90 hjo.F90 hop.F90 hop_rad.F90 hop_rad_ml.F90 hopad.F90 hoptl.F90 hretr.F90 laiddiobsad.F90 laidliobsad.F90 mpobseq_pack.F90 mpobseqad_unpck.F90 obshor.F90 obshorad.F90 obshortl.F90 preint.F90 preintad.F90 preintr.F90 preintrad.F90 preintrtl.F90 preinttl.F90 rtl_screen.F90 slint.F90 slintad.F90 slinttl.F90

phys_ec/callpar.F90 callparad.F90 callpartl.F90 ec_phys.F90 ec_phys_ad.F90 ec_phys_drv.F90 ec_phys_drv_ad.F90 ec_phys_drv_tl.F90 ec_phys_tl.F90 ec_physg.F90

setup/cmoctmap.F90 cmoctmap_inv.F90 su_events.F90 sudefo_gflattr.F90 sudim1.F90 sudyn_setgflattr.F90 sugfl.F90

smos/smos_update.F90

utility/deallo.F90 prtgom.F90 prtjo.F90

var/ecset.F90 ecset_thsafe.F90 gp_ssmi_inv.F90 setqccma.F90 sualcos.F90 surad.F90 taskob.F90 taskobad.F90 taskobtl.F90

Files modified(ODB):

bufr2odb/bufr2odb_amsre_1d.F90 bufr2odb_atovs.F90 bufr2odb_mwri_1d.F90 bufr2odb_ssmi.F90 bufr2odb_ssmis_1d.F90 bufr2odb_tmi_1d.F90 bufr2odb_windsat.F90

cma2odb/buf2cmat_new.F90 ctxinitdb.F90 distributedb.F90 getatdb.F90 getdb.F90 grid_nearest.F90 map_reportype.F90 putatdb.F90 shuffle_odb.F90 shuffledb.F90 sort_prepare_odb.F90

ddl/BUFRBASE.ddl black_allsky.sql black_robhdr_6.sql black_robody_6.sql ecmwf_matchup_-
allsky_body.sql getsatid.sql links_body.sql links_sat.sql matchup_allsky_body.sql
obsdist_allsky.sql obsdist_allsky_body.sql obsdist_hdr2allsky_body.sql obsdist_radiance.sql
obsdist_radiance_body.sql obsort_allsky.sql obsort_allsky_body.sql obsort_hdr2allsky_-
body.sql obsort_hdr2radiance_body.sql obsort_radiance.sql obsort_radiance_body.sql
obstype.h robhdr_grid_distribute.sql sat_ssmi.sql satbody_allsky.sql suobarea.sql
suobarea_sat.sql type_definitions.h varbc_allsky_robhdr.sql varbc_allsky_robody.sql

Files modified(SCMEC):

`source/su0yom1c.F90`

Files deleted(IFS):

`module/module_obb1_mix.F90`

Files deleted(ODB):

`ddl.CCMA/robhdr_mwave_get_ssmi.sql robhdr_mwave_put_ssmi.sql robody_mwave_get_ssmi.sql robody_mwave_put_ssmi.sql`
`ddl.ECMA/robhdr_mwave_get_ssmi.sql robhdr_mwave_put_ssmi.sql robody_mwave_get_ssmi.sql robody_mwave_put_ssmi.sql`
`ddl/robhdr_mwave_get_ssmi.sql robhdr_mwave_put_ssmi.sql robody_mwave_get_ssmi.sql robody_mwave_put_ssmi.sql`

Deborah Salmond - das_CY38_NEW_PLUS

Bug fixes

Files modified(ODB):

`include/fodbmp1.h`

Files modified(ALGOR):

`module/spectral_arp_mod.F90`

Files modified(IFS):

`transform/spec2grid.F90`