RESEARCH DEPARTMENT
MEMORANDUM

ECMWF

To:	RD Scientific Staff and Consultants	
Copy:	HR, HO, HMD, HMAS, HMOS, John Hodkinson, François Bouttier, Claude Fischer, Ryad El Khatib, Karim Yessad, John Hague	
From:	Deborah Salmond et al.	
Date:	April 15, 2011	File: R48.3/DS/1151
Subject:	**IFS Memorandum Cycle CY37R2**	

Cycle 37r2 was created in January-April 2011. This was created from 37r1 with GRIB2 and several bug fixes.

Contributors:

Jean Bidlot, Paul Burton, Carla Cardinali, Mohamed Dahoui, Patricia De Rosnay, Rossana Dragani, Mike Fisher, Anne Fouilloux, Jan Haseler, Hans Hersbach, Martin Leutbecher, Philippe Lopez, George Mozdzynski, Frederic Vitart, Nils Wedi, Tomas Wilhelmsson

DATA ASSIMILATION

Carla Cardinali - dac_CY37R1_FSO_for37r2_forJan

Fix for FSO

Files modified(IFS):
`control/cgr1.F90 sim4d.F90`
`var/cosjr.F90`

Patricia De Rosnay - dap_CY37R2_use_new_snow

Use of new ground snow data in addition to SYNOP data

Since December 2010 ECMWF receive new snow data which comes in addition to SYNOP snow data. The additional snow data is a new subtype and it is encoded in a specific BUFR format which contains reduced information (absence of T2m in the report) and with non WMO standard station identification. To enable the conversion from BUFR to ODB and the activation of the use of the new data in the snow analysis, scripts and Fortran modifications were necessary. This fix was back-stitched into the operational suite on 29 March 2011.

Files modified(ODB):
`tools/Bufr2odb.F90`

Files modified(SCRIPTS):
`gen/fetchobs`

Files modified(SSA):
`sub/fg2obs.F90 oiupd.F90 redundant_obs.F90 scan_cma_odb.F90`

Files created(ODB):
`bufr2odb/bufr2odb_snow.F90`

Philippe Lopez -pah_CY37R1_assim_NEXRAD_v1

NEXRAD assimilation and window offset

Files modified(ODB):
`ddl/obsdist_gbrad.sql obsdist_gbrad_body.sql obsdist_hdr2allsky_body.sql obsdist_-hdr2auxiliary_body.sql obsdist_hdr2gbrad_body.sql obsdist_hdr2radar_body.sql obsdist_-hdr2reo3_body.sql obsdist_hdr2surfemiss_body.sql`

Files modified(SCRIPTS):
`gen/ifsmin p4_mklib`

Hans Hersbach - er9_CY36R4_fix_ci_caspian_sea

Caspian Sea

The usage of RTG sea-ice product from NCEP over the Caspian and Sea of Azov. Although since 30 September 2008 the analysis of sea-surface temperature (SST) and sea ice cover (CI) is based on OSTIA, it was recently realized that the ice product (originating from OSI SAF) does not cover the Caspian and Sea of Azov. Since parts of these lakes do freeze over during winter it was decided to re-use the NCEP sea-ice product over these two areas. This is handled by two new switches in the sst analysis: LOSTIA_CASPIAN, and LOSTIA_AZOV, which are to be set to false. This fix was backstitched into the operational suite on 15 February 2011.

Files modified(SCRIPTS):

`gen/sstana`

Files modified(SSA):

`module/yomsst.F90`
`namelist/namssa.h`
`sub/control_ssa.F90 inisst.F90`
`util/setcomssa.F90`

SATELLITE

Rossana Dragani - st3_CY37R1_met9_seviri

Ozone from SEVIRI

Fix to cope with an increase of a factor of 100 in the SEVIRI total ozone data volume that started on 24 March 2011. This volume increase is due to changes in the way EUMETSAT now retrieves these data.

Files created(SATRAD):

`programs/bufr_resat_thin.F90`

Files modified(SCRIPTS):

`gen/fetchobs mkabs_satrad prereo3`

WAVE MODEL

Jean Bidlot - wab_CY36R4_next_cycle

GRIB_API fix

Fix for problem producing the output of those currents from WAM with grib_api (as intended when we run the LAW suite with currents).

Files modified(WAM):

`Wam_oper/outint.F wgribout.F`

Jean Bidlot - wab_CY37R1_bugfix_grib2wgrid

Fix for monthly forecast hindcast starting from era interim data

Frederic encountered a problem when running monthly forecast hindcast starting from era interim data. It has to do with a bug in the new grib_api software reading initial wave data. In case these data do not start from 90N as was the case in operation before March 2009 and in era-interim, the resulting input data will have a few latitudes near Antarctica set to zeros causing a floating point error when those zeros are used later on.

It should not affect any runs from operation for recent dates as their initial wave data should from 90N.

Files modified(WAM):
`Wam_oper/grib2wgrid.F`

Jean Bidlot - wab_CY37R2_bug_fix

Fix for stand alone version of WAM

We experienced a problem with the stand alone version of WAM in the e-suite. Following a change in mars whereby it is now based on the grib_api software, the wave model First Guess (FG) fields have to to written to FDB with fc step=0 (as it is specified in the grib headers) and not with step=6 (as it is currently the case in ops).

Files modified(WAM):
`Wam_oper/wgrib2fdb.F`

EPS

Martin Leutbecher - nel_CY37R2_runoff

Fix for the surface and subsurface runoff in the 2nd leg of the EPS

Correct initialization of surface runoff and sub-surface runoff in lower resolution legs of the variable resolution EPS.

Files modified(IFS):
`module/yomvareps.F90`
`setup/suvareps.F90`
`utility/reset_accfie_vareps.F90`

Files modified(scripts):
`gen/getgrb_vareps`
`sms/sfc.sms`

Files added(scripts):
`gen/vareps.h`

SEASONAL

Frederic Vitart - nec_CY37R1_bugfixes

Bug fixes for Seasonal Forecasts

- The first one is not linked to GRIB2 but to the the fact that the 3-leg configuration has never been properly tested in research (we only run 1 or 2 legs). - The second problem is due to an improper handling of tables in wm.F90.

Files modified(PREPDATA):

`programs/wm.F90`

Frederic Vitart - nec_CY37R1_nemo

Bug fix on tropical storm tracking

Files modified(PREPDATA):

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

OBSTAT

Mohamed Dahoui - mo3_CY37R1_obstat

Further improvements to obstat

In addition to what was provided in November, the current changes includes:

1. Upgrade of the classical plotting routines to Magics++.
2. Allow obstat to compute integrated ozone (in DU) for layered ozone. Currently we are doing just the average of data within the layer.
3. New way of plotting AIRS/IASI stats. The new plotting separates the data in 4 bands (selected by the Satellite section). The users have the possibility to select the y-axis (pressure, channel idx, channel number, wave number and frequency). The bias correction is plotted separately when requested.
4. Introduction and use of the reportType. This will be useful as it's indented to start testing the archiving of gridded statistics in Mars
5. Exclude varno=179 from soil moisture computations
6. Fix a small error in the cloud detection for AMSU-A
7. Update the script obstat mainly for Gabor's modifs. Anne added a fix for dcagen that was causing problems in reading Gabor's diagnostics from the ODB.
8. Fix a problem with MPI that was affecting occasionally Scan dependent stats
9. Allow obstat to accept any AIRS/IASI channels beyond those specified in the AIRS/IASI channels definition
10. allow users to quickly plot pre-computed obstat classical stats for only selected instruments

Updated config files are necessary. They are in /home/mo/mo3/obstat_37r1

Files modified(OBSTAT):

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

`src/allocsoft.F90 calcairspop.F90 inibufr.F90 iniglob.F90 iniitemloc.F90 inisoft.F90 inisoftdef.F90 inisoftinstr.F90 inisoftstream.F90 mergesoft.F90 mpsoft.F90 obstat_add_grib.F90 obstat_geo_plot.F90 obstat_hist_plot.F90 obstat_hov_plot.F90 obstat_normalize_scat.F90 obstat_overview_hist_plot.F90 odbread.F90 plothis.F90 plotime.F90 plotrms.F90 plotrmsbias.F90 plotsoft.F90 plotusage.F90 sucalcgauw.F90 updsoft.F90 user_data_read.F90 writealarm.F90 writegribs.F90 wrsoftdef.F90`

Files modified(ODB):

`ddl/obstat_scatt.sql`

Files modified(REANAL):

`Mon/obstat_timeseries.F90 plot_curves.F90`

Files modified(SCRIPTS):

`def/an.def`

`gen/lowres_fp mkabs_obstat mkabs_reanal obstat obstat_init sstana`

`metview/zondia_seas_icon_batch.met`

`sms/getiniLeg.sms`

`sms_an/clean_an.sms obstat_archive.sms`

`sms_era/obtime.sms`

Files deleted(OBSTAT):

`module/mod_sat_plot.F90`

TECHNICAL

Paul Burton - dab_CY37R1_lxab

Technical changes for new linux cluster

This provides the functionality to run on the new linux cluster, most notably the ”new” verification which will become the default at 37r3.

Files created(SCRIPTS):

`build/arch/Makefile.in.linux64 arch/Makefile.in.lxa arch/Makefile.in.lxab arch/Makefile.in.lxb`

`gen/ifsnewverify`

`wav/wave_newverify`

Files modified(BL):

`library/numarg_error.c`

Files modified(IFSAUX):

`eclite/i_system.c`

Files modified(SCRIPTS):

gen/create_odbglue mkabs_obstat mkabs_reanal mkgenlinks p4_compile_setup
sms/cancel.sms verify.sms wamverify.sms

Michael Rennie - da7_CY37R1_for_CY37R2

Technical changes to Aeolus

- append_L2C.F90: revert to Blazej's version
- lexer.F90: introduce "use ParKind1" to get consistent compilation options for real types
- TestL1B_ee2bufr.F90: remove some blank lines introduced by MF at CY37

Files modified(AEOLUS):
BUFR_file_handling/TestL1B_ee2bufr.F90
L2C_construction/append_l2c.F90
support/lexer.F90

Jan Haseler - dah_CY37_grib2

Changes for GRIB2

Files modified(SCRIPTS):
gen/anml coldstart_tiles ens_errors get_gems_surface getgrb getgrbme getini
getinigems getmars ifsgmon ifsmin ifstraj lowres_fp mkabs_prepdata mkidta model
modeleps modelsv run_fp sekf_sm ssaana var_include vardata
oce/extrafields_create
sens/J1.sms
wav/prep_wave wave_getrst wave_getwave wave_run wave_runcold

Jan Haseler - dah_CY371_grib2

More changes for GRIB2

Files created(PREPDATA):
kpp/average_fields.f90 axis.f90 cdfio.f90 cdfrestart.f90 conv2grib_geo_nemo.f90
defval.f90 nearneighbor_255l_2.f90 nearneighbor_399l_2.f90
nearneighbor_639l_2.f90 read_grb.f90 test_levels_analysis.f90 tools.f
programs/sqrt.F90

Files modified(IFS):
module/grib2gridspecs.F90 svtools.F90
odds/getres/getres.F
programs/Ens_Spread_Cal.F90 Ensemble_Stats.F90 Fieldset_Diff.F90 Spectral_Filter.F90
Spread_Skill_Time_Avg.F90 cinterpol.F90 ensms_veps.F90 forceinv.F90 gptosp.F90 interpo.F90
intsst.F90 invlap.F90 pertsst.F90 reord_veps.F90 spint.F90 sptogp.F90 timeint.F90
wm.F90 wmem.F90

Files deleted(PREPDATA):

kpp/average_fields.F90 axis.F90 cdfio.F90 cdfrestart.F90 conv2grib_geo_nemo.F90 defval.F90 nearneighbor_255l_2.F90 nearneighbor_399l_2.F90 nearneighbor_639l_2.F90 read_grb.F90 test_levels_analysis.F90 tools.F90

module/decode_grib.F90 encode_grib.F90 gribdim.F90 mergegrib.F90

programs/gptosp_api.F90 sptogp_api.F90 sqrt_api.F90 timeint_3d.F90

Jan Haseler - dah_CY37R1_for37r2

Miscellaneous changes

Caspian sea ice, ensemble data assimilation changes, add post-processing of total sky and clear sky direct solar radiation, changes from MetApps, assorted modifications

Files modified(SCRIPTS):

def/an.def eps_nemo.def eps_varfc.def fc.def

gen/anil ansfc archive_obs ens_errors fetchobs getgrbe getpersSST grib_def.h ifstraj mkabs_reanal mkabs_satrad mkgeninks model modeleps prereo3 restart_999 sstana

sms/getobsSST.sms model.sms trans_an.sms verify.sms

sms_an/clean_an.sms

Mike Fisher - dai_CY37R2_yomlun

Cleaning of YOMLUN

YOMLUN holds the Fortran unit numbers for files read and written by IFS.

This change removes several duplicate unit numbers (i.e. cases in which the same unit number was assigned to more than one varaible in YOMLUN). One duplicate remains: NULTRAJBG==NFGISH.

The variables in YOMLUN have been given the PARAMETER attribute. They should never be changed by the user. The GRIB codes in YOM_GRIB_CODES have also been declared as parameters.

We are running out of available unit numbers. Most numbers in the range 0–99 are named in yomlun and are thus effectively reserved for all configurations of IFS, whether they are used or not. To avoid this situation getting any worse, a ”unit-number pool” has been implemented. A unit number from the pool can be requested by a function call:

IUNIT=RESERVE_LUN()

and returned to the pool using:

CALL FREE_LUN(IUNIT).

This mechanism replaces NULTMP, which has been removed. NULUSR1–5 have been retained for now, but should probably be phased out in favour of the RESERVE_LUN/FREE_LUN mechanism.

Files modified(IFS):

climate/updo3ch.F90

dia/spnorm.F90

module/pardim.F90 varbc_setup.F90 yom_grib_codes.F90 yomlun.F90
obs_preproc/suobscor.F90 suobscor_resol.F90
ocean/wrcoe.F90 wrcpl.F90
phys_ec/radintg.F90
programs/merge_varbc.F90
setup/su0yoma.F90 sulun.F90 sumpini.F90 sumpout.F90 surand1.F90
var/rdvarbc.F90 sujbbal.F90 sujbcor.F90 sujbdat.F90 sujbwavtrans.F90 sujqdata.F90
wrvarbc.F90

Files modified(ODB):

pandor/module/bator_init_mod.F90

Files modified(SATRAD):

cmem/cmem_main.F90 cmem_setup.F90 rdcmemifs.F90
interface/rdcmemifs.h

George Mozdzynski - mpm_CY37R1_bugfix

Bug fixes

Fixes for problems running a T159 4D-Var experiment

Problem 1 - classical 'why we should not call internal subroutines from within OpenMP parallel regions' op_obs/mpobseq_pack.F90 op_obs/mpobseqtl_pack.F90 op_obs/mpobseqad_unpck.F90 In these routines variable IIND was illegally shared within an internal subroutine that was called within an OpenMP parallel region. This variable needed to be declared in the contained subroutine and was not needed in the 'main' routine. I presume that when using optimised libs IIND is contained in a register and is never load/stored from/to memory.

Problem 2 - subscript violation at surad.F90 line 286 arrays LCLD_RTCALC_ASSIM, LCLD_RTCALC_HRETR, LCLD_RTCALC_ASSIM are dimensioned (0:JPMXSENSOR) where JPMXSENSOR=31 At the above subscript violation these arrays were being indexed with values 40 and 41 (i.e. outside of the declared values). ifs/module/sats_mix.F90 My quick fix was to increase JPMXSENSOR to 41 in sats_mix.F90 and assign default values of .FALSE. to these extra 10 array items in each of the 3 arrays.

Files modified(IFS):

module/sats_mix.F90 yomtvrad.F90
op_obs/mpobseq_pack.F90 mpobseqad_unpck.F90 mpobseqtl_pack.F90

Files modified(IFSAUX):

module/local_trafos.F90

George Mozdzynski - mpm_CY37R1_mpdecomp2

Optimisation of wave model

Performance optimisation to wave model routine MPDECOMP. - reworked expensive loop over NPR (number of procs) to compute only own task's quantities (NLENHALO,IJFROMPE) and then to message pass these to other procs using MPI_ALLGATHERV - changed MPI non-blocking sends / blocking recvs to MPI_SCATTERV, this was for simplification/cleaning, no effect on performance

This is a technical branch and produces bit identical results to 37R1 controls.

```
48 nodes (192x16) ++++++++++++++++++++++++++++++++++++++++++++++
37R1 control
  Avg-%   Avg.time   Min.time   Max.time   : Name of the routine
  5.22%     14.899     14.161     16.376   : MPDECOMP
  0.85%      2.422      1.026      3.208   : >MPL-MPDECOMPBCASTWAM(694)
mpm_CY37R1_mpdecomp2
  Avg-%   Avg.time   Min.time   Max.time   : Name of the routine
  0.87%      2.168      1.013      2.435   : >MPL-MPDECOMPWAM(694)
  0.12%      0.309      0.126      1.513   : MPDECOMP

96 nodes (384x16) ++++++++++++++++++++++++++++++++++++++++++++++
37R1 control
  Avg-%   Avg.time   Min.time   Max.time   : Name of the routine
  9.04%     27.175     27.101     28.437   : MPDECOMP
  0.98%      2.952      1.651      3.131   : >MPL-MPDECOMPBCASTWAM(694)
mpm_CY37R1_mpdecomp2
  Avg-%   Avg.time   Min.time   Max.time   : Name of the routine
  0.84%      2.147      0.939      2.394   : >MPL-MPDECOMPWAM(694)
  0.19%      0.484      0.368      1.793   : MPDECOMP
```

Modified files:-

Files modified(IFS):

`control/gp_model.F90 obs_preproc/suobs.F90 phys_ec/ec_phys_drv.F90 ec_physg.F90 radintg.F90 utility/gstats_label_ifs.F90`

Files modified(WAM):

`Wam_oper/mpdecomp.F outwspec.F wgribout.F`

Tomas Wilhelmsson - nat_CY36R4_fix_for_operations

Use lagged post processing for CBASE, 0DEGL and VISIH

Also a correction to setup of CASHFSS.

Files modified(IFS):

`dia/sucddh.F90`
`fullpos/wrmlfp.F90 wrmlfpl.F90`
`setup/supp.F90`

Tomas Wilhelmsson - nat_CY36R4_pp3h

Add post processing for the new grib parameters MN2T3, MX2T3 and 10FG3

i.e. min/max T2M and max wind gust over the last 3 hours. The implementation also changes how MN2T6, MX2T36 and 10FG6 are computed.

Files modified(IFS):
`dia/grib_code_message.F90 pregrbenc.F90`
`fullpos/hpos.F90`
`module/yom_grib_codes.F90 yomafn.F90 yomppc.F90`
`phys_ec/ec_phys.F90`
`setup/suafn1.F90 suafn2.F90 suafn3.F90 supp.F90`

Tomas Wilhelmsson - nat_CY36R4_prepdata

GRIB_API in prepdata programs

Replace GRIBEX with GRIB_API in prepdata programs: cinterpol, forceinv, gptosp, interpo, intsst, pertsst, sptogp, and timeint.

Use edition independent GRIB_API keys in prepdata programs Ens_Spread_Cal, Enseble_Stats, Fieldset_Diff, Spectral_Filter, Spread_Skill_Time_Avg, svtools, ensms_veps, invlap, reord_veps, wm and wmem.

Merge prepdata programs gptosp_api into gposp, sptogp_api into sptogp and timeint_3d into timeint.

Replace GRIBEX with GRIB_API when reading climate data in rdecclimo.F90. Some GRIB_API related fixes to iostream_mix.F90.

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

Files modified(IFS):
`fullpos/rdecclimo.F90`
`module/iostream_mix.F90`

Files modified(PREPDATA): `grib2gridspecs.F90 svtools.F90`
`programs/Ens_Spread_Cal.F90 Ensemble_Stats.F90 Fieldset_Diff.F90 Spectral_Filter.F90`
`Spread_Skill_Time_Avg.F90 cinterpol.F90 ensms_veps.F90 forceinv.F90 gptosp.F90 interpo.F90`
`intsst.F90 invlap.F90 pertsst.F90 reord_veps.F90 spint.F90 sptogp.F90 timeint.F90`
`wm.F90 wmem.F90`

Files modified(SCRIPTS):
`gen/ens_errors getgrb mkabs_prepdata mkidta`

Files deleted(PREPDATA):
`module/decode_grib.F90 encode_grib.F90 gribdim.F90 mergegrib.F90`
`programs/gptosp_api.F90 sptogp_api.F90 sqrt_api.F90 timeint_3d.F90`

Tomas Wilhelmsson - nat_CY37R2_grib2_fixes

GRIB2 fixes

- Use GRIB edition independent keys in preset_grib_template.F90.

- Replicate GRIB_API's table2Version tricks for FDB output.
- Further corrections to prepdata programs intsst and timeint on top of nat_CY36R4_prepdata.

Files modified(IFS):
`dia/preset_grib_tempate.F90`

Files modified(PREPDATA):
`programs/intsst.F90 timeint.F90`

Nils Wedi - naw_CY37R2_bugfix_interpo

Fix for interpo

This fixes a problem in the creation of the persisted SST file in particular where there was a conflict with IFS for the case land-sea mask exactly equals 0.5, with interpo treating it as land and IFS as sea.

Furthermore, due to the update to grib2 compliance there is a problem with interpo reading the climate sst file from era40. This is fixed by modifying the grib-header in the file 37r2/sstclim

Files modified(SCRIPT):
`gen/getpersst`

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

Anne Fouilloux - stf_CY37R1_fix_for_operation

Changes to CY37R2 for MARS archiving

Files modified(ODB):
`bufr2odb/bufr2odb_atovs.F90 cma2odb/map_reportype.F90`

Files modified(SCRIPTS):
```
def/an.def gen/AIRS.ddl ALLSKY.ddl HIRS.ddl IASI.ddl IRAS.ddl MERIS.ddl
MONDB.ddl NEXRAD.ddl ODBCMP.ddl REO3.ddl REO3AK.ddl SATOB.ddl SMOS.ddl TOVS.ddl
archive_mondb archive_obsgroup convert_mondb mondb.sql mondb_allsky.sql
mondb_gpsro.sql mondb_meris.sql mondb_sat.sql mondb_satob.sql mondb_tovs.sql
sms_an/archive_obsgroup.sms convert_mondb.sms
```

Files created(SCRIPTS):
```
sms_an/archive_mondb.sms archive_mondb_airs.sms archive_mondb_amsre.sms
archive_mondb_amsua.sms archive_mondb_amsub.sms archive_mondb_conv.sms
archive_mondb_geos.sms archive_mondb_gpsro.sms archive_mondb_hirs.sms
archive_mondb_iasi.sms archive_mondb_meris.sms archive_mondb_mhs.sms
archive_mondb_msu.sms archive_mondb_mwhs.sms archive_mondb_mwri.sms
archive_mondb_mwts.sms archive_mondb_reo3.sms archive_mondb_reo3ak.sms
archive_mondb_satob.sms archive_mondb_scatt.sms archive_mondb_simulobs.sms
archive_mondb_smos.sms archive_mondb_ssmi.sms archive_mondb_ssmis.sms
archive_mondb_ssu.sms archive_mondb_surf_conv.sms archive_mondb_tmi.sms
archive_mondb_vtpr1.sms archive_mondb_vtpr2.sms archive_mondb_windsat.sms
convert_mondb_airs.sms convert_mondb_amsre.sms convert_mondb_amsua.sms
```

```
convert_mondb_amsub.sms convert_mondb_conv.sms convert_mondb_geos.sms
convert_mondb_gpsro.sms convert_mondb_hirs.sms convert_mondb_iasi.sms
convert_mondb_meris.sms convert_mondb_mhs.sms convert_mondb_msu.sms
convert_mondb_mwhs.sms convert_mondb_mwri.sms convert_mondb_mwts.sms
convert_mondb_reo3.sms convert_mondb_reo3ak.sms convert_mondb_satob.sms
convert_mondb_scatt.sms convert_mondb_simulobs.sms convert_mondb_smos.sms
convert_mondb_ssmi.sms convert_mondb_ssmis.sms convert_mondb_ssu.sms
convert_mondb_surf_conv.sms convert_mondb_tmi.sms convert_mondb_vtpr1.sms
convert_mondb_vtpr2.sms convert_mondb_windsat.sms
```