RESEARCH DEPARTMENT MEMORANDUM

To:	RD Scientific Staff and Consultants	
Copy:	HR, HO, HMD, HMAS, HMOS, J.Hodkinson Jean Pailleux, François Bouttier, Claude Fischer	
From:	Deborah Salmond et al.	
Date:	September 25, 2008	File: R48.3/DS/0888
Subject:	**IFS Memorandum Cycle CY35R1**	

Cycle 35r1 was created in September 2008.

This cycle comes from CY33R2 which was merged with contributions from Météo-France described in:
http://intra.ecmwf.int/publications/library/do/references/show?id=635
to make CY34, this was followed by a cleaning cycle CY35 described in detail in:
http://datasvc.ecmwf.int/twiki/pub/Main/IFSReleaseCY35/move_rename_for_cy35_v7.pdf
and then merged to form CY35R1 which was used in the esuite e_35r1.

Modified libraries: ifs ifsaux obstat odb reanal satrad scat scripts surf ssa wam

Contributors: M.Leutbecher, N.Borman, F.Vitart, J.Bidlot, M.Janiskova, P.Bechtold, R.Forbes, A.Beljars, G.Balsamo, M.Dahoui, E.Holm, M.Hamrud, M.Drusch, J.Haseler, D.Salmond

Martin Leutbecher

EPS related updates

- Bugfix in check of GFL attributes for Methane fields provided by Richard Engelen and required for the singular vector computation.
- Vertical finite-element scheme explicitly switched off in modelsv for Eulerian computations (this was previously done in the IFS).

Files modified(IFS):

`setup/suctrl_gflattr.F90`

Files modified(SCRIPTS):

`gen/modelsv`

Niels Bormann

Additional predictor for HIRS and AIRS short-wave channels and RTTOV-9 updates

A predictor was added to the bias model used for assimilated HIRS and AIRS short-wave channels in VarBC (for channels 14 and 15 for HIRS and channels 1921 to 1928 for AIRS). The predictor is zero during nighttime and cos(solar zenith angle) during daytime. It addresses solar effects observed in the FG departures of these channels.

Also included are updates to the RTTOV-9 code and other minor modifications.

Files created(SATRAD):

`interface/rttov_checkargs.h`

`rttov/rttov_checkargs.F90`

Files modified(IFS):

`module/yomvarbc.F90`

`op_obs/biaspred.F90 radtr.F90 radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrk.F90 radtrtl.F90`

`var/suvarbc.F90`

Files modified(ODB):

`bufr2odb/bufr2odb_ssmis.F90 bufr2odb_ssmis_1d.F90`

`ddl/cma.h`

Files modified(REANAL):

`Mon/obstat_timeseries.F90`

Files modified(SATRAD):

`interface/rttov_cldstr.h rttov_cldstr_ad.h rttov_cldstr_k.h rttov_cldstr_tl.h rttov_erfcx.h rttov_errorreport.h rttov_fresnel.h rttov_fresnel_ad.h rttov_fresnel_k.h rttov_fresnel_tl.h rttov_intext_prof.h rttov_layeravg.h rttov_layeravg_ad.h rttov_layeravg_k.h rttov_layeravg_tl.h rttov_opdpscattir.h rttov_opdpscattir_ad.h rttov_opdpscattir_k.h rttov_opdpscattir_tl.h rttov_scatt_k.h rttov_setpredictors_7.h rttov_setpredictors_9_solar.h`

rttov_setpredictors_9_solar_ad.h rttov_setpredictors_9_solar_k.h
rttov_setpredictors_9_solar_tl.h rttov_sublayer.h rttov_sublayer_ad.h
rttov_sublayer_k.h rttov_sublayer_tl.h rttov_writecoef.h

module/rttov_const.F90

rttov/rttov_ad.F90 rttov_check_temp.F90 rttov_direct.F90 rttov_errorreport.F90
rttov_iniscatt_ad.F90 rttov_integrate.F90 rttov_integrate_ad.F90
rttov_integrate_k.F90 rttov_integrate_tl.F90 rttov_k.F90 rttov_layeravg.F90
rttov_layeravg_ad.F90 rttov_layeravg_k.F90 rttov_layeravg_tl.F90
rttov_opdep_9.F90 rttov_opdep_9_k.F90 rttov_readcoeffs_ascii.F90
rttov_readcoeffs_binary.F90 rttov_setpredictors_7.F90
rttov_setpredictors_9_ad.F90 rttov_setpredictors_9_solar.F90
rttov_setpredictors_9_solar_ad.F90 rttov_setpredictors_9_solar_k.F90
rttov_setpredictors_9_solar_tl.F90 rttov_setpredictors_9_tl.F90
rttov_sublayer.F90 rttov_sublayer_ad.F90 rttov_sublayer_k.F90
rttov_sublayer_tl.F90 rttov_tl.F90 rttov_transmit.F90 rttov_transmit_9_solar.F90
rttov_transmit_9_solar_ad.F90 rttov_transmit_9_solar_k.F90
rttov_transmit_9_solar_tl.F90 rttov_transmit_ad.F90 rttov_transmit_k.F90
rttov_transmit_tl.F90 rttov_writecoef.F90

Files deleted(SATRAD):

interface/rttov.h

Frederic Vitart

Improvments to GetpersSST

GetpersSST has been changed. Previously getpersSST used intsst to interpolate the climatological SST field from T159 to the resolution of the forecast. Now, the climatological SST is available at various resolutions, and the intsst interpolations have been suppressed.

For legB of VarEPS, the SST initial conditions are now interpolated from the analysis directly to the resolution of legB (previously getpersSST interpolated to the resolution of legA, and intHtoL.sms interpolated the SST field from the resolution of legA to the resolution of legB). We use now interpo instead of intsst to perform this interpolation in getpersSST.

Files modified(SCRIPTS):

build/arch/Makefile.in.ibm_power5

gen/fdbksave fetchobs oce/saverestarts

Jean Bidlot

WAM bugfixes

A possible array bound violation and divsion by 0 was removed from fullmap. The maximun size of the halo in mpdecomp was modified to work in all configurations, including when the domain is reduced to a short segment. In case of a 1 PE run, some arrays in mpdecomp are now correctly defined.

Files modified(WAM):

Sar/fullmap.F

Wam_oper/mpdecomp.F

Marta Janiskova

Regularization of TL and AD linear physics

Regularization in the tangent-linear and adjoint versions of computation of the exchange coefficients between the upper model levels has been re-tuned in order to prevent possible spurious noise in the linearized model.

Files modified(IFS):
`phys_ec/vdfexcustl.F90 vdfexcusad.F90`

Peter Bechtold

Improvements to convection

Add a convective contribution to the (turbulent) wind gusts (postprocessing only) Also fix of possible memory overwrite in cumastrn.F90 and update and cleaning of budgets under LBUD23 switch

Files modified(IFS):
`phys_ec/callpar.F90 cumastrn.F90 cumastrntl.F90 cumastrnad.F90`

Philippe Lopez

Bugfix for TL Physics

Correction of bug (missing ”5” in trajectory array) in tangent-linear version of condensation adjustment (routine CUADJTQSTL), only active in convective downdraught calculations (KCALL=2). This bug (introduced in cycle 21r2) was found by Alan Geer when calling microwave radiance operator in CALLPARTL (gradient test was incorrect).

Files modified(IFS):
`phys_ec/cuadjtqstl.F90`

Richard Forbes

Melting of falling snow.

Changes to the melting of falling snow to reduce the depth of the melting layer and the occurrence of surface snowfall at temperatures above freezing. The timescale for melting was reduced by a factor of three (factor in RTAUMEL changed from 1.5 to 0.66) in the stratiform and convective cloud parametrizations.

Additionally the melting in the stratiform cloud scheme was changed to use the wet-bulb temperature rather than the dry-bulb temperature. This change represents the fact that melting can only proceed when the heating rate of the particle due to conduction from the air is greater than the cooling rate of the particle due to evaporation. In sub-saturated air, the impact will be to lower the height of the melting layer, but for saturated air there is no difference.

Files modified(IFS):
`phys_ec/cloudsc.F90 sucldp.F90 sucumf.F90 sucumf2.F90`

Anton Beljars

Ocean skin temperature.

Activated code for ocean skin temperature responding to surface energy budget (LEOCWA and LEOCCO set to true). This is the cool skin/warm layer ocean parametrization code originally put into CY31R1.

Files modified(IFS):

`setup/su0phy.F90`

Gianpaolo Balsamo

Surface snow albedo.

Change to the albedo of permanent surface snow (RALFMINPSN) from 0.75 to 0.8 following Pirazzini (2004).

Files modified(SURF):

`module/sussoil_mod.F90`

Mohamed Dahoui

MERIS monitoring

Introduction of the monitoring of TCWV (Total Column Water Vapor) from ENVISAT/MERIS. Also cleaning read of gpsro data by SATMON

Files created(OBSTAT):

`satmon/sat_summary_plot.F90`

Files modified(OBSTAT):

`module/mod_sat_create_netcdf.F90 mod_sat_monitor.F90`

`satmon/get_dmsprainy_odb.F90 get_gpsro_odb.F90 get_tcwv_odb.F90 sat_add_geo.F90 sat_geo_plot.F90 sat_hist_plot.F90 sat_hist_profile_plot.F90 sat_hov_plot.F90 sat_monitor.F90 sat_overview_hist_plot.F90`

Files modified(ODB):

`ddl/dmsprainy.sql`

Files modified(SCRIPTS):

`build/arch/Makefile.in.ibm_power5`

`def/an.def`

`gen/fetchobs getsmon satmon_getdat satmon_monitor smon smon_clean smon_def smon_funcs`

`oce/saverestarts`

Elias Holm, Jan Haseler, Mats Hamrud

Conserving interpolation of gridpoint trajectory and increments.

A new conserving interpolation of gridpoint trajectory and increments was introduced in the analysis, controlled by the namelist variables NINTERPTRAJ=3 and NINTERPINCR=3, which are set in /scripts/gen/ifstraj and /scripts/gen/ifsmin. In current operations linear interpolation is used (NINTERPTRAJ=1 and NINTERPINCR=1). In the present branch the default trajectory interpolation changes to conserving, whereas increment interpolation is unchanged (NINTERPTRAJ=3 and NINTERPINCR=1).

This is the first step towards applying conserving interpolation to all fields in the trajectory and the increments. Further optimization of the code is needed for efficient increment interpolation, and the extension to the spectral/dynamic fields requires changed treatment of spectral fields. This is planned for future releases.

The conserving interpolation performs an area integration of the pressure thickness weighted variables on the input grid over the gridpoints of the output grid. Surface fields are just area wighted. The low resolution pressure thicknesses are always first interpolated from the high resolution pressure, whatever the direction of the interpolation. The interpolation uses bicubic subgridcell variation along with a monotone limiter preventing the interpolation causing over and undershoots in the output field. Previous versions of the scheme included options for changing the order of the interpolation and turning the limiter off, but for this implementation the most best option was chosen, thereby simplifying the code by removing unused options.

The parallellization of the interpolation distributes the fields among processors so each level field is interpolated together on a single processor.

Files modified(IFS):
`module/iostream.F90 yom_grid_biconserv.F90 yomct0.F90 namelist/namct0.F90 setup/suct0.F90 sugridug.F90 sumpini.F90 utility/grid_biconserv.F90 interp_gp.F90 pre_grid_biconserv.F90 write_grid_grib.F90 write_grid_traj.F90 var/rdfpinc.F90`

Files created(IFS):
`utility/grid_psglobal.F90`

Files modeified(SCRIPTS):
`gen/ifsmin, ifstraj`

Matthias Drusch, Elias Holm

New sea surface temperature and sea ice product from OSTIA

A new sea surface temperature and sea ice product OSTIA has been included in the system in addition to the presently operationla NCEP products. In /scripts/gen/fetchobs, the OSTIA product is fetched after 2007010112, and in /scripts/gen/sstana the OSTIA fields are chosen for the analysis if present, LOSTI=.TRUE. (Note: Presently stored OSTIA at ECMWF should only be used after 2008022106 due to missing lines in the input data caused by our converter before that date). The data come in as NETCDF files at oversampled resolution (3600x7200), and are converted to BUFR during data acquisition.

Inside the surface analysis, the BUFR fields are converted back to gridpoint field and interpolated to the model resolution by a conserving interpolation algorithm, found in /ssa/sub/conservint.F90. (Note: Since this routine is practically identical to /utility/grid_biconserv.F90, it should be removed from the ssa library eventually to a

common area with ifs).

Files modified(SCRIPTS):
`gen/fetchobs, sstana`

Files modified(SSA):
`interface/gaulat.F90 module/yomsst.F90 yomarrays.F90`
`namelist/namssa.F90 plot/coordinates.F90 sub/inisst.F90, control_ssa.F90, sst_analysis.F90, ice_analysis.F90, reg_to_gg.F90`

Files created(SSA):
`sub/get_ostia.F90 sub/conservint.F90`

Jan Haseler

Back-fixes to the operational suite.

Changes to the satellite monitoring. Correction to the conversion of METAR data from BUFR to ODB format. Avoid failure of task targets when tropical cylones are reported with no name. Mods to operational post-processing from MetApps.

Files modified(ODB):
`bufr2odb/bufr2odb_metar.F90`

Files modified(PREPDATA):
`mc_tools/epsrdbufr.F`

Files modified(SCRIPTS):
`def/an.def`
`gen/fetchobs getpersSST getsmon mkidta_eps mkidta_sens model satmon_getdat satmon_monitor smon smon_clean smon_def smon_funcs`

Files modified(WAM):
`Sar/accuwa.F chasar.F dnfftf.F fftsub.F getsarpar.F sarinv.F sarinvert.F`
`Wam_oper/getwspec.F spec2fdb.F userin.F`
`module/yowparam.F`

AMSUA channel 14 set to zero

When cold-starting VARBC, set the bias correction for AMSUA channel 14 to zero. Remove satrad *.h's from IFS to fix compilation problem. Mods to satellite monitoring of GPS radio occultation data.

Files modified(IFS):
`module/yomvarbc.F90`
`namelist/namvarbc.h`
`op_obs/radtr.F90 radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrk.F90 radtrtl.F90`
`var/suvarbc.F90`

Files modified(OBSTAT):
`module/mod_sat_monitor.F90`
`satmon/get_gpsro_odb.F90`

Files modified(SCRIPTS):

```
build/Makefile.root.aeolus
gen/ifstraj
```

MERIS, OSTIA etc.

Remove references to ECLIB. New algorithm library split from ifsaux. Correction to build of satrad library. Task for converting MERIS data from ODB to BUFR format. Mods to OSTIA SST and sea ice analysis. Use pre-interpolated SST climate fields for persistence SST correction. Satellite monitoring of MERIS data. Use conserving interpolation scheme to interpolate from high to low resolution trajectory. Mods from MetApps for Norwegian EPS.

Files created(SCRIPTS):

```
sms_an/o2b_meris.sms
```

Files modified(SCRIPTS):

```
build/Makefile.root.satrad
def/an.def eps_varfc.def
gen/fetchobs getpersSST getsmon ifsmin ifstraj libsgen mkabs_aeolus mkabs_an
mkabs_fc mkabs_matools mkabs_mctools mkabs_obsproc mkabs_prepdata mkabs_satim
mkabs_satmon mkabs_satrad mkabs_scat mkgenlinks modelsv premwimg satmon_getdat
satmon_monitor smon smon_clean smon_def smon_funcs sstana
sms/ifs.sms
sms_an/sst.sms
```

Deborah Salmond

Various bugfixes

- Fix to ensure same results when run with same number of OpenMP threads (wrevecs.F90 and xformev.F90)
- Fix for restart of forecast (cnt4.F90)
- Fix to run with -C (array bounds checking) library (statpred.F90)
- Fix to run with NANS (arrays initialised to NANS) library (addbgs.F90, sbsfgs.F90, gwdragad.F90)
- Fix miss-match of land-sea mask - where UPDCLIE corrects the surface temperatures using values from the climate files.

Files modified(IFS):

```
var/xformev.F90 var/wrevecs.F90
control/cnt4.F90
obs_preproc/statpred.F90
utility/addbgs.F90 sbsfgs.F90 phys_ec/gwdragad.F90
climate/updclie.F90
```