RESEARCH DEPARTMENT MEMORANDUM

To:	RD Scientific Staff and Consultants	
Copy:	DR, DF, HPS, HES, Alain Joly, John Hodkinson, François Bouyssel, Claude Fischer, Ryad El Khatib, Karim Yessad	
From:	Deborah Salmond et al.	
Date:	March 24, 2015	File: RD15-070
Subject:	**IFS Memorandum Cycle CY41R2**	

Cycle 41r2 was created in February-March 2015.

Contributors:

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Again the merge was done incrementally testing each version:

V0: Base version: das_CY41R1_NEW, dag_CY41R1_for_41R2_v0

dag_CY41R1_esuite

das_CY41R1_OPT

V1: das_CY41R1_NEW_V1, dag_CY41R1_for_41R2_v1 (Bit-reproducible branches)

da7_CY41R1_Dec1_aeolus_ecflow

nel_CY41R1_NEW_v1

V2: das_CY41R1_NEW_V2, dag_CY41R1_for_41R2_v2 (Satellite)

stg_CY41R1_satmerge_13

V3: das_CY41R1_NEW_V3, dag_CY41R1_for_41R2_v3 (ODB, ENKF and MACC - Bit-reproducible)

dipl_CY41R1_odb_bit_repro_for_41r2

nar_SB41R1_ENKF_D

stj_CY41R1_CAMS_for_CY41R2_5

V4: das_CY41R1_NEW_V4, dag_CY41R1_for_41R2_v4 (SMOS, ATLAS and NA - Bit-reproducible)

nal_CY41R1_fieldman_proj

daq_CY41R1_SMOS_newstuff_v2

nawd_CY41R1_atlas

nas_CY41R1_NA_passive

V5: das_CY41R1_NEW_V5, dag_CY41R1_for_41R2_v5 (Wam, Nemo, Surface Analysis, NITMP, Fix)

wab_SB41R1_wam_nemo_forCY41R2

dap_CY41R1_ssa_notbi_for_41r2

pah_CY41R1_radlsw_tlad_fix

namd_CY41R1_new_nitmp

V6: das_CY41R1_NEW_V6, dag_CY41R1_for_41R2_v6 (Physics)

pae_CY41R1_for41r2_PA_C17

need_CY41R1_surface_fcm_OSM_ONLY

V7: das_CY41R1_NEW_V7, dag_CY41R1_for_41R2_v7 (Data Assimilation, SCAT)

dae_CY41R1_hybrid_JB_cycling_errors_2

dig_SB41R1_for41r2_with_esuite

V8: das_CY41R1_NEW_V8, dag_CY41R1_for_41R2_v8 (OOPS)

nat_CY41R1_OOPS

V9: das_CY41R1_NEW_V9, dag_CY41R1_for_41R2_v9

nas_CY41R1_VDF

nas_CY41R1_NAfixes

str_CY41R1_satmerge_13_bitrep

mo3_CY41R1_OBSTAT

datk_CY41R1_cope_release_41r2

nar_CY41R1_ioserv

nar_CY41R1_pointer_2_allocatable

dipl_CY41R1_gmi

V10: das_CY41R1_NEW_V10, dag_CY41R1_for_41R2_v9

pafv_CY41R1_SP

pafv_SB41R1_SP_220

NUMERICS

Sylvie Malardel, Nils Wedi, George Mozdzynski, Michail Diamantakis, Mat Hamrud - nas_-CY41R1_NA_passive - BR

Modifications necessary to run with the octahedral mesh

Contains:

naw_CY41R1_collignon + mpm_CY41R1_sldebug

naw_CY41R1_octahedral

nar_CY41R1_ps_tend_diag

namd_CY41R1_mfix

mpm_CY41R1_gmcontrib

Collignon Mesh The source branch contains the changes necessary to run with the octahedral mesh (except for scripts which are in a separate branch). The branch changes the sponge for cubic grids to use NDGLG-1 instead of NSMAX. The branch also contains the necessary changes to use FFTW instead of FFT992.

This branch also resolves a known failure in ifsmin when using a collignon grid. The fix is in SLCSET and the other routines in this branch enhance the existing LSLDEBUG capability to aid diagnosing such problems. The associated scripts branch contains the necessary modifications to run with octahedral grid GTYPE=_4 with fixes to assimilation scripts

GW surface pressure diagnostics Surface pressure tendency diagnostics: computation and output in grib file. Become ACTIVE if LGWDIAGS_ON in NAMGWDIAG.

Mass fixers Algorithmic and structural improvements in the mass fixing package. Various changes have been introduced for tracer mass fixer package: (i) use same namelist control for forecast model tracers with MACC tracers (ii) allow more flexibility (e.g. apply BC fixer on a set of tracers and simple proportional on another) (iii) algorithmic and user control enhancements for improved chemical composition forecasts.

Grib header via grib_set_vtable.F90 also for IFS Grib header (fullPos) built in mknam_fp instead of wrmlfp inside IFS by program grib_set_vtable (same as in lowres)

Fix for shallow water in sudyn Fix for a floating point exception in the Fast Legendre Transform (FLT); address the high cost of initialisation in SULEG when the fast Legendre transform is enabled (i.e. LUSEFLT=T); rewrite of sumplatb_mod.F90 to give a better latitude distribution for the Fourier transforms; fix namtrans initialisation issue for FLT

Testing:

```
FC only at TL1279: ref=g9sh, new=g9si
Early Delivery, 2 cycles at TL1279 (TL255, TL255, TL255): ref= g9tf, new: g9uf

Longer octahedral mesh runs:
g9he (TC159 climate run)
g9ot (TC639/TC159/TC159/TC159 analysis)
```

Files modified(SCRIPTS):

gen/coldstart_lakes ens_errors ens_errors_rad ens_fetch_fields ens_stats_mem fast_-
sgint gaussgr getgrb ifsmin ifstraj lowres_fp mkabs_prepdata mkidta_eps mkidta_ocean
mkidta_sens mknam_fp model modeleps_nemo postenkf sekf_sm

Files created(PREPDATA):

programs/grib_set_vtable.F90

Files created(TRANS):

module/tpm_fftw.F90

Files modified(IFS):

fullpos/cpfpfilter.F90 sufptrans.F90 module/yoerad.F90 yomtrans.F90
namelist/naerad.nam.h namtrans.nam.h obs_preproc/suobscor_resol.F90
phys_dmn/surdi15.F90 phys_radi/suecrad.F90 setup/suarg.F90 suecphypo.F90
suhdf_ec.F90 susc2b.F90 sutrans.F90 sutrans0.F90 var/sujbwavtrans.F90
interpol/check_sl_struct.F90 interpol/slcset.F90 module/eint_mod.F90
op_obs/slint.F90 op_obs/slintad.F90 namelist/namtrans0.nam.h
namelist/namtrans.nam.h setup/sutrans.F90 sutrans0.F90
utility/gstats_label_ifs.F90 adiab/cpg_gp.F90 control/cnt4.F90
module/yomgwdiag.F90 setup/su0yomb.F90 adiab/laitre_gfl.F90
control/gmassdiag.F90 jmgfixer.F90 pfixer.F90 qmfixer.F90 qmfixer2.F90
tracmf.F90 trmfixers.F90 module/chem_mix.F90 gfl_subs_mod.F90 type_gfls.F90
yom_ygfl.F90 yomchem.F90 namelist/namgfl.nam.h setup/suctrl_gflattr.F90
sudefo_gflattr.F90 sudyn.F90 sugfl1.F90 sugfl2.F90 sugfl3.F90

Files modified(PREPDATA):

programs/gptosp.F90 interpo.F90 intsst.F90 sptogp.F90

Files modified(TRANS):

external/setup_trans.F90 trans_end.F90 interface/setup_trans.h
module/dealloc_resol_mod.F90 ftdir_mod.F90 ftdirad_mod.F90 ftinv_mod.F90
ftinvad_mod.F90 set_resol_mod.F90 setup_geom_mod.F90 sufft_mod.F90 tpm_fft.F90
module/suleg_mod.F90 sumplat_mod.F90 sumplatb_mod.F90

Files modified(ALGOR):

module/butterfly_alg_mod.F90 interpol_decomp_mod.F90

Willem Deconinck - nawd_CY41R1_atlas - BR

Linking Atlas framework in passive mode

- Atlas has been successfully linked, becoming a dependency of libifs.
- Atlas is initialized in su0yoma.F90
- Bitreproducible changes in gridpoint distribution, so that distribution becomes unique independent of round-off errors

Linking Atlas in:

- Issue was encountered with libmpi_serial and linking serial tools with MPI-enabled Atlas.

- A script $create_serial_wrapper$ copies the parallel version of the program to $< program > .orig$, and creates a script $< program >$ calling $< program > .orig$ internally with aprun or mpiexec as needed.
- Future Action needed: ideally remove all occurences of libmpi_serial, and use this workaround. Alternatively use "run_parallel -s" script everywhere needed, so that "seemingly" serial programs don't exist.
- Only tested with cray environment. In lxab, atlas is not linked in, which is controlled with -DNO_ATLAS flag during compilation.

Atlas is initialized in su0yoma.F90 - Setup internal MPI communicator, as copy of MPL_COMM - Setup of logging facility - Version and git-sha1 are printed for atlas and eckit

Atlas has been installed in /usr/local/apps/atlas/CY41R1. When CY41R2 is ready, a version CY41R2 will be installed, which can also be loaded with "module load atlas/CY41R2"

Mats branch nar_CY41R1_atlas_gp_dist, integrated here as well, changes the gridpoint distribution slightly, by using a modified decision algorithm which is not influenced by round-off errors. - Changes are bit-reproducible for "fc" experiments – WAM model prints LOCAL norms which MUST show differences when distribution changes, but feed-back correctly in bit-reproducible way to IFS. - Changes are bit-reproducible for "an" experiments, only with LREPRO4DVAR=ON and is verified.

TESTED Methodology: - increased limits in varbc_table.F90 and varbc_setup.F90 (see Nils, Tomas) - run "an" experiment T159 [ga5a] from branch nawd_CY41R1_repro [control] with LREPRO4DVAR=ON - run "an" experiment T159 [ga5n] from branch nawd_CY41R1_atlas_repro [test] with LREPRO4DVAR=ON - all tools compile and run, and results are bit-reproducible.

Files modified(IFS):

`setup/su0yoma.F90`

Files modified(SCRIPTS):

`build/Makefile.root.ifs arch/Makefile.in.cray_XC30_cce arch/Makefile.in.linux64`
`gen/create_schema inter_fp mkabs_an mkabs_b2otools mkabs_enkf mkabs_fc mkabs_obsproc`
`mkabs_odbtools mkabs_prepdata mkabs_satim mkabs_satrad mkabs_ssa mkabs_wam run_parallel`

Files modified(TRANS):

`module/sustaonl_mod.F90`

George Mozdzynski - mpm_CY41R1_fftw - BR

Support for FFTW - Fastest Fourier Transform in the West

FFTW is a portable Fast Fourier Transform package that runs on many systems today (including our XC-30 CRAY clusters).

see http://www.fftw.org/

Our own FFT package (called FFT992) is constrained by only supporting data lengths (i.e. grid points on a latitude) which have prime factors of 2, 3 and 5, which could be an issue for future grids that we may want to use (research in numerical aspects section). FFTW has no such restrictions, but this comes at a cost (more on this later).

With this branch, the **DEFAULT IS TO USE FFT992**, so this branch has no effect on results, and as such results are bit identical to 41R1 controls for a fc model and 4D-Var.

If you want to use FFTW then, you need to specify,

```
&NAMTRANS
LFFT992=.FALSE.,
LFFTW=.TRUE.,
/
```

When using FFTW, you can expect to get small differences in results, which should not be meteorologically significant. In addition, all model cases tested meet the RAPS benchmarking criteria for correctness, noting there is no RAPS correctness check for 4D-VAR.

```
Cases tested are,
  T159   FC 10 days , 32Tx8t, control=g74k, fftw=g74l
  T511   FC 10 days ,128Tx8t, control=g75f, fftw=g75g
  T1279  FC  2 days ,480Tx12t,control=g7yk, fftw=g7yl
  T159   AN         , 96Tx8t, control=g76x, fftw=g77q
```

Initial experience shows that FFTW is faster than FFT992, but only at resolutions greater than TL1279, as summarised here, where I show the combined cost of the following gstat counters,

```
 106 FTDIR_CTL   - DIRECT FOURIER TRANSFORM
 107 FTINV_CTL   - INVERSE FOURIER TRANSFORM
```

as a percentage of the total wall clock time, for runs of 240 time-steps.

Resolution	FFT992	FFTW	Tasks x threads
TL399	1.7%	2.3%	16T x 6t
TL1279	2.8%	2.9%	512T x 6t
Tc1023	1.9%	1.6%	1024T x 12t
Tc1999	3.1%	2.4%	2048T x 12t

So no significant savings (for the higher resolutions), but savings nevertheless.

What is more important for now is the functionality of FFTW to allow any data (latitude) length. Here are some examples for executing 100 iterations of back to back dir/inv FFTs (amortising the cost of plan creation).

data length	wall cost	++++prime factors++++++++++++++++++						
10	0.092	2	5					
17	0.158	17						
84	0.113	2	2	3	7			
96	0.139	2	2	2	2	2	3	
128	0.070	2	2	2	2	2	2	2

```
  129   0.288     3   43
  137   0.648   137
  191   1.080   191
  256   0.074     2    2    2    2    2    2    2    2
  257   0.850   257
 1637   1.265  1637
 4321   0.834    29  149
 5082   0.130     2    3    7   11   11
 6673   1.578  6673
 8223   1.498     3 2741
 8224   0.463     2    2    2    2    2  257
10007   1.709 10007
10008   0.418     2    2    2    3    3  139
10009   1.710 10009
10487   1.598 10487
10488   0.341     2    2    2    3   19   23
14359   1.719    83  173  <- the highest cost (1..16000)
14528   0.414     2    2    2    2    2    2  227
15972   0.188     2    2    3   11   11   11
15999   1.565     3 5333
16000   0.102     2    2    2    2    2    2    2    5    5    5
```

What can be clearly seen is that having data lengths with large prime factors can increase the FFTW cost by up to 15-17 times.

Note I have only looked at FFTW being used as an alternative to FFT992. FFTW can do a lot more, for example, 2D FFTs, 3D FFTs, with parallelisation of FFTs over threads and MPI tasks. For an IFS model today we do multiple independent 1D FFTs in each thread, and have no immediate need for these additional FFT parallelisation capabilities.

Finally, the FFTW use in IFS described here has been shown to be thread safe and produce bit identical results for an IFS model when the number of MPI tasks or OpenMP threads are changed.

Files created(TRANS):

`module/tpm_fftw.F90`

Files modified(IFS):

`fullpos/cpfpfilter.F90 sufptrans.F90`
`module/yomtrans.F90`
`namelist/namtrans.nam.h`
`obs_preproc/suobscor_resol.F90`
`phys_radi/suecrad.F90`
`setup/suecphypo.F90 sutrans.F90 sutrans0.F90`
`var/sujbwavtrans.F90`

Files modified(TRANS):

`external/setup_trans.F90 trans_end.F90`
`interface/setup_trans.h`
`module/dealloc_resol_mod.F90 ftdir_mod.F90 ftdirad_mod.F90 ftinv_mod.F90 ftinvad_-mod.F90 set_resol_mod.F90 sufft_mod.F90 tpm_fft.F90`

Michail Diamantakis - namd_CY41R1_new_nitmp - ACTIVE

Increase departure point iteration defaults

Increases the default setting for the number of iterations used for finding the semi-Lagrangian departure point (NITMP changes from 3 to 5 in the outer loop (model) and from 2 to 3 in the inner loop (ifsmin)). It has been shown to improve tropical cyclones, mid latitude wind scores at jet stream level and precipitation over China. This is mainly observed at high resolutions (TL1279 and higher) which for efficiency reasons IFS is run with a slightly overstretched timestep leading to larger CFL numbers.

This change affects only ECMWF IFS runs. Parameter NITMP is fully under prepIFS control for ”fc” experiment types but not for other types, however, its value can still be changed from the default editing namelist scripts.

The increase in run-time cost is in the region of 1

Testing:

Experiments:

- TC1023 4DVAR exp g7ir (compare against g7j9 41r1 control)

- TL1279 4DVAR exp g878 (compare against g7ux 41r1 control)

- TL639 4DVAR experiment ga22 (copy of Gabor's winter control g8e3)

Files modified(IFS):
`adiab/larmes5.F90`
`setup/sudyn.F90`

Mats Hamrud - nar_CY41R1_pointer_2_allocatable - BR

Change POINTERs to ALLOCATEABLEs in trans

Files created(TRANS):
`module/fftw3.f03.h tpm_fftw.F90`

Files modified(TRANS):
`external/setup_trans.F90 trans_end.F90`
`interface/setup_trans.h`
`module/dealloc_resol_mod.F90 ftdir_mod.F90 ftdirad_mod.F90 ftinv_mod.F90 ftinvad_-mod.F90 gath_grid_32_ctl_mod.F90 set_resol_mod.F90 setup_geom_mod.F90 sufft_mod.F90 suleg_mod.F90 sumplat_mod.F90 sumplatb_mod.F90 sustaonl_mod.F90 tpm_distr.F90 tpm_-fft.F90 tpm_fields.F90 tpm_flt.F90 tpm_geometry.F90 trltom_mod.F90 trmtol_mod.F90`

PHYSICS

Combined physics branch - pae_CY41R1_for41r2_PA_C17

https://software.ecmwf.int/wiki/display/IFS/CY41R2+Physics+and+Numerics+Testing

Gianpaolo Balsamo - pad_CY41R1_lake_ice_fraction_only - ACTIVE

Subgrid lake freezing

Sub-grid fractional lake freezing to enable smooth transitions between liquid and frozen state in resolved and subgrid lakes based on the tiling scheme.

Testing: Offline experiment 1979-2014 g96a (cntl ga2o) Climate run TL255fc g9ir (cntl g7ex) Test of adjoint passed (ga57) Winter TL639AN g9ye (cntl g8e3) IVER:file:///scratch/rd/pad/iver/plots/winter_41r1_an_lake_-rough/index.html

Files modified(SCRIPTS): `gen/soilana`

Files modified(IFS): `climate/updclie.F90`

Files modified(SURF):

`module/surfbc_ctl_mod.F90 surftstp_ctl_mod.F90`

Peter Bechtold and Marta Janiskova - pae_CY41R1_pae_CY41R1_minCAPE_caprain_detrsnow - ACTIVE

Convection and non-orographic gravity wave changes, preparing for easier coupling with PBL -Resolution dependece of non-orographic gravity wave launch flux -UPDATE OF tl/ad TO INCLUDE LATITUDE DEPENDENCE OF LAUCH FLUX -minimum CAPE adjustment of 5virtual temperature computation for diurnal cycle, consistent parcel perturbations for departure levels KLEV and KLEV-1, increased cloud diffusion for convection -cleaning of convection and vertical diffusion, enabling future branching of a simpler moist boudnary-layer scheme and removing many unused arrays and computations

Impact: Improves the mean winds above 2 hPa by up to 20Improved 200 hPa temperatures, reduction in convective LCC otherwise largely neutral with slightly positive summer and slight degradation (1

Testing:

-Forecast (30-day integration) resolution dependence run for non-orographic gravity waves g7zq=T255, g7us=T511, g7mk=T799 g7qc=TC1023, g834=TL1279 variable GWD, g835=TC1023 variable GWD -analysis Test GWD mods at T1279 (Nota: GWD changes only efefctive for TL¿700): g87b=CTL g87a=resolution dependent GWD flux

-T639 Analysis for convection changes: winter=g8pq, CTL=Gabors experiments However, in the final combined physics branch (see Wiki page) the entrainment change in the test parcle (cubasen.F90) has been reverted as impact from it was slightly negative

Files created(SCRIPTS):

`scripts/metview/climplot_batch compvar_ens.met monmeans_clim.met`

Files created(IFS):

`namelist/namvdf.nam.h phys_ec/vdfeis.F90`

Files modified(IFS):

`module/yoecldp.F90 yoecumf.F90 yomphyder.F90 yomsekf.F90 namelist/namcldp.nam.h namcumf.nam.h phys_ec/callpar.F90 callparad.F90 callpartl.F90 cloud_layer.F90 cloudsc.F90 convection_layer.F90 cuascn.F90 cubasen.F90 cubasmcn.F90 cucalln.F90 cudtdqn.F90 cuflxn.F90 cuinin.F90 cumastrn.F90 gwdrag_wmss.F90 gwdrag_wmssad.F90`

gwdrag_wmsstl.F90 local_arrays_fin.F90 local_arrays_ini.F90 noturbulence.F90
phys_arrays_ini.F90 restore_vdfout.F90 sucldp.F90 sucumf.F90 sugwwms.F90
suphec.F90 suvdf.F90 turbulence_layer.F90 vdfexcu.F90 vdfmain.F90 vdfouter.F90
sekf/susekf.F90 utility/dealsc2.F90

Alessio Bozzo - paab_CY41R1_sunshine_fix - BR

Fix for direct solar beam and sunshine hours computation - Modification in the computation of the direct beam solar radiation. - Removed the incorrect scaling by the solar zenith angle. - Impact only on the computation of the diagnostic for sunshine duration.

Files modified(IFS):
phys_radi/srtm_spcvrt_mcica.F90

Alessio Bozzo - paab_CY41R1_MACC_AERCLIM - BR

new MACC aerosol climatology

- new 2D aerosol monthly-mean climatology from the 10-years cycling experiment g01j
- aerosol types from the 12-category MACC prognostic aerosols
- planned to be for Cy42r1 only under switch NAERMACC=1

Testing: Climate TL255fc g95k (cntl g7ex)

Files created(IFS):
module/yoeaercli.F90 namelist/naercli.nam.h phys_ec/su_aerv.F90 sumaccbc1.F90
sumaccbc2.F90 sumaccor1.F90 sumaccor2.F90 sumaccsd1.F90 sumaccsd2.F90
sumaccsd3.F90 sumaccss1.F90 sumaccss2.F90 sumaccss3.F90 sumaccsu1.F90

Files modified(IFS):
module/yoeaerc.F90 yoerad.F90 namelist/naeaer.nam.h naerad.nam.h
phys_dmn/apl_arome.F90 surdi15.F90 phys_ec/aer_clcld.F90 aer_rrtm.F90
callpar.F90 climaer_layer.F90 radaca.F90 radact.F90 raddrv.F90 radina.F90
radinaad.F90 radinatl.F90 radintg.F90 radlswr.F90 su_aerw.F90 suaerv.F90
suecaec.F90 phys_radi/rrtm_ecrt_140gp_mcica.F90 srtm_srtm_224gp_mcica.F90
suecrad.F90 uvradi.F90 setup/suallo.F90 utility/deallo.F90 updtim.F90

Emanuel Dutra - need_CY41R1_lw_tiling - ACTIVE

Surface longwave radiation tiling Tiling of longwave radiation for each surface tile considering the tile skin temperature

Testing: - Climate TL255 fc 41r1 g7uj (cntl g7ex) - In combination with Robin Radiation changes Summer TL639an 41r1 g944 (cntl g8e2)

Files modified(IFS):
phys_ec/surftstp_layer.F90

Files modified(SURF):

`external/surftstp.F90 interface/surftstp.h module/srfsn_lwimp_mod.F90 srft_mod.F90 surfseb_ctl_mod.F90 surftstp_ctl_mod.F90 suvexc_mod.F90 yos_exc.F90 offline/driver/callpar1s.F90 driver/wrtdcdf.F90 phys_ec/vdfmain1s.F90 util/convNetcdf2Grib.F90`

Emanuel Dutra - need_CY41R1_snow_fix - ACTIVE

Snow fixes Minor fix for snow sublimation in forests and Average snow density by depth rather than mass after snowfall

Testing: Climate TL255 fc g971 (cntl g7ex) Winter TL639 an g963 (cntl g8e3)

Files modified(SURF):

`module/srfsn_lwimp_mod.F90 surfexcdriver_ctl_mod.F90`

Richard Forbes - pas_CY41R1_snowevap - BR

Microphysics update New ice phase submlimation/deposition microphysics options New snowfall sublimation and ice deposition physics options for cloud scheme (turned off for this cycle)

Testing: To test options turned on: TL639 analysis g8yl summer (cntl g8e2), g936 winter (cntl g8e3) TL255 climate To test bit-identical when options turned off: Short analysis TL639 g9yt (cntl g9tq)

Files modified(IFS):

`module/yoecldp.F90 phys_ec/cloudsc.F90 sucldp.F90`

Richard Forbes - pas_CY41R1_newfreezingrain - ACTIVE

Microphysics : Freezing rain - New freezing rain physics - New more physically based parametrization of the rain freezing process and a new ”accumulated freezing rain” diagnostic.

New parameters for operation suite: Yes freezing rain accumulation in an/fc/eps paramId 228216 shortName fzra name Accumulated freezing rain unit m description Freezing rain precipitation at the surface. Accumulated field

-add surface diagnostic to an/fc/eps postprocessing panel for accumulated freezing rain: paramId=228216, shortname=fzra

Testing: TL639 analysis Winter 20140201- g9b8 (cntl g8e3) TL1279 forecast freezing rain case studies (g9as)

Files modified(IFS):

`adiab/cpedia.F90 postphy.F90 dia/wrmlppg.F90 wrmlpplg.F90 fullpos/hpos.F90 wrmlfp.F90 wrmlfpl.F90 module/parfpos.F90 surface_fields_mix.F90 yoecldp.F90 yom_grib_codes.F90 yomafn.F90 yomphyder.F90 yomppc.F90 yomvareps.F90 namelist/namafn.nam.h phys_ec/callpar.F90 cloud_layer.F90 cloudsc.F90 diag_clouds.F90 local_arrays_fin.F90 local_arrays_ini.F90 phys_arrays_fin.F90 phys_arrays_ini.F90 postphy_layer.F90 sucldp.F90 setup/su_surf_flds.F90 suafn1.F90 suafn2.F90 suafn3.F90 supp.F90 suvareps.F90 utility/reset_accfie_vareps.F90`

Robin Hogan - parr_CY41R1_approx_radiation_update2 - ACTIVE

Approximate radiation updates Perform approximate updates of longwave and shortwave fluxes every timestep and gridbox in response to surface temperature and albedo, to mitigate surface temperature errors both at coastlines and in the diurnal cycle over land associated with running the radiation scheme infrequently in time and space.

Bit-reproducible: no. The following flags are true by default but even when set to false the branch is not perfectly bit-reproducible with the original cycle due to rearrangement and simplification of some mathematical expressions.

LApproxLwUpdate (Turn on and off the approximate longwave update),

LApproxSwUpdate (Turn on and off the approximate shortwave update) and

LCentredTimeSZA (Ensure all solar zenith angles are computed at the right time).

Testing: Forecast experiments of 4 months each, where experiment IDs indicate "Control", "With branch", and "As control but with radiation every timestep/gridpoint for comparison": T639 summer: g5wg, g5wm, g89w T639 winter: g5wx, g5wy, g8g6 T1279 summer: g5os, g8gg, g8gl T1279 winter: g5oq, g8gh, g8gj

-Analysis experiment: g931

-Increases run time by around 2% of the cost of the radiation scheme

See technical memo 746 for details.

Files modified(IFS):

```
module/yoerad.F90 yoerip.F90 yomphyder.F90 yomradf.F90 namelist/naerad.nam.h
phys_dmn/surdi15.F90 phys_ec/callpar.F90 ec_phys_drv.F90 radcfg.F90 raddrv.F90
radflux_layer.F90 radheatn.F90 radiation_layer.F90 radina.F90 radintg.F90
radlswr.F90 updtier.F90 phys_radi/rrtm_rrtm_140gp_mcica.F90
rrtm_rtrn1a_140gp_mcica.F90 srtm_spcvrt_mcica.F90 srtm_srtm_224gp_mcica.F90
suecrad.F90 utility/deallo.F90 dealmod.F90 updtim.F90
```

Marta Janiskova - pan_CY41R1_surfmod_TLAD - ACTIVE

Activation of TL/AD surface scheme + modifications of some surface related TL/AD computations:

- The linearized surface scheme already included as passive in the cycle CY41R1 is made active in 4D-Var (i.e. setting LESURF2=true in ifsmin);
- Regularization for momentum exchange coefficient between the surface and the lowest model level is more relaxed (i.e. perturbation of that coefficient is less suppressed);
- Computation of stability parameters in the simplified physics is made consistent with the full non-linear code;
- The previous time step surface fluxes for heat and momentum are used in the linearized routines (surfexdrivers-routines) controlling the ensemble of routines that prepare the surface exchange coefficients and associated surface quantities needed for the solution of the vertical diffusion equations.

Files modified(SCRIPTS):

gen/ifsmin

Files modified(SURF):

module/surfexcdrivers_ctl_mod.F90 surfexcdriverstl_ctl_mod.F90 vexcsstl_mod.F90 vexcssad_mod.F90 vupdz0s_mod.F90 vupdz0stl_mod.F90 vupdz0sad_mod.F90

Philippe Lopez - pah_CY41R1_fix_ZALFAW_v1 - NotBR

Fixes - Bugfix in liquid/ice partitioning function in TL/AD. - Slight modification of the liquid/ice partitioning function used in TL/AD to avoid small negative snow fluxes at positive temperatures.

Testing: - T511 L137 4D-Var (LWDA) runs: g8m6 (my own control) and g8m8 (exper with fix) Period: June-December 2013. - impact is neutral, as expected. - no change in running cost.

Files modified(IFS):

phys_ec/cuascn.F90 cucalln.F90 cucalln2.F90 cucalln2ad.F90 cucalln2tl.F90 cuddrafn2.F90 cuddrafn2ad.F90 cuddrafn2tl.F90 cudlfsn.F90 cudtdqn.F90 cudtdqn2.F90 cudtdqn2ad.F90 cudtdqn2tl.F90 cuflx2.F90 cuflx2ad.F90 cuflx2tl.F90 cuflxn.F90

Irina Sandu - pa3_CY41R1_snow_roughness_only - ACTIVE

Change of roughness length for snow exposed snow, short grass and bogs and marshes The roughness length for the exposed snow tile represents now an weighted average (by snow depth) between the roughness of the underlying low vegetation and the roughness of snow, when the snow depth is inferior to 25 cm. When the snow depth is superior to 25 cm, the roughness of snow is used. The roughness length for short grass and bogs and marshes was reduced.

Testing: autumn T639 an run : g9y6 - vs gabor's control g8e2 - 10.10.2014-30.10.2014 and running

winterT639 an run : g9ui - vs gabor's control g8e3 - 1.02.2014-3.03.2014 and running

Files modified(SURF):

module/surfexcdriver_ctl_mod.F90 susveg_mod.F90 vupdz0_mod.F90

Filip Vana - pafv_CY41R1_1dmodel - BR

Update of the SCM version - only part of the above branch is included concerning physics coupling: diagnostic fields passed out the ECMWF physics to be seen by the SCM diagnostics - for the renaining parts of the branch see Wilhelmson and Vana

Files modified(IFS):

module/yomphyder.F90 phys_ec/aer_phy3_layer.F90 backscatter_layer.F90 callpar.F90 cloud_layer.F90 cloud_s_layer.F90 convection_layer.F90 convection_s_layer.F90 lightning_layer.F90 local_arrays_fin.F90 local_arrays_ini.F90 noconvection.F90 phys_arrays_fin.F90 phys_arrays_ini.F90 turbulence_layer.F90 turbulence_s_layer.F90 setup/susavtend.F90

Nils Wedi - nas_CY41R1_AREA_CONV - ACTIVE

Change of resolution dependent convective adjustment time-scale

Use for the relative scaling to the 799 resolution the area — the Gaussian weight divided by the number of points on the corresponding latitude — instead of only the latitude number

Testing::

g9sf TL1279

climate runs:

g9tt TL191 g9he TCo159 g9va TCo255 g9te TC199

Files modified(IFS):

`phys_ec/callparad.F90 callpartl.F90 convection_layer.F90 convection_s_layer.F90 cucalln.F90 cucalln2.F90 cucalln2ad.F90 cucalln2tl.F90 cumastrn.F90 cumastrn2.F90 cumastrn2ad.F90 cumastrn2tl.F90 ec_phys_ad.F90 ec_phys_tl.F90 phys_ad.F90 phys_nl.F90 phys_tl.F90 sucumf.F90 sucumf2.F90`

Philippe Lopez - pah_CY41R1_radlsw_tlad_fix - BR except for 19 levels

Fix for RADLSWTL/AD for low vertical resolution (19 levels).

The maximum cloud top level estimated when LWLCLHR=T (i.e. optimization in TL and AD of longwave radiation) is now bounded by KLEV.

Files modified(IFS):

`phys_ec/radlsw.F90 radlswad.F90 radlswtl.F90`

Emanuel Dutra - need_CY41R1_surface_fcm -BR

Surface only updates for 41r1

Use of fcm to compile the surface model, added support to run regular lat/lon simulations, post-processing optimizations for the cray

Testing: ERA-Land surface experiments (1979-near real time) g94w at T255 and g96a at T639. g94w is used by in 41r1 to initialize the reforecasts 12) This branch already includes the changes that will go in the physics branch from need_CY41R1_lw_tiling but the option is de-activated.

Files created(SCRIPTS):

`gen/create_forcing_LL.ksh create_init_clim_LL.ksh pp_osm_LL.ksh surface_clean_LL.ksh`

`sms_osm/pp_osm.sms`

Files created(SURF):

`make/cfg/cce-noopt.cfg cfg/cce-opt.cfg cfg/gnu-noopt.cfg cfg/gnu-opt.cfg cfg/intel-opt.cfg cfg/pgi-noopt.cfg cfg/pgi-opt.cfg osm.cfg`

`offline/driver/ibm.F90 driver/netcdf_utils.F90 driver/parkind1.F90 driver/ptrgp1s.F90 driver/ptrgpd1s.F90 driver/sucst.F90 driver/sulwn.F90 driver/surdi.F90 driver/suswn.F90`

driver/suvdf.F90 driver/suvdfs.F90 driver/vdfdifc.F90 driver/vdfdifh1s.F90 driver/vdfdifm1s.F
driver/vdfincr.F90 driver/vdfmain1s.F90 driver/yoelw.F90 driver/yoephy.F90 driver/yoerad.F90
driver/yoerdi.F90 driver/yoerdi1s.F90 driver/yoerip.F90 driver/yoesoil1s.F90 driver/yoesw.F90
driver/yoethf.F90 driver/yoevdf.F90 driver/yoevdfs.F90 driver/yomcc1s.F90 driver/yomcdh1s.F90
driver/yomcst.F90 driver/yomct01s.F90 driver/yomdim1s.F90 driver/yomdphy.F90 driver/yomdyn1s.
driver/yomforc1s.F90 driver/yomgc1s.F90 driver/yomgdi1s.F90 driver/yomgf1s.F90 driver/yomgp1s
driver/yomgp1s1.F90 driver/yomgp1sa.F90 driver/yomgpd1s.F90 driver/yomhook.F90 driver/yomjfh.
driver/yomlog1s.F90 driver/yomlun1s.F90 driver/yomrip.F90 util/get_points_mod.F90
util/lib_dates.F90

Files modified(SCRIPTS):

def/surface.def
gen/archive_an.ksh archive_fc.ksh archive_flx.ksh archive_forcing.ksh
create_forcing.ksh create_init_clim.ksh osm_makex.ksh prepare_an.ksh
prepare_fc.ksh prepare_flx.ksh surface_clean.ksh surface_model.ksh
sms_osm/archive_an.sms archive_fc.sms archive_flx.sms create_forcing.sms create_-
init_clim.sms prepare_an.sms prepare_fc.sms prepare_flx.sms surf.sms surface_clean.sms
surface_model.sms

Files modified(SURF):

external/surftstp.F90
interface/surftstp.h
module/srfsn_lwimp_mod.F90 srft_mod.F90 surfseb_ctl_mod.F90 surftstp_ctl_mod.F90
suvexc_mod.F90 yos_exc.F90
offline/driver/callpar1s.F90 driver/cnt01s.F90 driver/cnt21s.F90 driver/cnt31s.F90
driver/cnt41s.F90 driver/cntend.F90 driver/cpedia1s.F90 driver/cpg1s.F90 driver/dattim.F90
driver/dtforc.F90 driver/minmax.F90 driver/rdclim.F90 driver/rdcoor.F90 driver/rdfvar.F90
driver/rdres.F90 driver/rdsupr.F90 driver/stepo1s.F90 driver/su0yom1s.F90 driver/su1s.F90
driver/sucdfres.F90 driver/sudcdf.F90 driver/sufcdf.F90 driver/sugc1s.F90 driver/sugdi1s.F90
driver/sugp1s.F90 driver/sugpd1s.F90 driver/suinif1s.F90 driver/sulun1s.F90 driver/supcdf.F90
driver/suphec.F90 driver/upddiag.F90 driver/updtim1s.F90 driver/wrtclim.F90 driver/wrtd1s.F90
driver/wrtd2cdf.F90 driver/wrtdcdf.F90 driver/wrtpcdf.F90 driver/wrtres.F90 master1s.F90
namelist/nam1s.h util/adjust_forc.F90 util/caldtdz.F90 util/convNetcdf2Grib.F90 util/conv_-
forcing.F90 util/create_init_clim.F90 util/find_points.F90

Files deleted(SCRIPTS):

gen/osm_setup.ksh

Files deleted(SURF):

offline: many files

Filip Vana - pafv_CY41R1_SP - BR

Super-parametrization code as an alternative to the IFS moist physics

This branch allows the moist processes to be computed by cloud resolving model (CRM) on sufficient resolution with periodic boundary condition. The CRM model maintains its own history (stored under GFL structure allowing in addition an memory optimized restart) and time stepping. The present interface is truly just an interface between the IFS and CRM. (It would be more efficient to rewrite the CRM in a way to share the

IFS field decomposition and numbering conventions.) As a result it makes the IFS-SP about 40 times more expensive with respect to the reference.

emphFiles created(IFS):

`phys_ec/crm_layer.F90`

Files modified(IFS):

`control/reresf.F90`

`module/type_gflflds.F90 yoephy.F90 yom_ygfl.F90`

`namelist/naephy.nam.h namgfl.nam.h`

`phys_ec/callpar.F90 suphec.F90`

`setup/su0phy.F90 suctrl_gflattr.F90 sudefo_gflattr.F90 sugfl1.F90 sugfl2.F90 sugfl3.F90`

`utility/wrresf.F90`

DATA ASSIMILATION

Massimo Bonavita and Elias Holm - dae_CY41R1_hybrid_JB_cycling_errors_2 - ACTIVE

Optimisation of EDA

This branch modifies/optimizes the ensemble data assimilation as follows:

1. Introduce the computation of the hybrid wavelet JB merging a pre-existing climatological wavelet JB file with forecast perturbations from the latest EDA/EnKF. This capability is activated by setting the NAMWAVELETJB namelist variable LHYBRID_JB to .true. The relative weight given to the online part of the hybrid wavelet JB is specified by the NAMWAVELETJB namelist variable ALPHA_HYBRID_JB. Default is 0.3 for current 25 member EDA.
2. An alternative weighting of the hybrid EDA is introduced by setting LONLINEWEIGHTED_HYBRID_-JB to .true. in the NAMWAVELETJB namelist. This version increases the weight of the current cycle for higher wavebands in proportion to the number of samples/waveletmatrix per state, with the power spectrum only from the current cycle. Default is false.
3. Introduce the capability to set up EDA/EnKF experiments which compute the number of wavelet JBs specified in the new prepIFS variable MXUP_RESOLJB, at the spectral resolutions specified in the new prepIFS variables RESOLJB_0, RESOLJB_1,...,RESOLJB_$(MXUP_RESOLJB-1) The cut-off wavelengths of the JB wavelet can also be specified in the NAMWAVELETJB namelist variable JB_WAVELET_-SCALES.
4. Introduce the capability to cycle the EDA-estimated background errors and covariances (wavelet JB) inside an EDA experiment. To do this the user need to set both prepIFS variables LEDA_ERRORS_IN and LEDA_ERRORS_OUT to true.
5. Further halve the computational cost of the covariance calculation in sujbwavgen.F90 by parallellizing power spectrum calculations.
6. Reduce archiving volume for research EDA's by two thirds by eliminating model level fields not necessary for cycling and/or starting an EPS. This is automatically controlled through the value of OD_MODE. In anml the following fields are now are now archived:

- control as normal 4DVAR

- members only AN00/06/12/18, FC06+03/06, FC18+03/06.

7. Change the way EDA variances are computed by implementing the one-pass Knuth algorithm in Ensemble_Stats.F90. This improves numerical stability and robustness to cancellation errors.

8. New B matrices calculated from a set of T399 40R3 EDA's (g53r, g50f, g554) evenly sampled at 56 datums every 5.5 days from begin January to end October 2014. Files are in wavelet_out_T$[resolinc]_-L$[LEVELS]_40R3_sky_04.cv and should be the new files for 40R2 (modify mklinks correspondingly). They contain the same waveband as default for the EDA (waveband 215 changed to 191) and new 4DVAR experiments MUST use these files plus an EDA based on

   dav_CY41R1_hybrid_JB_cycling_errors_1,

   dae_CY41R1_hybrid_JB_cycling_errors_2,

   or das_CY41R1_NEW_V7 onward.

   The files in /home/rd/rdx/data/41r1/an -> /home/rd/rdx/data/41r2/an

   wavelet_out_T95_L137_40R3_sky_04.cv -> wavelet_T95_L137.cv

   wavelet_out_T127_L137_40R3_sky_04.cv -> wavelet_T127_L137.cv

   wavelet_out_T159_L137_40R3_sky_04.cv -> wavelet_T159_L137.cv

   wavelet_out_T191_L137_40R3_sky_04.cv -> wavelet_T191_L137.cv

   wavelet_out_T255_L137_40R3_sky_04.cv -> wavelet_T255_L137.cv

   wavelet_out_T319_L137_40R3_sky_04.cv -> wavelet_T319_L137.cv

   wavelet_out_T399_L137_40R3_sky_04.cv -> wavelet_T399_L137.cv

Testing:

New Hybrid JB computation: EDA TL399 g8ic (EDA TL399 g554 control) 20140510 - 20140731

Cycling Errors and Covariances:

g7lz: EDA TL399 (EDA TL399 g554 control) 20140601 - 20140922

g8x5: 4DVAR TL1279/TL255/TL255/TL255 (EDAEXPVER g554) 20140602 - 20140731

g8x6: 4DVAR TL1279/TL255/TL255/TL255 (EDAEXPVER g7lz) 20140602 - 20140731

Combined:

g93s: EDA TL639 non-cycling (EDA TL399 g554 control) 20140715 - 20140831+ (running)

g9at: EDA TL639 cycling 20140715 - 20140831+ (running)

g9ss: EDA TL639 cycling LONLINEWEIGHTED_HYBRID_JB=.true. 20140715 - 20140831+ (running)

g9vp: 4DVAR TL1279/TL255/TL255/TL255 (EDAEXPVER 0001) 20140715 - 20140828+ (running)

g9vo: 4DVAR TL1279/TL255/TL255/TL255 (EDAEXPVER g9ss) 20140715 - 20140902+ (running)

g9vn: 4DVAR TL1279/TL255/TL319/TL399 (EDAEXPVER g9ss) 20140715 - 20140902+ (running)

g9n9: EDA TL639 cycling (EDA TL399 0067 control) 20141001 - 20141115

g9qh: EDA TL639 cycling LONLINEWEIGHTED_HYBRID_JB=.true. 20140101 - 20140216+ (running) (EDA TL399 g50f control)

One-pass Knuth variance calculation: g9q3: EDA

Files created(IFS):

`ifs/var/sujbwavalls_wavgen.F90`

Files modified(IFS):

`module/yomwavelet.F90 var/sujb.F90 sujbwavelet.F90 sujbwavelet0.F90 sujbwavgen.F90 sujbwavstats.F90 sujbwavvc.F90`

Files modified(PREPDATA):

`programs/Ensemble_Stats.F90`

Files modified(SCRIPTS):

`def/inc_stream.py gen/anml eda_err_save ens_errors fetch_jb_fields_mem fetcherr fetchmars ifsmin ifsvar lowres_fp mklinks varconsts`

Tomas Kral and Bruce Ingleby - datk_CY41R1_cope_release_41r2 - ACTIVE

Improvements in observation pre-processing system (B2O, COPE)

- Switched to Sonntag saturation vapour pressure equation in the computation of relative and specific humidities (contributed by Bruce Ingleby).
- Fixed vertical coordinate units in BUFR PILOT and BUFR SYNOP data.
- Re-introduced support for merged SATEM 500km data in B2O (requested by Hans Hersbach for ERA project).
- Extracting humidity mixing ratio measurements from WIGOS-AMDAR data for monitoring purposes (blacklisted).
- Guarding against invalid number of levels in B2O for TEMP and PILOT data to prevent future operational failures of similar nature.
- Improvements in B2O logging and error handling.
- Cleaning in B2O to simplify access to BUFR elements via 'rank' argument.
- Added regression tests in B2O for SATEM, ASCAT, MERIS, ERS, MACC, MSG, IMS, QSCAT, TERRA MOPITT, TERRA MODIS, METOP-A GOME-2, AURA OMI, GOES 15
- Updated IFS scripts and sources to use the latest ODB-API version 0.10.2

Use of Sonntag saturation vapour pressure equation for observation processing

For observations reported as dew point temperature or RH a saturation vapour pressure (SVP) equation is needed to convert the reported value to specific humidity. Currently this uses the Goff-Gratch SVP equation for liquid water, this change is to use the Sonntag (1994, Met. Zeitschrift) SVP equation for liquid water. This (or similar) SVP equations are recommended as being more consistent with the calibration of radiosonde humidity sensors (eg Chapter 4 of WMO CIMO Guide, 2014 version, available from

http://www.wmo.int/pages/prog/www/IMOP/IMOP-home.html).

The difference from Goff-Gratch is only noticable below -40 C. The principle of this change was discussed with Elias Holm, Peter Bechtold and Richard Forbes in 2014.

The change is implemented in COPE (Tomas Kral).

- Assimilation of ACARS mixing ratio Some US aircraft reporting via the ACARS system are fitted with WVSS-II (Water Vapor Sensing System, using Tunable Diode Laser Absorption Spectroscopy). In general the quality looks good (excluding zero values) and trials give a small positive impact. Most of the code needed was included in cy40r3, the only further code change is to ifs/obs_preproc/defrun.F90, now included in Tomas's branch. It does need ACARSmr data from SAPP being included instead of (or in addition to) ACARS data and a blacklist change.

- Addition of station_type to archived ODB So that we can distinguish manual and automatic BUFR SHIPs/SYNOPs

Testing:

cy40r3+ T511 trials for December 2013 - February 2014 g65s Control; g6ef Sonntag; g6n4 Sonntag plus ACARS humidity Modest improvements from both changes

cy41r1+ T639 trials for April-June 2014 g929 Control; g957 Sonntag; g97k Sonntag plus ACARS humidity

file:///scratch/rd/dabi/iver/plots/ac2014amj_sonn/index.html g957 vs g929 : neutral impact

file:///scratch/rd/dabi/iver/plots/ac2014amj_ammr/index.html g97k vs g957 : positive impact

Files created(ODB):

`bufr2odb/b2o_convert_satem.F90`

Files modified(IFS):

`obs_preproc/defrun.F90`

Files modified(OBSTAT):

`src/inisoftdef.F90`

Files modified(ODB):

```
bufr2odb/b2o_access.F90 b2o_context.F90 b2o_convert.F90 b2o_convert_aircraft.F90
b2o_convert_airs.F90 b2o_convert_amsr2_1d.F90 b2o_convert_amsre_1d.F90
b2o_convert_ascat.F90 b2o_convert_asr.F90 b2o_convert_atms.F90
b2o_convert_atovs.F90 b2o_convert_cris.F90 b2o_convert_fy3.F90
b2o_convert_gch1.F90 b2o_convert_gch2.F90 b2o_convert_gch3.F90
b2o_convert_gch4.F90 b2o_convert_gch5.F90 b2o_convert_grad.F90
b2o_convert_iasi.F90 b2o_convert_ims.F90 b2o_convert_iscat.F90
b2o_convert_meris.F90 b2o_convert_metar.F90 b2o_convert_modisaer.F90
b2o_convert_msg.F90 b2o_convert_mwri_1d.F90 b2o_convert_oscat.F90
b2o_convert_paob.F90 b2o_convert_pgps.F90 b2o_convert_pilot.F90
b2o_convert_qscat.F90 b2o_convert_radio.F90 b2o_convert_radio_lat_long.F90
b2o_convert_rain_gauges.F90 b2o_convert_rain_rates.F90 b2o_convert_reo3.F90
b2o_convert_satob.F90 b2o_convert_scat.F90 b2o_convert_smos.F90
b2o_convert_snow.F90 b2o_convert_ssmi.F90 b2o_convert_ssmis_1d.F90
b2o_convert_synop_land.F90 b2o_convert_synop_ship.F90 b2o_convert_temp.F90
b2o_convert_temp_hires.F90 b2o_convert_tmi_1d.F90 b2o_convert_windprofiler.F90
b2o_convert_windsat.F90 b2o_decode.F90 b2o_handle.F90 b2o_log.F90
b2o_utility.F90 geosangl.F90
include/Odb2Odb1.h
```

interface/FcSensObs.h

lib/Odb2Odb1.cc msgpass_storeobs.F90

module/b2o_common.F90 b2o_internal.F90 getval_module.F90

tools/Bufr2odb.F90 FcSensObs.cc FcSensObsMain.cc Odb2Odb1Main.cc

Files modified(SCRIPTS):

build/Makefile.root.aeolus Makefile.root.obstat Makefile.root.odb Makefile.root.odbdummy Makefile.root.odbmain Makefile.root.odbport Makefile.root.wam perl/dependanal.pl

gen/airep.json biassave bufr2odb metar.json mkabs_aeolus mkabs_b2otools mkabs_obstat mkabs_odbtools mkabs_wam p4_mklib ship.json soilana synop.json temp.json

sms/libcope.sms

sms_an/cope_obsgroup.sms sekf.sms

Files deleted(ODB):

bufr2odb/b2o_convert_205.F90 b2o_convert_aircraft_new.F90 b2o_convert_radio_lat_-long_old.F90

SURFACE ASSIMILATION

Patricia de Rosnay - dap_CY41R1_ssa_notbi_for_41r2 - ACTIVE

BUFR SYNOP and new blacklist in the surface analysis; T2m lapse rate forward operator.

- Introduce BUFR SYNOP observations for T2m, Rh2m and snow depth in the surface analysis with redundancy check adapted to cope with TAC and BUFR SYNOP redundancy.
- New surface analysis blacklist for T2m, RH2m and snow, flexible to blacklist per station id, codetype, lat-lon range etc..
- Introduce a T2m forward operator to account for a lapse rate correction. The lapse rate correction is set at the script level.
- Surface analysis code cleaning, fixes in the snow analysis rejection and sekf soil moisture analysis

Testing:

All the experiments were conducted at T639 using Gabors control g8e3 (winter) and g8e2 (summer).

- ga92: BR test (ctrl g8e3) using an intermediate branch that contains only the purely technical modifications to include the new blacklist and the BUFR SYNOP and lapse rate. BR results show that the technical part is BR as expected.

- ga4b: Neutral winter experiment using full branch and the new blacklist such as we can compare to the control (without BUFR SYNOP) and 0 degrees lapse rate in the ssa namelist.

So far more than 1.5 months days is completed showing neutral impact

(see https://software.ecmwf.int/wiki/display/IFS/CY41R2+Data+Assimilation+Testing)

- ga9o: Neutral summer experiment with the new blacklist such as we can compare to the control (without BUFR SYNOP) and a 0 degrees lapse rate in the ssa namelist. More than a month of testing conducted showing neutral results.

The default conguration is controlled from the ssa namelist and blacklist. It uses a laspe rate correction of zero degrees and a blacklist that allows the same observations as in the control. A range of tests using different T2m lapse rate values (ssa namelist) and ssa blacklist content is ongoing.The namelist lapse rate value and the blacklist content may be modied based on these experiments results.

Files modified(IFS):

`sekf/sm_ekf_main.F90`

Files modified(ODB):

`ddl/ssa_robhdr_2m.sql ssa_robhdr_snow.sql ssa_robody_2m.sql ssa_robody_snow.sql ssafb_surfbody_2m.sql ssafb_surfbody_snow.sql`

`lib/msgpass_storeobs.F90`

Files modified(SCRIPTS):

`gen/get_nearest_infile_date mkabs_odbtools soilana ssaana`

Files modified(SSA):

`module/yomssa.F90`

`namelist/namssa.nam.h`

`plot/print_nml.F90 print_summary.F90`

`sub/fg2obs.F90 initial_rejection.F90 oiinc.F90 oiupd.F90 redundant_obs.F90 reg_to_gg.F90 scan_cma_odb.F90 snow_analysis.F90 ssa.F90 t2m_analysis.F90`

`util/alloc_mem.F90 setcomssa.F90`

Files deleted(SSA):

`interface/corwhd.h corwvz.h sucsnw.h`

`sub/corwhd.F90 corwvz.F90 sucsnw.F90`

SATELLITE

Alan Geer, Niels Bormann, Cristina Lupu, Julie Letertre-Danczak, Katrin Lonitz, Heather Lawrence, Stefano Migliorini, Louis-Francois Meunier, Reima Eresmaa, Sean Healy and Qifeng Lu - stg_CY41R1_satmerge_13 C - ACTIVE

Satellite section contribution to 41r2

Merged satellite section updates including:

- Activation of F-18 humidity sounding channels over ocean and extension of all-sky assimilation to snowy land surfaces
- Passive code updates to allow FY3-C monitoring
- Passive code updates to allow all-sky ATMS
- New RTTOV coefficient files for microwave instruments: move to 54 levels and improved 22 GHz spectroscopy

- All-sky cold-air outbreak screening using stability index
- AMSU-A sensor & situation dependent observation errors
- CRIS activation (note: this has since gone operational anyway)
- Improved IASI aerosol screening
- GPSRO observation error increased 25%
- Preparations for passive monitoring of COMS and INSAT-3D AMVs
- AMV blacklist relaxation (including zenith angles to 64 degrees, improving high-latitude coverage)
- RTTOV v11.2 technical upgrades (but not v11.2 changes that induce numerical differences)
- Meteo France / L-F Meunier technical upgrades including performance fix to RTTOV coef reading
- Preparations for all-sky infrared
- Passive code updates to allow a mixture of a quadratic and linear observation error model for all sky instruments

Contains:

stg_CY41R1_f18_snow,

sthl_CY41R1_FY3C_all4,

sthl_CY41R1_allsky_obmodel2,

str_CY41R1_AtmsAllsky_Ave,

stc_CY41R1_54lMW,

dikl_CY41R1_newf1_oldf2_CAO_screen,

sthl_CY41R1_satmerge11_amsua_oberr_final_v2,

stjl_CY41R1_dust_detect_IASI_old,

sti_CY41R1_satmerge_7,

sts_CY41R1_COMS_INSAT3D_DUALMETOP_AMVs,

stc_CY41R1_satmerge11_plusv112,

stc_CY41R1_LFM_MeteoFrance,

stg_CY41R1_mwri_11,

stsm_CY41R1_iasi_allsky_passive

Testing: https://software.ecmwf.int/wiki/display/IFS/CY41R2+Satellite+merged+testing

Louis-Francois Meunier - stc_CY41R1_LFM_MeteoFrance - BR

Technical upgrades including performance fix to RTTOV coef reading

1. The emissivity used in RTTOV is missing in ODB (emis_fg@radiance_body) : It comes from a problem in rttov_ec.F90

2. In rttvi, for MW sensors, the TELSEM emissivity atlas is systematically initialised. Since, we do not want to use it at Mto-France and because it's not recommended to add LECMWF keys in the satrad project, So add an new argument to rttvi (ltelsem) and trigger it using a namelist key defined in NAMEMIS_CONF (LUSE_TELSEM).

3. From cy40_t1, a strange modification has been introduced in rttov_ec_setopts.F90 : we are not using anymore the logical lltracer(1) to trigger CO2 in RTTOV (instead (.not.linterp) is used)... It was introduced by Meteo-France - switch back to the previous code and also clean rttov_ec (+TL/AD) of the useless initialisation of CO2 profiles when lltracer(1)=.F..

4. The coefficient files were not read in parallel because some MPI communications occur in the middle of the loop that reads the files. Now files are all read in parallel and communications happen all at once. Provided that the filesystem is fast enough, it's not a big optimisation (according to DrHook: just 2 seconds :-() but at least it looks better on a parallel computer.

5. Using the program rttov_conv_coef of RTTOV, it's possible to create coefficient files that contain only a subset of channels (which could be usefull for IASI, AIRS and CrIS) : it results in much smaller files. Introduce a new namelist key in namsats and to change rt_setup and rttvi (see l.348 of my modified rttvi).

Files modified(IFS):

`module/sats_mix.F90 yomemis.F90 namelist/namemis_conf.nam.h namsats.nam.h setup/suemis_conf.F90 var/rtsetup.F90`

Files modified(SATRAD):

`interface/rttvi.h programs/calc_radiance_fields.F90 gensatim.F90`

Cristina Lupu - stc_CY41R1_satmerge11_plusv112 - BR

Technical changes to RTTOV

Some bit-reproducible changes to RTTOV v11.2

Files created(IFSAUX):

`module/rttov_const.F90`

Files modified(IFS):

`module/get_lwpcoeff_mix.F90 get_scattidxcoeff_mix.F90 sats_mix.F90 varbc_allsky.F90 varbc_rad.F90 yomclddet.F90 yomcosjo.F90 yomemis.F90 yommwave.F90 yomsats.F90 yomscc.F90`

`mwave/mwave_emis.F90 mwave_lwp.F90 mwave_obsop_traj.F90 mwave_screen.F90 mwave_setup.F90`

`obs_preproc/black.F90 cloud_detect_setup.F90 defrun.F90 fgchk_setup.F90 gefger.F90 level1cgeos_ob.F90 new_thinn.F90 new_thinner.F90 new_thinner_no_sq.F90 post_thinner.F90 pre_thinner.F90 rad1cin.F90 read_crischans.F90 read_iasichans.F90 suobscor.F90`

`op_obs/bgobs.F90 cloud_detect.F90 cloud_estimate.F90 co2slicing.F90 emis_atlas.F90 emis_ir_atlas.F90 emis_mw.F90 emis_mw_n.F90 hop.F90 hopad.F90 hoptl.F90 hradp_ml.F90 hretr.F90 hsatang.F90 interchan_obserr_cor.F90`

mw_clearsky_screen.F90 mw_clearsky_screen_ecdecis.F90
mw_clearsky_screen_mfdecis.F90 rad1cemis.F90 radtr.F90 radtr_ml.F90
radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrtl.F90 sat_avg_stdev_filter.F90

phys_dmn/mts_phys.F90

setup/suemis_conf.F90

var/ecset.F90 getsatid.F90 rtsetup.F90 sulimb.F90 surad.F90 taskob.F90 taskobad.F90
taskobtl.F90

Files modified(SATRAD):

emiss/atlas_iniall.F90 emiskf_config.F90 emiskf_estimate_emissivity.F90
emiskf_init.F90

module/mod_emiskf.F90 mod_emiskf_stats.F90

mwave/mwave_emis_rttov.F90

programs/calc_radiance_fields.F90 gensatim.F90

Files modified(SCRIPTS):

gen/varconsts

Files deleted(SATRAD):

module/rttov_const.F90

Julie Letertre-Danczak - stjl_CY41R1_dust_detect_IASI_old - ACTIVE

IASI aerosol detection

Change the aerosol detection for IASI on all pixels

Testing:

g9ep : 2014053100 to 2015010100, resolution : 511, CTRL : g9mi

Files modified(IFS):

obs_preproc/cloud_detect_setup.F90

op_obs/aerosol_detect.F90 cloud_detect.F90 hretr.F90

Files modified(SCRIPTS):

gen/mklinks

Cristina Lupu, Alan Geer, Niels Bormann - stc_CY41R1_54lMW - ACTIVE

Revision of the MW coefficient files

New 54 fixed vertical pressure levels with additional stratospheric levels and smoothly varying layer thickness for all MW instruments; Ozone is included in mixed gases to take into account the 183 GHz line for sensors like SSMIS, MWHS. Improved spectroscopy for the 22 GHz line for SSMIS,

Testing:

Long run experiments : T639/137L, CY41R1, stc_CY41R1_54lMW winter 20140201-20140430: g8pz vs g8e3 (Gabor's control) summer 20140601-20140930: g8py vs g8e2 (Gabor's control)

Files modified(SCRIPTS):
`gen/mklinks`

Katrin Lonitz - dikl_CY41R1_newf1_oldf2_CAO_screen - ACTIVE

All-sky cold-air outbreak screening using stability index

New screening criteria for microwave data assimilated using the all-sky approach, based on stability and ratio of liquid to total cloud water. More information see: EUMETSAT/ECMWF Fellowship Research Report No. 35 "New screening of cold-air outbreak regions used in 4D-Var all-sky assimilation"

Testing:

experiment id: g7b5 (control run g73y) with T511 resolution experiment run time: 1 July - 30 September 2013

Files modified(IFS):
`common/yomdb_defs.h yomdb_vars.h`
`module/parmwave.F90 yomdb.F90`
`mwave/mwave_diags.F90 mwave_obsop_traj.F90 mwave_put.F90`

Files modified(ODB):
`cma2odb/initmdb.F90`
`ddl/allsky.h cma.h sat_ssmi.sql`

Heather Lawrence, Niels Bormann and Qifeng Lu - sthl_CY41R1_FY3C_all4 - PASSIVE and Not BR

FY-3C instruments

The branch contains modifications to use data from the Chinese FY-3C satellite, in particular the new instruments MWTS2 (Microwave Temperature Sounder 2) and MWHS2 (Microwave Humidity Sounder 2). MWTS2 is implemented in the clear-sky system, similar to the implementation of ATMS, whereas MWHS2 is implemented in the all-sky system, similar to the treatment of MHS. The activation of these instruments is controlled through the new prepIFS switches LMWTS2 and LMWHS2. In addition, for MWTS2 the prepIFS switch MWTS2_AVERAGE controls whether or not spatial averaging of the observations is performed. The branch also allows the use of IRAS and MWRI from FY-3C. The default for 41r2 is to activate the passive monitoring of the data from MWTS2, MWHS2, and IRAS, for which real-time data is available. The instruments remain initially blacklisted.

The branch also fixes a bug in the emissivity Kalman Filter update which, in some circumstances, led to data being used twice during the emissivity atlas update.

Testing:

Experiments with FY-3C instruments passive: g96v (exp) vs g8te (control), T639 experiments tested as part of the satellite section merge

Files created(IFS):
`mwave/mwave_assign_emis_mwhs2.F90`

Files created(ODB):

ddl.ECMA/emiskf_mwts2.sql

ddl/emiskf_mwts2.sql

Files created(SCRIPTS):

sms_an/archive_mwhs2.sms archive_mwts2.sms b2o_mwhs2.sms b2o_mwts2.sms convert_iras.sms convert_mwhs2.sms convert_mwts2.sms pre1crad_mwhs2.sms pre1crad_mwts2.sms

sms_era/obtime_mwhs2.sms obtime_mwts2.sms

Files modified(IFS):

module/varbc_allsky.F90 varbc_rad.F90 yomemis.F90 yommwave.F90 yomsats.F90

mwave/mwave_emis.F90 mwave_obsop_traj.F90 mwave_screen.F90 mwave_setup.F90

namelist/namemis_conf.nam.h

obs_preproc/black.F90 defrun.F90 gefger.F90 new_thinn.F90 new_thinner_no_sq.F90 pre_thinner.F90

op_obs/emis_mw_n.F90 hop.F90 hretr.F90 hsatang.F90 mw_clearsky_screen.F90 mw_clearsky_screen_ecdecis.F90 rad1cemis.F90

setup/suemis_conf.F90

var/getsatid.F90

Files modified(ODB):

bufr2odb/b2o_convert_fy3.F90

cma2odb/map_reportype.F90

include/bufr2odb.h

Files modified(SATRAD):

emiss/emiskf_alloc_read_input.F90 emiskf_init.F90 emiskf_prep_h.F90

module/mod_grid_screen.F90 mwave_const.F90

mwave/mwave_get_filename.F90 mwave_get_rtcoeff.F90

programs/bufr_grid_screen.F90 bufr_screen_mwri_1d.F90 emiskf_update.F90 screen_1c.F90

Files modified(SCRIPTS):

def/an.def inc_obs.py

gen/archive_obsgroup bufr2odb cleanodb emiskf fetchobs ifsmin mklinks obstat pre1crad_screen premwimg varconsts

sms_an/bufr2odb.sms makeodb.sms

sms_era/obtime.sms

Heather Lawrence and Niels Bormann - sthl_CY41R1_satmerge11_amsua_oberr_final_v2 - ACTIVE and Not BR

A new observation error model for AMSU-A, and changes to cloud and orography screening

The branch introduces the use of satellite and situation dependent observation errors for AMSU-A. Each AMSU-A instrument now has different observation errors (previously there were differences between channels but not instruments). These new values are read in through files with defaults taken from defrun.F90. The files can be updated in the future, adding a new file with a more recent date in the filename, in a similar manner to blacklist changes. Channels 5 8 have additional observation error terms that vary with cloud liq-

uid water path (calculated from observations), skin temperature (model value), surface-to-space transmittance (background value) and surface type (snow-free land, snow-covered land, ocean and sea-ice). The window channel cloud screening check over ocean has been replaced with a scatter index check, allowing in more data, for channels 6 8. The orography screening has been removed from the blacklist for channels 5 6 and replaced by a new observation error screen (in hop.F90) which allows in more AMSU-A data for channels 5 - 6. More information is given in EUMETSAT fellowhsip report no. 34.

Note that the sthl_CY41R1_satmerge11_amsua_oberr_final_v2 branch also includes other satellite section contributions (satmerge11). For only the AMSU-A changes please see branch sthl_CY41R1_amsua_oberr_final which has these changes on top of CY41R1 only.

Testing:

Scientific impact tested in 2 stages:

New satellite-dependent observation errors for channels 5 to 13, minus situation-dependent terms for channels 5 to 8:

T511 on top of 41R1 (an older version, without later scripts changes) for 3 months x 2 seasons:

summer control: g7ri (2014060100 - 2014083112)

summer experiment: g7rs (2014060100 - 2014083112)

winter control: g7rj (2014020100 - 2014043012)

winter experiment: g7rt (2014020100 - 2014043012)

Situation-dependent observation errors for AMSU-A channels 5 to 8 and changes in orography and cloud-screening:

T511 on top of 41R1 (an older version, without later scripts changes) for 3 months x 2 seasons:

summer control: g7ri (2014060100 - 2014083112)

summer experiment: g7v4 (2014060100 - 2014083112)

winter control: g7rj (2014020100 - 2014043012)

winter experiment: g7v5 (2014020100 2014043012)

Files created(IFS):

`module/mw_clearsky_oberror_mod.F90`

Files modified(IFS):

`module/yomsats.F90`
`obs_preproc/defrun.F90`
`op_obs/hop.F90 mw_clearsky_screen.F90 mw_clearsky_screen_ecdecis.F90`
`var/surad.F90`

Files modified(ODB):

`ddl/robhdr.sql robody_traj.sql`

Files modified(SCRIPTS):

`gen/get_nearest_infile_date varconsts`

Heather Lawrence and Alan Geer - sthl_CY41R1_allsky_obmodel2 - PASSIVE and BR

Bit-reproducible change making observation error code for all-sky instruments more flexible

In this change we created the option to have a mixture of quadratic and linear observation error models for all-sky instruments, as well as the option to have different models for different channels of an all-sky instrument. Two columns have been added to the observation error files for these instruments which define whether the channel is quadratic, linear or a mixture: values of 1 indicate quadratic, 0 indicate linear and fractions indicate a mixture. One column is for observation errors over ocean and the second is for observation errors over land. mwave_read_sat_error.F90 was changed to read the new columns as beta_sea and beta_land and yommwave.F90 was adjusted to calculate the observation errors using these new values. Previously, in yommwave.F90 the observation errors were calculated as a quadratic function if the instrument was mhs and linear otherwise. The new version of yommwave.F90 uses beta_sea and beta_land to decide if the error model is quadratic, linear or a mixture. Note that mklinks was changed for testing only but this change was removed in the final merge. This change is bit-reproducible with CY41R1 and was done to provide more flexibility for the future.

Testing:

Experiments to check bit-reproducibility over 3 days were performed as follows:

T639 control: g8e2 (Gabor's 41R1 control) T639 experiment: g8jm

Files modified(IFS):

`module/yommwave.F90`

`mwave/mwave_read_sat_error.F90`

Files modified(SCRIPTS):

`gen/mklinks`

Niels Bormann - str_CY41R1_AtmsAllsky_Ave - PASSIVE and Not BR

ATMS humidity channels in the all-sky system

The branch contains modifications to use the ATMS humidity channels in the all-sky system. The code largely follows the same approach as the one used for AMSU-A and MHS, ie, a copy of the data for the selected channels is treated separately, using the NSSMI code-type and NALLSKY observation type. The changes are activated through a switch in prepIFS (LATMS_ALLSKY), and the default for now is false, ie ATMS continues to be assimilated through the clear-sky route for temperature and humidity sounding channels.

The branch also modifies the BUFR grid screening used for all-sky data to be able to return averaged latitudes/longitudes if super-obbing is requested for certain data. It also fixes a bug in the option to disable averaging for selected BUFR elements. This led to some elements nevertheless being averaged when multiple instances of the BUFR element are present.

Testing:

Short experiments without activation of ATMS humidity channels in all-sky: g8g3 vs g8g2 (as intended for CY41R2) Active use of the branch: T639 experiments using a version of the satellite section merge, (g8t4 & g8t7 with controls g8fx & g8fy, covering 2 x 3 months)

emphFiles created(IFS):

`module/mw_clearsky_oberror_mod.F90`

Files modified(IFS):

`module/yomsats.F90`
`obs_preproc/defrun.F90`
`op_obs/hop.F90 mw_clearsky_screen.F90 mw_clearsky_screen_ecdecis.F90`
`var/surad.F90`

Files modified(ODB):

`ddl/robhdr.sql robody_traj.sql`

Files modified(SCRIPTS):

`gen/get_nearest_infile_date varconsts`

Alan Geer - stg_CY41R1_f18_snow - ACTIVE

Extend all-sky assimilation to snow-covered land surfaces; add F-18 water vapour sounding channels over ocean.

Changes that together add a greater volume and coverage of microwave humidity sounding channels in the all-sky assimilation path. For the first time there is coverage over the continents in winter. There is some evidence of improved winds and temperatures in the forecast and in observation fits.

Files modified(IFS):

`common/yomdb_defs.h yomdb_vars.h`
`module/parmwave.F90 yomdb.F90 yommwave.F90`
`mwave/mwave_assign_emis_mhs.F90 mwave_assign_emis_ssmis.F90 mwave_diags.F90`
`mwave_emis.F90 mwave_get.F90 mwave_get_ad.F90 mwave_get_tl.F90`
`mwave_obsop_traj.F90 mwave_put.F90 mwave_screen.F90 mwave_setup.F90`
`namelist/nammwave.nam.h`
`obs_preproc/gefger.F90`

Files modified(ODB):

`cma2odb/initmdb.F90`
`ddl/allsky.h cma.h sat_ssmi.sql`

Files modified(SCRIPTS):

`gen/ifsmin ifstraj mklinks premwimg varconsts`

Qifeng Lu and Alan Geer - stg_CY41R1_mwri_11 - PASSIVE

MWRI developments

Additional changes to MWRI pre-processing (revised superobbing density; removal of land surfaces)

Files modified(SATRAD):

`bufr_screen_mwri_1d.F90`

Files modified(SCRIPTS):

`mklinks`

Stefano Migliorini and Alan Geer - stsm_CY41R1_iasi_allsky_passive - BR

Developments for all-sky infrared assimilation

Adds the possibility to run some IASI channels in clear-sky mode while others are in all-sky mode. This is done via a new configuration file "iasichannels_allskymask". Also an adjoint bugfix in RTTOV.

Files modified(IFS):
`common/yomdb_vars.h`
`module/yomnmev.F90 yomsats.F90`
`obs_preproc/defrun.F90 read_iasichans.F90`
`op_obs/hretr.F90 radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90`
`setup/su_events.F90`
`var/surad.F90`

Files modified(IFSAUX):
`module/rttov_ec_mod.F90`

Files modified(ODB):
`cma2odb/initmdb.F90`
`ddl/allsky.h radiance.h satbody_screen_atovs.sql type_definitions.h`
`module/odb2_flag_definitions.F90`

Files modified(SATRAD): `rttov_ec_settings.F90`
`rttov/ifs/rttov_ec.F90 ifs/rttov_ec_ad.F90 ifs/rttov_ec_setopts.F90 ifs/rttov_ec_-`
`tl.F90 main/rttov_cldstr_ad.F90 main/rttov_cldstr_k.F90 main/rttov_cldstr_tl.F90 main/rttov_-`
`integrate.F90 main/rttov_integrate_ad.F90 main/rttov_integrate_k.F90 main/rttov_-`
`integrate_tl.F90`

Files modified(SCRIPTS):
`gen/mklinks varconsts`

Sean Healy and Cristina Lupu - sti_CY41R1_satmerge_7 - Active

Increase in the assumed GPS-RO observation error statistics above 10 km.

The asssumed error used for assimilating GPS-RO is increased from 1.0

Testing:

g8uq (winter, CONTROL = g8td) and g8ur (summer, CONTROL = g8te).

Positive impact on stratospheric temperatures and winds in the short-range.

Clear improvement in fir to other observations.

Files modified(IFS):
`op_obs/gpsro_oberror.F90`

FILE LIST FOR MERGED SATELLITE BRANCH:

Files created(IFS):
`module/mw_clearsky_oberror_mod.F90`

mwave/mwave_assign_emis_atms.F90 mwave_assign_emis_mwhs2.F90

Files created(ODB):

ddl.ECMA/emiskf_mwts2.sql

ddl/emiskf_mwts2.sql

Files created(SCRIPTS):

sms/fc_sens_save_atms_allsky.sms

sms_an/archive_atms_allsky.sms archive_mwhs2.sms archive_mwts2.sms b2o_atms_allsky.sms b2o_mwhs2.sms b2o_mwts2.sms convert_atms_allsky.sms convert_iras.sms convert_mwhs2.sms convert_mwts2.sms obstat_archive_atms_allsky.sms obstat_atms_allsky.sms odb2odb1_atms_allsky.sms pre1crad_mwhs2.sms pre1crad_mwts2.sms

sms_era/obtime_mwhs2.sms obtime_mwts2.sms

Files modified(IFS):

common/yomdb_defs.h yomdb_vars.h

module/parmwave.F90 sats_mix.F90 varbc_allsky.F90 varbc_rad.F90 yoephy.F90 yomdb.F90 yomemis.F90 yommwave.F90 yomnmev.F90 yomsats.F90

mwave/mwave_assign_emis_mhs.F90 mwave_assign_emis_ssmis.F90 mwave_diags.F90 mwave_emis.F90 mwave_get.F90 mwave_get_ad.F90 mwave_get_tl.F90 mwave_obsop_traj.F90 mwave_put.F90 mwave_read_sat_error.F90 mwave_screen.F90 mwave_setup.F90

namelist/naephy.nam.h namemis_conf.nam.h nammwave.nam.h namsats.nam.h

obs_preproc/black.F90 cloud_detect_setup.F90 defrun.F90 gefger.F90 new_thinn.F90 new_thinner_no_sq.F90 pre_thinner.F90 read_iasichans.F90

op_obs/aerosol_detect.F90 cloud_detect.F90 emis_mw_n.F90 gpsro_oberror.F90 hop.F90 hretr.F90 hsatang.F90 mw_clearsky_screen.F90 mw_clearsky_screen_ecdecis.F90 rad1cemis.F90 radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90

setup/su0phy.F90 su_events.F90 suemis_conf.F90

var/getsatid.F90 rtsetup.F90 surad.F90

Files modified(IFSAUX):

module/rttov_const.F90 rttov_ec_mod.F90

Files modified(ODB):

bufr2odb/b2o_convert_atms.F90 b2o_convert_fy3.F90 b2o_convert_satob.F90 satobfreq.F90

cma2odb/initmdb.F90 map_reportype.F90

ddl/allsky.h cma.h radiance.h robhdr.sql robody_traj.sql sat_ssmi.sql satbody_screen_atovs.sql type_definitions.h

include/bufr2odb.h

module/odb2_flag_definitions.F90

Files modified(SATRAD):

emiss/emiskf_alloc_read_input.F90 emiskf_init.F90 emiskf_prep_h.F90

interface/rttvi.h

module/bufr_grid_screen_keep.F90 mod_grid_screen.F90 mod_rttov_fastem5_coef.F90 mwave_const.F90 rttov_chain.F90 rttov_coef_io_mod.F90 rttov_ec_settings.F90 rttov_math_mod.F90 rttov_types.F90

mwave/mwave_get_filename.F90 mwave_get_rtcoeff.F90

programs/bufr_grid_screen.F90 bufr_screen_mwri_1d.F90 calc_radiance_fields.F90 emiskf_update.F90 gensatim.F90 screen_1c.F90

rttov/coef_io/rttov_coeffname.F90 rttov_dealloc_coef.F90 rttov_get_pc_predictindex.F90 rttov_init_coef_optpar_ir.F90 rttov_init_coef_pccomp.F90 rttov_nullify_coef.F90 rttov_nullify_coef_pccomp.F90 rttov_read_ascii_coef.F90 rttov_read_ascii_pccoef.F90 rttov_read_ascii_scaercoef.F90 rttov_read_ascii_sccldcoef.F90 rttov_read_binary_coef.F90 rttov_read_binary_pccoef.F90 rttov_read_binary_scaercoef.F90 rttov_read_binary_sccldcoef.F90 rttov_write_ascii_coef.F90 rttov_write_binary_coef.F90 ifs/phrtsetup.F90 rttov_ec.F90 rttov_ec_ad.F90 rttov_ec_setopts.F90 rttov_ec_tl.F90 rttvi.F90 main/rttov_calcemis_ir_ad.F90 rttov_calcemis_ir_k.F90 rttov_calcemis_ir_tl.F90 rttov_calcemis_mw.F90 rttov_calcemis_mw_ad.F90 rttov_calcemis_mw_k.F90 rttov_calcemis_mw_tl.F90 rttov_cldstr_ad.F90 rttov_cldstr_k.F90 rttov_cldstr_tl.F90 rttov_fastem5.F90 rttov_fastem5_ad.F90 rttov_fastem5_k.F90 rttov_fastem5_tl.F90 rttov_integrate.F90 rttov_integrate_ad.F90 rttov_integrate_k.F90 rttov_integrate_tl.F90 mw_scatt/rttov_iniscatt.F90 rttov_iniscatt_ad.F90 rttov_iniscatt_tl.F90 rttov_read_scattcoeffs.F90 rttov_scatt.F90 rttov_scatt_ad.F90 rttov_scatt_tl.F90 rttovscatt_test_one.F90 mw_scatt_coef/liu_density.F90 mie_one_temp.F90 permittivity.F90 predict_psd.F90 predict_psd_F07.F90 set_spectra.F90

Files modified(SCRIPTS):

def/an.def inc_obs.py

gen/bufr2odb cleanodb emiskf fetchobs get_nearest_infile_date ifsmin ifstraj mklinks obstat pre1crad_screen premwimg preobs varconsts

sms_an/bufr2odb.sms makeodb.sms

sms_era/obtime.sms

Kirsti Salonen and Niels Bormann - str_CY41R1_satmerge_13_bitrep - BR

Modifications for AMVs

The modifications assign the QI for INSAT-3D AMVs to the correct place in the ODB, and make the calculations of additional diagnostics for AMVs robust for cases where the assigned AMV pressure level is a missing value.

Files modified(IFS):

op_obs/amv_get_preds.F90

Files modified(ODB):

bufr2odb/b2o_convert_satob.F90

Kirsti Salonen and Niels Bormann - sts_CY41R1_COMS_INSAT3D_DUALMETOP_VIIRS_AMVs_final - BR

Preparations for COMS, INSAT-3D, VIIRS and dual Metop AMVs in the system

New AMVs have become available via the GTS. The system is prepared for AMV data from COMS, INSAT-3D, VIIRS and dual Metop AMVs. For INSAT-3D AMVs the disseminated data is not always following the standard. Thus, the system sets the computational method based on channel frequencies.

For VIIRS AMVs the odb_code_mappings.dat needs to be updated.

The new AMVs are initially blacklisted and monitored only.

Note: the difference between sts_CY41R1_COMS_INSAT3D_DUALMETOP_AMVs and sts_CY41R1_COMS_-INSAT3D_DUALMETOP_VIIRS_AMVs_final is minor. It is a fix for storing INSAT-3D QI information.

Alan's satellite section merge includes sts_CY41R1_COMS_INSAT3D_DUALMETOP_AMVs and the fix came in with Niels's branch str_CY41R1_satmerge_13_bitrep

Testing:

ga1v: Test for the bit-reproducibility against g8e2, 2014060100 - 2014060112, T639, 137 levels.

ga1q: Test that the system is able to handle the INSAT-3D, VIIRS and dual Metop AMVs. 2015012700 - 2015012712, T159, 137 levels.

g9b3: Test that the system is able to handle COMS AMVs

Files modified(ODB):

`bufr2odb/b2o_convert_satob.F90 satobfreq.F90`

Peter Lean and Alan Geer - dipl_CY41R1_gmi - BR

Code changes in preparation for GMI instrument on GPM satellite

Provides code changes for bufr preprocessing and bufr2odb for GMI data. The IFS code changes for GMI were previously included in CY40R3.

Files created(ODB):

`bufr2odb/b2o_convert_gmi.F90 tools/Merge_gmi_swaths.F90`

Files created(SATRAD):

`programs/bufr_screen_gmi_1d.F90`

Files created(SCRIPTS):

`sms_an/b2o_gmi.sms premwimg_gmi.sms sms_era/obtime_gmi.sms`

Files modified(ODB):

`bufr2odb/b2o_convert.F90`

Files modified(SATRAD):

`module/mod_grid_screen.F90 programs/bufr_grid_screen.F90`

Files modified(SCRIPTS):

`gen/bufr2odb fetchobs mkabs_b2otools mkabs_satrad pre1crad_screen premwimg preobs sms_an/bufr2odb.sms sms_era/obtime.sms`

ENSEMBLE PREDICTION

Martin Leutbecher, Simon Lang and Beatriz Monge-Sanz - nel_CY41R1_NEW_v1 - BR

Ensemble Prediction section contribution to 41r2

Contains:

nesl_CY41R1_for_42

nel_CY41R1_skebV3

nel_CY41R1_higherResV0

dibm_CY41R1_new_o3_next_cycle

Testing:

```
-----------------------------------------------------------
exp-type Resolution CONTROL(41r1)  EXPT(nel_CY41R1_NEW_v1)
-----------------------------------------------------------
an       TL639      g9yk           ga27

eps_nemo TL639/319  ga28           ga2e
-----------------------------------------------------------
```

Simon Lang - nesl_CY41R1_for_42

Fixes for computing singular vectors on cubic grid

These contributions include fixes to make it possible to compute SVs on the cubic grid, minor fixes to modeleps_nemo and a fix for SSTs in the ensemble (remove type=AN from getpersSST.n).

Files modified(PREPDATA):

`mc_tools/svsp2gp.F90`

Files modified(SCRIPTS):

`def/eps_sv.def`

`gen/getpersSST.n modeleps_nemo modelsv`

Martin Leutbecher - nel_CY41R1_skebV3

Revision of SKEB

The stochastic kinetic energy scheme (SKEB) has been revised. This contribution is passive and can be activated with namelist switches. It prepares for the horizontal resolution upgrade, i.e. using the cubic grid and spectral viscosity.

Files modified(IFS):

`module/stoph_mix.F90 yomphyder.F90`

namelist/namstoph.nam.h
phys_ec/backscatter_layer.F90 convection_layer.F90 cucalln.F90 cumastrn.F90 local_arrays_fin.F90 local_arrays_ini.F90 spbsgpupd.F90
setup/surand1.F90

Files modified(SCRIPTS):

gen/modeleps_nemo

Martin Leutbecher - nel_CY41R1_higherResV0

Further preparation for horizontal resolution updgrade Preparation for the horizontal resolution upgrade and technical fix (already included in 41r1 e-suite branch)

Files modified(PREPDATA):

mc_tools/comp_mean_pert.F90

Files modified(SCRIPTS):

gen/modeleps_nemo

Beatriz Monge-Sanz - dibm_CY41R1_new_o3_next_cycle

New ozone scheme

A new ozone scheme, following the method in Monge-Sanz et al. (2011, ACP), has been included as alternative to the default Cariolle scheme. The scheme can be activated with switch LO3CH_BMS in namelist naephy.nam.h.

Files modified(IFS):

climate/updo3ch.F90
module/yoephy.F90
namelist/naephy.nam.h
phys_ec/o3chem.F90
setup/su0phy.F90 sudimf1.F90

Files modified(SCRIPTS):

gen/getini model

MACC

Richard Engelen, Alessio Bozzo, Johannes Flemming, Antje Inness, Samuel Remi, Angela Benedetti, Anna Agusti-Panareda, Sebastien Massart - stj_CY41R1_CAMS_for_CY41R2_5 - BR

Contribution from Chemical Aspects section

This contribution contains removal of all references to GRG in code and scripts (coupled chemical system), C-IFS modelling and data assimilation improvements, new UV processor, various improvements to greenhouse gas modelling and data assimilation, various improvements to aerosol modelling and data assimilation.

https://software.ecmwf.int/wiki/display/CA/CY41R2

Contains:

stj_CY41R1_CAMS_esuite

naj_CY41R1_for_update

dism_CY41R1_GHG_ref

stj_CY41R1_clean_scripts

disr_CY41R1_MACCesuite_Sam

paz_CY41R1_paz_CY41R1_AER_for_CY41R2_v2

Testing: Final branch was tested for bit-identical results at T255L137 with experiment rdst1/stj/g9uy versus rdst1/stj/g9if. A experiment using the MACC configuration was run at T255L60 (rdst1/stj/g9ux).

Files created(IFS):

`module/rrtmg_sw_reftra.F90 rrtmg_sw_spcvrt.F90 rrtmg_sw_vrtqdr.F90`

`phys_ec/aerc_scav.F90 cldpp_simplified.F90 fireinj.F90`

Files created(PREPDATA):

`programs/timeint1lev.F90`

Files created(SCRIPTS):

`gen/comp_gpp_rec_bfas get_bfas_factors`

Files modified(IFS):

`adiab/cpedia.F90 postphy.F90`

`chem/chem_main.F90 chem_massdia.F90 chem_scav.F90 chem_tm5.F90 cod_op_tm5.F90 tm5_calrates.F90 tm5_chem_ini.F90 tm5_do_ebi.F90 tm5_macc_aerosol.F90 tm5_photo_flux.F90`

`control/cdsta.F90 cpicgfl.F90 scan2m.F90`

`dia/ppeddhec.F90 sucddh.F90 sunddh.F90`

`fullpos/endpos.F90 endpos_prepgfl.F90 endvpos.F90 hpos.F90 specfitg.F90 vpos.F90 vpos_prep.F90 wrmlfp.F90 wrmlfpl.F90`

`module/gom_mod.F90 pardimo.F90 parfpos.F90 surface_fields_mix.F90 tm5_chem_module.F90 traj_physics_mod.F90 type_gems_profiles.F90 type_gflflds.F90 varbc_pred.F90 varbc_setup.F90 varbc_to3.F90 yoeaeratm.F90 yoeaersnk.F90 yoephy.F90 yoerad.F90 yom_grib_codes.F90 yom_ygfl.F90 yomafn.F90 yomaneb.F90 yomchem.F90 yomcosjo.F90 yomgrib.F90 yomobs.F90 yomphyder.F90 yomsats.F90 yomtraj.F90 yomvar.F90`

`namelist/naeaer.nam.h naephy.nam.h naerad.nam.h namafn.nam.h namchem.nam.h namgfl.nam.h namobs.nam.h namrlx.nam.h namvar.nam.h`

`obs_preproc/defrun.F90 fgchk.F90 first.F90 gefger.F90 reo3sin.F90 sugoms.F90`

`op_obs/acos_ak_ad.F90 acos_ak_tl.F90 bgobs.F90 cobs.F90 cobsad.F90 ghg_ak_ad.F90 ghg_ak_op.F90 ghg_ak_tl.F90 grg_ak_ad.F90 grg_ak_op.F90 grg_ak_tl.F90 hdepart.F90 hop.F90 hopad.F90 hoptl.F90 hradp_ml.F90 hradp_ml_ad.F90 hradp_ml_tl.F90 hretr.F90 hretr_aeolus.F90 hvnmtlt.F90 isac_grg.F90 isac_grgad.F90 isac_grgtl.F90 mopitt_ak_ad.F90 mopitt_ak_op.F90 mopitt_ak_tl.F90 preint.F90 preintad.F90 preinttl.F90 radtr.F90 radtr_ml.F90 radtr_ml_ad.F90 radtr_ml_tl.F90 radtrad.F90 radtrtl.F90`

`phys_dmn/surdi15.F90`

phys_ec/aer_bdgtmss.F90 aer_dmso.F90 aer_negat.F90 aer_phy1.F90 aer_phy2.F90
aer_phy3.F90 aer_phy3_layer.F90 aer_scavbc.F90 aer_so2so4.F90 aer_src.F90
aerini_layer.F90 aero_init.F90 callpar.F90 callparad.F90 callpartl.F90
chem_main_layer.F90 culight.F90 ec_phys.F90 ec_phys_ad.F90 ec_phys_drv.F90
ec_phys_tl.F90 gems_init.F90 gems_init_ad.F90 gems_init_tl.F90 gems_tend.F90
gems_tend_ad.F90 gems_tend_tl.F90 local_arrays_fin.F90 local_arrays_ini.F90
m7_emi.F90 m7_interface.F90 postphy_layer.F90 sltend.F90
store_traj_phys_layer.F90 su_aerp.F90 su_aerw.F90 turbulence_layer.F90
vdfmain.F90 vdfouter.F90

phys_radi/suecrad.F90 uvradi.F90

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

setup/cmoctmap.F90 su0phy.F90 su0yomb.F90 su_surf_flds.F90 suafn1.F90 suafn2.F90
suafn3.F90 sucpicgfl.F90 suctrl_gflattr.F90 sudefo_gflattr.F90 sudyn.F90
sugfl.F90 sugfl1.F90 sugfl2.F90 sugfl3.F90 sugridg.F90 sumcc.F90 supp.F90
suvnmb.F90

utility/sualspajb.F90 updrlxref.F90

var/cain.F90 cainad.F90 cainin.F90 caininad.F90 estsig.F90 estsiga.F90 get_traj_-

phys.F90 rdfpinc.F90 suanebuf.F90 suinfce.F90 sujb.F90 sujbwavelet.F90 surad.F90 sureo3.F90

suvar.F90 vec2gp.F90 writesd.F90

Files modified(ODB):

bufr2odb/b2o_convert.F90 b2o_convert_205.F90 b2o_convert_gch1.F90
b2o_convert_gch2.F90 b2o_convert_gch3.F90 b2o_convert_gch5.F90

cma2odb/map_reportype.F90 subuoctp.F90

ddl/varno.h

module/getval_module.F90 yomboctp.F90

tools/FcSensObs.cc

Files modified(PREPDATA):

mc_tools/comp_mean_pert.F90

programs/vert_interpol.F90

Files modified(SATRAD): reo3_prescreen.F90 screen_1c.F90

Files modified(SCMEC):

source/sugfl1c.F90

Files modified(SCRIPTS):

build/arch/Makefile.in.linux

def/an.def enkf.def fc.def fsobs.def inc_an.py inc_obs.py inc_stream.py

era/monthlyMean

gen/anil anml anpl ansfc chem_ifsnam.pl chem_setup chemarch_ml ens_cal
ens_fetch_fields fc_sens_prepare fetch_jb_fields_mem fetcherr fetchmars fetchobs
gems_ifsnam.pl gems_setup get_fire_emis get_fire_emis_ctm get_gems_surface
get_nrt_fire_chem get_tm5_initcond getgrb getgrbe getinigems getmars getrelax
ifsmin ifstraj mkabs_an mkabs_fc mkabs_prepdata mkgenlinks mkidta mklinks
mknam_fp model prep_flux prep_initcond prepare_an.ksh restart_999 run_parallel
sstana stagemars update_ensemble_metadata varconsts vardata

sens/J1.sms

sms/getfcdata.sms getvarepsdata.sms libcope.sms ml.sms model.sms pl.sms pt.sms
pv.sms sfc.sms

sms_an/4dvar.sms lowres.sms mergeodb.sms monitoring.sms sekf.sms vardata.sms

sms_nemo/nconst.sms nemogetini.sms

wav/wave_run

Files modified(SURF):

module/yos_veg.F90

Files deleted(IFS):

module/chem_mix.F90 grg_photolysis_mix.F90 yomcouplo4.F90

namelist/namcouplo4.nam.h

op_obs/grg_fparam.F90 grg_jno2_cloud.F90 nox2no2.F90 nox2no2ad.F90 nox2no2tl.F90

phys_ec/grg_nox2no2.F90 grg_tend_layer.F90 grg_tendctm.F90

pp_obs/ppak.F90 ppakad.F90 ppaktl.F90

prism/couplo4_definitions.F90 couplo4_endmpi.F90 couplo4_exchange.F90 couplo4_grg_-input.F90 couplo4_grg_stats.F90 couplo4_inimpi.F90

Files deleted(SCRIPTS):

gen/monthlyMean_macc prep_couplo4

sms/archivectm.sms archivectm_bc.sms archivectm_his.sms libmozart.sms prep_couplo4.sms

sms_an/monthlyMean_macc.sms monthlyMean_macc_pl.sms monthlyMean_macc_sfc.sms

Luke Jones - nal_CY41R1_fieldman_proj - BR

Addition of new fieldman project

This consists of C++ code that allows easy access to grib files and some basic manipulation routines not available elsewhere. The motivation is make available the interp_boxmax binary which does a special type of interpolation for the MACC near-real-time fire emissions. The executable will only be built for MACC experiments. The project does not depend on, nor interfere with, any other projects.

Files created(FIELDMAN):

general/Array.cpp Array.hpp CachedFieldValues.cpp CachedFieldValues.hpp Field.cpp Field.hpp FieldSet.cpp FieldSet.hpp FieldSetIndices.cpp FieldSetIndices.hpp FieldSet_TypeFuncMacros.hpp FieldSet_TypeFuncs.cpp FieldSet_TypeFuncs.hpp Field_Grid2GridProcessOverlaps.cpp FindInVector.hpp GribHandle.hpp Grid.cpp Grid.hpp Grid2GridOverlapProcessor.hpp Regex2FileList.cpp Regex2FileList.hpp error.h fm_debug.h gaussian_rows.cpp gaussian_rows.hpp int2string.cpp int2string.hpp londiff.cpp londiff.hpp longreater.cpp longreater.hpp sign.cpp sign.hpp

specific/interp_boxavg.cpp interp_boxmax.cpp

Files created(SCRIPTS):

gen/mkabs_fieldman

sms/fieldman.sms

Files modified(SCRIPTS):

def/inc_libs.py

sms/p4setup.sms

Files deleted(FIELDMAN): dummy.F90

WAM

Jean Bidlot - wab_SB41R1_wam_forCY41R2 - NotBR

WAM code optimisation + unstructured grid option

Merged from wab_SB41R1_wam_nemo_forCY41R2

Unstructured grid option (inactive by default). MeteoFrance WAM version (not their latest version) Some more optimisations on the input/output. Code clean up (in progress).

Testing:

In stand alone model, the new version of WAM does not give exactly the some norms, but the differences are so small that when output grib data are plotted, there are not differences. see standalone g9vt (reference with dag_CY41R1_esuite) v g9vu (new)

Once coupled to IFS, differences will grow, so to verify that it was OK:

T639 analysis experiments (2014110100 to 2014120100) reference with dag_CY41R1_esuite: g9tw new : g9tv

Files created(WAM):

```
Wam_oper/clean_outbs.F dummy_no_nemo.F init_fieldg.F kerkei.F kzeone.F
mswell.F90 outunwamfield.F outunwamtest.F propag_wam.F runwam.F
sdiss_ardh_vec.F90 setwmask.F sinput_ard.F90 tabu_swellft.F unblkrord.F
unwam.F90 wam_u2l1cr.F wgribencode.F wgribenout.F wsigstar.F
Wam_setup/create_wam_library_cray create_wam_library_ibm
run_wamodel_cray_on_shared_processor
module/coupling_var.F90 parkind_wave.F90 pgmcl_lib_wam.F90 wav_netcdf.F90 wav_netcdf_-
var.F90 yow_rank_gloloc.F90 yowchecksmodule.F90 yowdatapool.F90 yowelementpool.F90
yowerror.F90 yowexchangeModule.F90 yowincludes.h yowmpiModule.F90 yownodepool.F90
yowpd.F90 yowpdlibmain.F90 yowrankModule.F90 yowsidepool.F90 yowunpool.F
```

Files modified(SCRIPTS):

```
build/Makefile.root.wam arch/Makefile.in.cray_XC30_cce
gen/mkabs_an mkabs_fc mkabs_wam
sms/wamarchive.sms wamuracol.sms
wav/archive_wave prep_wave preset_input wam_input wam_preproc_input wave_bsdcol wave_-
const wave_create_bathymetry wave_getalt wave_getwave wave_run wave_runcold wave_-
save wave_set_config wave_set_tstep wave_setup wave_setup_3v wave_setup_4v wave_-
setup_an
```

Files modified(WAM):

```
Alt/readpreb.F
Wam_oper/abort1.F adjust.F airsea.F aki.F aki_ice.F altas.F90 bouinpt.F bouint.F
bsdcol.F buildstress.F cal_second_order_spec.F chief.F cigetdeac.F cimsstrn.F
cireduce.F ciwabr.F ciwaf.F closend.F ctuw.F current2wam.F dev.F difdate.F
dotdc.F dummy_alt.F dummy_fdb.F dummy_no_assimil.F femean.F femeanws.F
file_transfer.F fkmean.F fld2wam.F fldinter.F fndprt.F frcutindex.F getcurr.F
getspec.F getstress.F getwnd.F gradi.F grfield.F90 grib2wgrid.F h_max.F
ifstowam.F implsch.F incdate.F inisnonlin.F initialint.F initmdl.F initnemocpl.F
intpol.F intwaminput.F inwgrib.F jonswap.F kurtosis.F loc2glo.F makeblos.F
makegrid.F mbounc.F mbounf.F mcout.F meansqs.F micep.F mpbcastgrdfld.F
```

mpbcastgrid.F mpcrtbl.F mpdecomp.F mpdistribfl.F mpdistribscfld.F mpexchng.F mpfldtoifs.F mpgatherfl.F mpgathergrdfld.F mpgatherscfld.F mpmdl4alt.F90 mpuserin.F mwp1.F mwp2.F newwind.F notim.F out_onegrdpt.F outbeta.F outbs.F outcom.F outgrid.F outint.F outspp.F outwnorm.F outwspec.F preproc.F preset.F preset_wgrib_template.F prewind.F propags.F propags1.F propags2.F prspp.F prspps.F readfl.F readpre.F readstress.F readwgrib.F readwind.F recvnemofields.F rfl4wam.F90 savspec.F savstress.F sbottom.F sdissip.F secspom.F semean.F sep3tr.F sepwisw.F setice.F setmarstype.F sinput.F snonlin.F stresso.F tauhf.F timin.F topoar.F uibou.F uiprep.F unsetice.F updnemofields.F updnemostress.F userin.F wam2odb.F90 wamadszidl.F wamassi.F wamcur.F wamininemoio.F wamodel.F wamoi.F wamwnd.F wavemdl.F wdfluxes.F wgrib2fdb.F wgribout.F wnfluxes.F wposnam.F write_currents.F writefl.F writestress.F wvalloc.F wvdealloc.F wvwaminit.F

Wam_setup/extract_WAM_code readme run_bouint run_preproc run_preproc.fine run_preset run_preset.fine run_wamassi run_wamodel run_wamodel.fine

module/yowcoup.F yowcout.F yowgrid.F yowmespas.F yowparam.F yowshal.F yowspec.F yowstat.F yowtabl.F yowwind.F

Files deleted(WAM):

Wam_oper/cmpbls.F mswell.F phys.F seticemask.F

Wam_setup/create_wam_library

SCAT

Giovanna De Chiara - dig_SB41R1_for41R2_with_esuite - BR

Modification of OSCAT data processing to be able to process also RapidSCAT and HY-2A Scatterometer data.

dig_CY41R1_for41R2 was pre-merged with some files created or modified in dig_CY41R1_rscat_hscat_v2 (some of these files came from a merge with dab_CY41R1_fornextcycle/scripts)

some routines and scripts used for the processing of OSCAT data have been modified in order to process also RapidSCAT and HY-2A scat data. These new datasets have the same BUFR format as OSCAT so will be processed in the system in the same way. Modifications were necessary to distinguish the datasets and to use specific configuration set-up.

Testing:

Experiments run with T159

- experiment ids (with OSCAT data IN) Exp ID: GA55 (new branch) GA54 (control run: branch dig_CY41R1_esuite_dab_v2 merge between dag_CY41R1_esuite and some scripts from dab_CY41R1_fornextcycle)

- experiment ids (with passive RSCAT data) Exp ID: GACI (new branch) GACP (control run: branch dig_CY41R1_esuite_dab_v2 merge between dag_CY41R1_esuite and some scripts from dab_CY41R1_fornextcycle)

Files created(IFS):

obs_preproc/kscatin.F90

Files created(SCAT):

module/kscat_wind.F oretrieve/decode_oscat_flag.F init_oscat_bufr.F

kscat_write_bufr.F kupdate_windstat.F kwind_biascorr.F kwrite_windstat.F reset_stat.F update_stat.F write_oscat_flag_stat.F programs/kscat_filter.F

Files modified(IFS):

module/parersca.F90 yomcoctp.F90 yomcosjo.F90 yommkodb.F90 yomscc.F90 yomthlim.F90 namelist/namcosjo.nam.h nammkodb.nam.h namscc.nam.h obs_preproc/decis.F90 defrun.F90 fgwnd.F90 scaqc.F90 scat_ob.F90 sufglim.F90 var/suscat.F90

Files modified(ODB):

bufr2odb/b2o_convert.F90 b2o_convert_oscat.F90 ddl/decis_robhdr_2.sql decis_robhdr_4.sql

Files modified(SCAT):

module/datstat_scat.F oscat_bufr.F oscat_flag.F oretrieve/read_speed_bias.F

Files modified(SCRIPTS):

build/Makefile.root.scat def/gen.def inc_an.py inc_libs.py gen/getbias mkabs_odbtools mkabs_scat prescat

NEMO

Kristian Mogensen, Magdalena Alonso Balmaseda, Hao Zu , Tim Stockdale, Patrick Laloyaux - ne1_CY41R1_nemo_forCY41R2_v2 and net_CY41R1_for41R2 - BR

IFS-NEMO coupled model changes + NEMOVAR assimilation changes

Merged from wab_SB41R1_wam_nemo_forCY41R2

Ocean model changes: Optmizations of the reading of input files in NEMO. Various updates for the ORCA025 configuration. Source term update to the TKE scheme.

Coupled model changes: Option to pass cloud cover to LIM2. Possibility of running the coupled model as prepIFS type fc.

Several mods for the Ocean DA system: ensembles (forcing, observations perturbations), datasets, improved online diagnostics, cleaning of scripts. Change defaults on assim namelists (vertical interpolation, T background error in deep ocean). Option for neutral stability bias correction.

Technical changes to the relaxation code, to allow more control over how relaxation to model fields is done. Relaxation timescales now given in hours instead of timesteps. Defaults for relaxation in type ”longrange” set to use only vorticity and temperature fields, with 12 and 48h timescales, and no temperature relaxation above the lower stratosphere.

Script changes to support ECMWF configuration of multi-year runs.

Script changes to support longrange experiments starting at dates other than the 1st of the month.

Revision to the reduced stratospheric diffusion option (LRDIFF_STRATO) in the IFS. Several simple options are possible, controlled by the new namelist variable NDIFF_STRATO. When active, default configuration is NDIFF_STRATO=5, corresponding to reduced diffusion only in the tropical lower stratosphere (10-100 hPa, less than 25 deg latitude, with smooth transitions). Reduction is via a simple transition to a short-tail function.

Assorted script/suite changes for improvements and fixes for type longrange.

FILES for ne1_CY41R1_nemo_forCY41R2_v2

Files created(NEMO):

Many files

Files created(SCRIPTS):

nemo/combine_fdbk getdaily_avisoTS.v5 narcres_date narcres_stock_date
ncheckssicweights nemo_clim.ksh nemo_sst_model nemoqc ngethadisst ngethighressst
ngetostia ngetreynolds ngetslacfnrtv5 ngetslacfv5 ngetsstprod nin2out
ninitialres nmaininter_loop nout2in nprepinter_loop nslasuperob
nsshglobal_monthly nsshglobal_yearly nsstinteratm obsextract_month_1

sms_nemo/icmcl_rm_sstice.sms mppcombnemo.sms ncheckssicweights.sms ngetinitrestart.sms
ngriddists_T_sic.sms ngridremap_sic.sms ninnerpp.sms nouterpp.sms nscripgridssic.sms
nshow_dates.sms ntime_trigger.sms sstfromnemoini.sms

Files modified(IFS):

climate/accnemoflux.F90 updclie.F90 updnemoocean.F90

module/yoegwd.F90 yommcc.F90 yomrlx.F90

namelist/namgwd.nam.h namrlx.nam.h

nemo/couplnemo.F90

ocean/sugco0.F90

phys_ec/accnemoflux_layer.F90 sugwd.F90 turbulence_layer.F90 vdfexcu.F90
vdfmain.F90 vdfouter.F90

setup/sumcclag.F90 surlx.F90

transform/relaxgp.F90

utility/updrlxref.F90

Files modified(IFSAUX):

eclite/datecmd.h julian.h

lfi_alt/lfi_alts.c lfi_grok.c

svipc/svipc.c

Files modified(NEMO):

Many files

Files modified(PREPDATA):

programs/intsst.F90

Files modified(SCRIPTS):

def/fc.def gen.def longrange.def opa.def

gen/bcsst coldstart_lakes fetchobs getgrb getrelax inter_fp mkabs_odbtools
mkidta_ocean model modeleps_nemo preobs

nemo/genstats.ksh getdaily_avisoTS move_restarts move_restartsICE
namelist.nemo.ORCA025_Z75 namelist.nemo.ORCA1_Z42 namelist.nemo.ORCA1_Z46
namelist.nemo.ORCA1_Z75 namelist.nemo.OUTPUT namelist.nemovar.ORCA025_Z75
namelist.nemovar.ORCA1_Z42 namelist.nemovar.ORCA1_Z46 namelist.nemovar.ORCA1_Z75
namelist_ice.coup namelist_ice.nemo.ORCA025 namelist_ice.nemo.ORCA1 narcout
nchecksstweights nconst ndiags.h nemo.h nemo_oper_model nemo_sst_orca_parameters
nemo_wam_model nfluxinter_blkfc nfluxinter_blkqtml ngetatmsst ngetenact ngetmars
ngetmars_blkcldcov ngetmars_blkfc ngetmars_blkqtml ngetmars_blkuv10m ngetnml
ngetres ngetseaice ngriddist_T_sst ngridremap_sst npertprof nplots_saxo_var.ksh

nprepseaice nscripgridssst nscripgridswam nsstinter nsstsettings
nsstsettings_scrip nwaminter_nomask omona.ksh plot_fbmona5d_netcdf.ksh
prep_nemoIFS reshape_cdo tidy_nemoIFS trpmona.ksh
oce/archive_ml archive_sfc checkrestarts chunk.h mm_archive_sfc mm_archive_ua
mm_create_ua model_nemoIFS ninoatmos
sms/getsst.sms model.sms modeleps_nemo.sms nemo_tools.sms p4setup.sms
sms_nemo/arcnemo.sms intermake.sms narcobs.sms narcres.sms narcrescp.sms ncatforcing.sms
ncheckfluxweights.sms ncheckssstweights.sms ncheckssstweightscpl.sms ncheckwamweights.sms
nchkres.sms nclean_forcing.sms nclean_pert.sms nconst.sms nderive.sms nemoatm.sms
nemoatmintsst.sms nemogetini.sms nemoini.sms nemomake.sms nemomm.sms nemoodbmake.sms
nfluxinter.sms nfluxinteraccum.sms nfluxintercldcov.sms nfluxinterqt10.sms nfluxinteruv10.sms
ngetmars.sms ngetmarswam.sms ngetmeanssh.sms ngetobs.sms ngetsst.sms ngetsstcpl.sms
ngriddists_T_flux.sms ngriddists_T_sst.sms ngriddists_T_sst_cpl.sms ngriddists_T_-
wam.sms ngriddists_U_flux.sms ngriddists_U_wam.sms ngriddists_V_flux.sms ngriddists_-
V_wam.sms ngridremap_flux.sms ngridremap_sst.sms ngridremap_sst_cpl.sms ngridremap_-
wam.sms nomona.sms nomona_inc.sms npertadd.sms npertgen.sms npertprof.sms nplotsbox.sms
nplotsvar.sms nprepicelongrange.sms nprepobs.sms nreshape.sms nscripgridsflux.sms
nscripgridssst.sms nscripgridssst_cpl.sms nscripgridswam.sms nseaicestats.sms nslastats.sms
nsstinter.sms nssststats.sms ntrpmona.sms nwaminter.sms nwaminter_nomask.sms obsmonthly.sms
obsstats.sms outer.sms prepicenemo.sms qcmake.sms

Files modified(WAM):

Wam_oper/getwspec.F rearrngsar.F recvnemofields.F rfl4wam.F90 saras.F

FILES for net_CY41R1_for41R2

Files modified(IFS):

module/yoegwd.F90 yomrlx.F90
namelist/namgwd.nam.h namrlx.nam.h
phys_ec/sugwd.F90 turbulence_layer.F90 vdfexcu.F90 vdfmain.F90 vdfouter.F90
setup/surlx.F90
transform/relaxgp.F90
utility/updrlxref.F90

Files modified(PREPDATA):

programs/intsst.F90

Files modified(SCRIPTS):

def/longrange.def
gen/getrelax inter_fp mkidta_ocean
oce/archive_ml archive_sfc checkrestarts chunk.h mm_archive_sfc mm_archive_ua
mm_create_ua model_nemoIFS ninoatmos
sms/getsst.sms

AEOLUS

Michael Rennie - da7_CY41R1_Dec1_aeolus_ecflow - BR

Aeolus L2B/C processing and L2/Met PF scripting changes

An update of the aeolus project code i.e. Aeolus L2B/C processing software, to a version 2.10 + some extra changes (compatible with L1B v6.03 files). Functional Aeolus L2/Met PF in ec-flow.

SCRIPTS: Improvements of Aeolus L2/Met PF scripts, and get it to work in ec-flow.

AEOLUS: Update to v2.10 + some extra modifications.

Files modified(SCRIPTS):

```
def/aeolus.py an.def inc_fam.py gen/L1B_gtt2odb2 aeolus_archive
aeolus_auxmet_odb aeolus_l2b_parallel aeolus_l2b_prepare aeolus_l2b_tidy
aeolus_l2c fetch_L2BP_inputs fetchorbpre get_external_l2b_odb gtt l2b_ee_to_odb
odb2odb1 sms/p4setup.sms sms_an/aeolus_archive.ecf aeolus_auxmet.sms
aeolus_l2b_parallel.sms aeolus_l2b_tidy.sms aeolus_l2c.sms
get_external_l2b_odb.sms l1b_pred_orb2odb.sms
```

Files modified(AEOLUS):

```
AMD_file_handling/ConvertAMDtoKnmiAsc.F90 ODB_to_AMDdata.F90
Application_Client_Example/application_client_example.F90
AuxCal_file_handling/readauxcaldata.F90 BUFR_file_handling/L1B_BufrUtil.F90
L2B_ee2bufr.F90 adm_bufr_descr_codes.F90 BUFR_install/Set_config.linux_compiler
make.bufr.lib.sc BUFR_tables/B0000000000098015002.TXT D0000000000098015002.TXT
create_L2B_tables.py DataStructures/amd_datastructure.F90 ee_cfi_datatypes.F90
joborder_datastructure.F90 l1b_geoloc_ads.F90 l1b_gwd_ads.F90 l1b_meas_ads.F90
l1b_pcd_ads.F90 l1b_sph.F90 l2b_geoloc_ads.F90 l2bc_datastructure.F90
rbc_sph.F90 working_datastructure.F90 DirectBinaryIO/TestDirectBinaryIO.F90
directbinaryio.F90 HLOS_retrieval/hlos_retrieval.F90
InputScreening/Makefile.aeolus Test_Screening_AMD_Data.F90
screening_amd_data.F90 screening_checks.F90 screening_l1b_data.F90
screening_rbc_data.F90 L1B_geolocation_extraction/L1B_pred_orb_to_ODB.F90
L2B_AuxPar_file_handling/read_l2b_auxpar_data.F90
L2C_construction/L2C_Processor.F90 Makefile.aeolus MolScat/molscat.F90
OpticalProperties/lut_raycalib_handling.F90 opticalproperties.F90
RBC_FileHandling/readrbcdata.F90
RayleighBrillouinProcessing/rayleighbrillouinprocessing.F90 tentispectrum.F90
Scripts/CheckVersionNumbers.py Set_Systemsettings.sc
binary_datapack_listing.txt.expected install_binary_datapack.sc
install_installtest.sc installtest_listing.txt.expected run_feedback_agent.py
Test/L2C_construction/Makefile.aeolus Makefile.TestOneExecutable Makefile.aeolus
MieCoreProcessing/Makefile.aeolus
ThinLayer/AE_TEST_AUX_PAR_2B_20050331T000000_20111231T000000_0000.EEF
AE_TEST_AUX_PAR_2C_20050331T000000_20111231T000000_0000.EEF configure
main/L2B_processor.F90 l2bp_module.F90 support/Makefile.aeolus TestInterp1.F90
aeolusconstants.F90 arraytools.F90 c_support.F90 interp1.F90
profileinterpolate.F90 stringtools.F90 test_c_support.F90 test_f90_c_support.c
```

SMOS

Joaquin Munoz Sabater - daq_CY41R1_SMOS_newstuff_v2 - BR

Scientific preparation for SMOS operational assimilation

Main Changes are:

- Introduced mixed-layer lake temperature in the SMOS observation operator,
- Created structure to introduce a 3D background error in the soil moisture analysis as a function of soil texture,
- Different incidence angles for operational monitoring and assimilation allowed with ODB interface,
- Feedback to ODB to monitor ”bias corrected first-guess”,
- Bug-fix to assimilate SMOS and ASCAT simultaneously and other minor bugs-fixes.

Testing:

CTRL: g920 (TL639), EXPT: ga5z (TL639)

Files modified(IFS):

```
control/csekf2.F90
module/yomcmemtypes.F90 yomsekf.F90 yomsmos.F90
namelist/namsekf.nam.h
obs_preproc/sekf_prep_smos.F90
phys_ec/ec_phys.F90
sekf/sm_ekf_main.F90 store_sekf_cv.F90 susekf.F90
smos/smos_obsop.F90
utility/dealsc2.F90
```

Files modified(ODB):

```
cma2odb/ctxgetdb.F90 getdb.F90
ddl/robody_smos_sekf.sql
interface/ctxgetdb.h getdb.h
module/context.F90
```

Files modified(SATRAD):

```
cmem/cmem_alloc_types.F90 cmem_dealloc_types.F90 cmem_main.F90 cmem_soil.F90
rdcmemifs.F90
interface/rdcmemifs.h
programs/bufr_screen_smos.F90
```

Files modified(SCRIPTS):

```
gen/sekf_sm
```

Joaquin Munoz Sabater - daq_CY41R1_SMOS_for_41R2_v2 - BR

Technical preparation for SMOS operational assimilation

New structure to use SMOS data assimilation in operations

Testing:

CTRL: g920 (LSMOS="on", LMONITORING=true, OBS_MONITORING="smos",

LUSE_SMOS=false, BRANCH=CY41R1, which are the defaults for oper)

EXPT: gafo (LSMOS="on", LMONITORING=true, OBS_MONITORING="smos",

LUSE_SMOS=false, BRANCH=daq_CY41R1_SMOS_for_41R2_v2)

Files created(SCRIPTS):

`sms_an/presatsekf.sms`

Files modified(SCRIPTS):

`def/inc_common.py inc_fam.py`
`gen/ifstraj ifsvar mergeodb sekf_sm`
`sms_an/monitoring.sms`

ENKF

Mats Hamrud, Massimo Bonavita, Jan Haseler, Alan Geer, Jean Bidlot, Peter Lean, Tony McNally and Sean Healy - nar_SB41R1_ENKF_D - BR

EnKF contribution

- New Ecflow definition for EnKF bringing the suite much closer to an suite. Includes the JB_stats configuration. The intent is that this suite should produce the same outputs as the operational EDA configuration (Jan Haseler)
- Introduction of Hybrid EnKF/4Dvar configurations
- Optimizations of the EnKF code, get single obs experiment working etc.
- Get Jacobian peak computations working foe All-sky radiances (Alan Geer)
- Get Jacobian peak computations working for gpsro 2-D operator (Sean Healy)
- Get Jacobian peak calculations working with MWHS (Tony Mcnally)
- Get EnKF working with WAM (Jean Bidlot)
- Make EnKF re-runnable (Petar Lean)

Testing:

Experiment ga3k with control g9w7. Results bit-identical, no noticeable change in run-time

Files created(ENKF):

`module/m_mrgrnk.F90 oper_ens_mod.F03`

Files created(IFS):

var/sujbwavalls_wavgen.F90

Files created(ODB):

bufr2odb/b2o_f008042.F90 b2o_gbyte.F90 b2o_sbyte.F90 bufr2odb_temp_hi_res.F90

Files created(SCRIPTS):

def/enkf_ecf.py

gen/add_infl_memb copyhybrid ens_precomp getenkf

sms_an/add_infl_memb.sms copyhybrid.ecf precomp_ens.sms

Files modified(ENKF):

module/analysis_mod.F03 comp_kernel_mod.F03 control_mod.F03 covar_local_mod.F03 covlocal.F90 extern_packages.F03 inflation_mod.F03 obs_base_mod.F03 obs_distr_mod.F03 state_geometry.F03 state_mod.F03 state_utils.F03 xb_state_mod.F03

programs/master_enkf.F03

Files modified(IFS):

module/sats_mix.F90 yomwavelet.F90

mwave/mwave_get.F90 mwave_obsop.F90 mwave_put.F90

op_obs/gpscalc_alpharkm2.F90 gpsro_2dop.F90 hop.F90 hradp.F90 hradp_ml.F90 hretr.F90

var/sujb.F90 sujbwavelet.F90 sujbwavelet0.F90 sujbwavgen.F90 sujbwavstats.F90

Files modified(ODB):

ddl/global_enkf_1.sql global_enkf_10.sql global_enkf_100.sql global_enkf_105.sql global_enkf_110.sql global_enkf_115.sql global_enkf_120.sql global_enkf_15.sql global_enkf_2.sql global_enkf_20.sql global_enkf_25.sql global_enkf_3.sql global_enkf_30.sql global_enkf_35.sql global_enkf_4.sql global_enkf_40.sql global_enkf_45.sql global_enkf_5.sql global_enkf_50.sql global_enkf_55.sql global_enkf_60.sql global_enkf_65.sql global_enkf_70.sql global_enkf_75.sql global_enkf_80.sql global_enkf_85.sql global_enkf_90.sql global_enkf_95.sql

scripts/create_global_enkf_sql.ksh

Files modified(SATRAD):

mwave/mwave_obsop_rttov.F90

rttov/mw_scatt/rttov_iniedd.F90 mw_scatt/rttov_scatt.F90

Files modified(SCRIPTS):

def/enkf.def inc_an.py inc_common.py inc_fam.py inc_libs.py inc_obs.py inc_stream.py

gen/anml anwave archive_obs archive_obsgroup create_enkf eda_err_save enkf_anal enkf_ctl.h enkf_ecfs ens_cal ens_errors ens_errors_rad ens_fetch_fields ens_stats_mem fetch_jb_fields_mem fetcherr fetchmars fetchobs getxb hybrid_an ifsmin ifstraj ifsvar lowres_fp mkabs_enkf mkabs_odbtools mkidta mklinks model obstat_init postenkf update_ensemble_metadata varconsts vardata

sms/getini.sms getpersSST.sms

sms_an/4dvar.sms convert_obsgroup.sms getxb.sms hybrid_an.sms postenkf.sms

wav/wave_setup_4v

Files modified(TRANS):

module/gath_grid_32_ctl_mod.F90

Files modified(WAM):

```
Wam_oper/getwspec.F rearrngsar.F saras.F
```

Files deleted(SCRIPTS):

```
sms_an/stdev.sms
```

ODB

Peter Lean - dipl_CY41R1_odb_bit_repro_for_41r2 - BR

Package of minor ODB improvements and bug fixes

- code portability changes provided by Met Office,
- new ODB varnos used by Met Office,
- new ODB vertco_types used by Met Office,
- improved error reporting when loading reportype mapping config file,
- fixes bug in compiled SQL engine so that the '#' operator now works correctly when inside a WHERE clause,
- fixes bug reported by MeteoFrance where ODB crashes if an empty database is merged into the first position of the ECMA,
- fix for odbsql so that it works if the ODB directory path contains a '-' character (as happens in $TMPDIR on Cray).

Testing: g9wg -Controlm g9wh -Test

Files modified(IFSAUX):

```
module/mpi4to8_s.F90 mpl_abort_mod.F90 mpl_allreduce_mod.F90
mpl_alltoallv_mod.F90 mpl_arg_mod.F90 mpl_broadcast_mod.F90
mpl_buffer_method_mod.F90 mpl_gatherv_mod.F90 mpl_init_mod.F90 mpl_recv_mod.F90
mpl_send_mod.F90 yomhook.F90
support/abor1.F90 dr_hook_util.F90 dr_hook_util_multi.F90
```

Files modified(ODB):

```
compiler/tree.c
ddl/varno.h vertco_type.h
lib/create_iomap.F90 msgpass_loaddata.F90
module/odbgetput.F90 odbmap_reportype.F90 odbmp.F90
scripts/odbsql use/use_odb.sh
tools/Fscheduler.F90
```

Files modified(SCRIPTS):

```
build/Makefile.root.ifsaux
```

OOPS

Tomas Wilhelmsson - nat_CY41R1_OOPS - BR

More derived types and ASSOCIATE statements

DrHook

Sami Saarinen - das_CY41R1_NEW_V9 - BR

Support for Single Precision

ZHOOK_HANDLE can be 4 or 8 bytes.

OPTIMISATION

Deborah Salmond, Peter Lean, Peter Towers, Jean Bidlot and John Hague - das_CY41R1_OPT - BR

Optimisations for Cray

Contains:

dipl_CY41R1_msgpass_refactor_for_41r2,

wab_CY41R1_wam_opt,

das_CY41R1_LW_OPT,

das_CY41R1_Peter,

da0j_CY41R1_VARBC

- Optimisation of msgpass_loaddata and msgpass_storedata
  To revert to the old msgpass_loaddata/storedata you need to: export ODB_NEW_MSGPASS=0
- Optimisation of I/O for Lustre
- Optimisation of I/O in WAM for Lustre
- Optimisation of LWVDRAD

I/O optimisations were to reduce load on Meta-Data in Lustre, for example so that only 1 task inquires, opens, reads and then broadcasts. For the first trajectory the total number of open and stat operations are reduced by over 30%. On a lightly loaded system there is little impact on run time but on a heavily loaded system there

will be a reduction in run time variability and less impact on other jobs. An additional mod was made such that fort.4 is now opened just once per task instead of twice.

Files created(IFS):

`parallel/write_spec_traj.F90`

`phys_ec/state_copy.F90 state_increment.F90 state_update.F90`

Files created(ODB):

`interface/msgpass_loadobs.h msgpass_storeobs.h`

`lib/msgpass_loadobs.F90 msgpass_storeobs.F90`

Files modified(IFS):

`fullpos/sufpc.F90`

`module/traj_main_mod.F90 varbc_setup.F90 yomtrans.F90`

`mwave/mwave_read_sat_error.F90`

`obs_preproc/iniersca.F90 inifger.F90`

`phys_dmn/lwc15.F90 lwvd15.F90 lwvn15.F90`

`phys_ec/callpar.F90 wvcouple.F90`

`phys_radi/lwad.F90 lwbv.F90 lwbvad.F90 lwc.F90 lwcad.F90 lwctl.F90 lwv.F90 lwvad.F90 lwvd.F90 lwvdad.F90 lwvdr.F90 lwvdrad.F90 lwvdrtl.F90 lwvdtl.F90 lwvn.F90 lwvnad.F90 lwvnr.F90 lwvnrad.F90 lwvnrtl.F90 lwvntl.F90 rrtm_kgb1.F90 srtm_kgb16.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_mch4clim.F90 su_mcica.F90 su_mco2clim.F90 su_mozoclim.F90 su_n2oclim.F90 su_no2clim.F90 su_ozoclim.F90 suecozc.F90 suecrad.F90`

`setup/sumpini.F90`

`var/amv_read_oberror.F90 sujbwavtrans.F90 sureo3.F90`

Files modified(IFSAUX):

`module/mpl_broadcast_mod.F90`

Files modified(ODB):

`lib/msgpass_loaddata.F90 msgpass_storedata.F90`

`module/odb.F90 odbio_msgpass.F90`

Files modified(PREPDATA):

`programs/intsst.F90`

Files modified(SATRAD):

`module/mod_mwatlas.F90`

Files modified(SCRIPTS):

`build/Makefile.root.ifsaux Makefile.root.oops Makefile.root.trans arch/Makefile.in.XC30_cce arch/Makefile.in.cray_XC30_cce arch/Makefile.in.cray_gfortran`

`gen/ifsmin mkabs_an mkabs_fc mkabs_prepdata model modeleps modeleps_nemo modelsv sekf_sm varconsts`

Files modified(TRANS):

`module/trltom_mod.F90 trmtol_mod.F90`

Files modified(WAM):

`Sar/sarinvert.F`

Wam_oper/buildstress.F chief.F getspec.F initmdl.F inwgrib.F mpdecomp.F mpuserin.F mubuf.F preproc.F readwind.F rfl4wam.F90 userin.F wamassi.F wamodel.F wavemdl.F wgribout.F write_currents.F write_mpdecomp.F wvalloc.F wvwaminit.F

module/yowstat.F yowunit.F

nar_CY41R1_ioserv

Philippe Marguinaud and Mats Hamrud - nar_CY41R1_ioserv - BR

IO server

Make IO server work at ECMWF in forecast mode.

Testing: 4D-Var experiment gagu, control g9w7

EPS experiment gane

Files created(IFS):

fullpos/wrmlfp_io_serv.F90 wrplfp_io_serv.F90

io_serv/dump_field.F90 io_serv_write_ec.F90 io_serv_writefld_ec.F90

module/fdb_utils_mod.F90 grib_utils_mod.F90 iogride_mod.F90 iogridoe_mod.F90 iogridue_mod.F90 iospece_mod.F90

setup/sufdb.F90

Files created(IFSAUX):

fi_libc/fi_gettimeofday.F90

Files modified(IFS):

control/cnt4.F90

dia/grib_code_message.F90 prepfdb.F90 wroutgpgb.F90

fullpos/gridfpos.F90 iofpos.F90 sufpgrib.F90 wrmlfp.F90 wrplfp.F90

io_serv/io_serv_close.F90 io_serv_get_req.F90 io_serv_init.F90 io_serv_log.F90 io_serv_map_send_part1.F90 io_serv_recv.F90 io_serv_recv_sort.F90 io_serv_run.F90 io_serv_suiosctmpl.F90

module/ioflddesc_mod.F90 iostream_mix.F90 yomgrib.F90 yomio_serv.F90

setup/su0yomb.F90 sugrib.F90 suoph.F90

Files modified(SCRIPTS):

def/fc.def

Files deleted(IFS):

fullpos/wrmlfpl.F90 wrpvlfp.F90 wrthlfp.F90

SINGLE PRECISION

Filip Vana - pafv_SB41R1_SP_220 -notBR

Optional single precision arithmetic as an alternative to the default double precision

By -DSINGLE cpp directive the forecast configuration (001) of IFS could be run in single precision arithmetic.

The single precision is consistently applied for all the libraries except the ocean model (Nemo) and ODB which are so far only allowed to be in double precision. Without this directive the model keeps it original functionality with perhaps more protection for some near overflow/underflow computations.

Testing:

Double precision (default) tests:

g9u7 - t639 assim summer experiment (copy of Gabor's g8e2) g9u8 - t639 assim winter experiment (copy of Gabor's g8e3)

gaa4 - TL399 20member 15-day experiment of coupled EPS with NEMO (copy of Martin's ga9k reference experiment)

ga8a - T255 climate experiment

the results are nearly identical with the reference CY41R1 experiment g7ex. The differences are mostly about zero isoline.

Single precision tests:

g9zo - T255 climate experiment

We have noticed around 1.35 EPS runs (100 forecast in total). I suppose they are coming from ifs/climate/updclie.F90 where some field copy had to be introduce in order to pass compilation in single precision.

ESUITE

Gabor Radnoti - dag_CY41R1_esuite - BR

Files modified(IFSAUX):
`utilities/ec_cray_meminfo.F90`

Files modified(ODB):
`tools/FcSensObs.cc`

Files modified(PREPDATA):
`mc_tools/comp_mean_pert.F90`

Files modified(SATRAD):
`programs/screen_1c.F90`

Files modified(SCRIPTS):
`def/an_ecf.py inc_an.py inc_common.py inc_fam.py inc_obs.py inc_stream.py`
`gen/coldstart_lakes ens_cal ens_fetch_fields fc_sens_prepare fetch_jb_fields_mem fetchmars fetchobs ifsmin mkabs_an mkabs_fc mkabs_odbtools mkabs_prepdata mkgenlinks model modeleps modeleps_nemo modelsv preobs prepare_an.ksh run_parallel sekf_sm simulobs2odb ssaana sstana update_ensemble_metadata varconsts vardata`
`nemo/namelist.nemo.ORCA025_Z75 namelist.nemo.ORCA1_Z42 namelist.nemo.ORCA1_Z46 namelist.nemo.ORCA1_Z75 namelist.nemo.OUTPUT nemo.h tidy_nemoIFS`
`sens/J1.sms`
`sms/getvarepsdata.sms libcope.sms model.sms p4setup.sms`

sms_an/4dvar.sms cope_obsgroup.sms mergeodb.sms monitoring.sms sekf.sms
sms_nemo/nconst.sms nemogetini.sms
wav/wave_run

Files modified(SCRIPTS):
Wam_oper/getwspec.F rearrngsar.F saras.F

BUG-FIX

Vincent Guidard - das_CY41R1_NEW_V9 - BR

Fix in forecast error interpolation: SUVIFCE

If the LLBLOW logical is FALSE, then the code was wrongly taking the SQRT of (possibly interpolated) standard deviations.

Files modified(IFS):
var/suvifce.F90