Regional Cooperation for
Limited Area Modelling in Central Europe

LACE
nwp central europe

Code Refactoring and cleaning for ALARO physics

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Overiview

Many reasons:
- new coding structures introduced by ECMWF,
- GPU adaptation,
- long subroutines hardly understandable

Work for ALARO to be based on the ARPEGE work of Philippe Marginaud

TO DO:
- have a separate aplpar for each physics package -> aplpar_alaro
- introduce new coding structures
- remove computations from mf_phys and aplpar_alaro
- adapt the code to go through automated GPU adaptation procedure

Code cleaning and APLPAR splitting

Physics calls are organized in MF_PHYS and APLPAR subroutines

- physics is one OpenMP loop
- too complex for for ttransformation to GPU code
- hard to use/modify/learn
- contains computations, allocations, variable definitions and many subroutine calls

MF_PHYS

– local computations moved to subroutines

APL_ARPEGE

- only calls to different subroutines
- all computations moved to subroutines
- uses encapsulated data (no modules)
- new data structures do not go below this level (EMCWF did differently)

New coding stuctures

- only one subroutine per file (acraneb2)

- only NPROMA arrays (no ZVARH(0:KLEV) or ZVARF(KLEV))
- no module variables (no more use YOMPHY, ONLY : ...)
  - moved them to a specific data structure
- no ALLOCATABLE arrays
  - everything is allocated at a single place before phy (memory)
- all output arguments should be NPROMA arrays
- new notations

APLPAR split done for ARPEGE

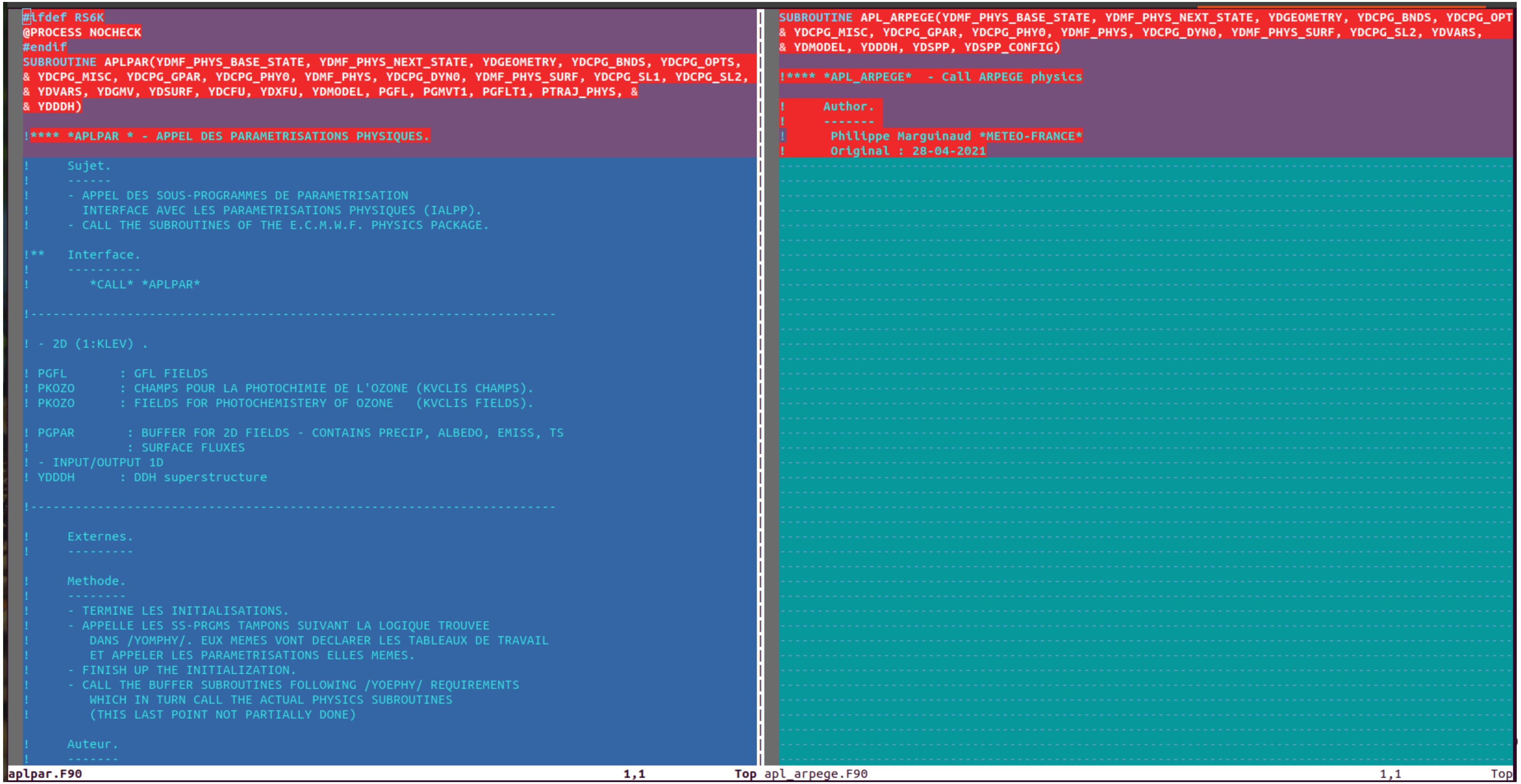
apl_arpege_aerosols_for_radiation.F90
apl_arpege_albedo_computation.F90
apl_arpege_atmosphere_update.F90
apl_arpege_cloudiness.F90
apl_arpege_deep_convection.F90
apl_arpege_dprecips.F90
apl_arpege.F90
apl_arpege_hydro_budget.F90
apl_arpege_init.F90
apl_arpege_init_surfex.F90
apl_arpege_oceanic_fluxes.F90
apl_arpege_precipitation.F90
apl_arpege_radiation.F90
apl_arpege_shallow_convection_and_turbulence.F90
apl_arpege_soil_hydro.F90
apl_arpege_surface.F90
apl_arpege_surface_update.F90

APL_ARPEGE calls

```
CALL CPPHINP
CALL MF_PHYS_FPL_PART1
  CALL MF_PHYS_SAVE_PHSURF_PART1
CALL APLPAR_INIT
  CALL CHECKMV
CALL APL_ARPEGE_INIT
CALL ACTQSAT
    CALL ACSOL               &
CALL APL_ARPEGE_INIT_SURFEX
  CALL ACHMTLS
  CALL ACHMT
CALL ACCLPH
CALL APL_ARPEGE_OCEANIC_FLUXES
CALL APL_WIND_GUST
CALL APL_ARPEGE_SHALLOW_CONVECTION_AND_TURBULENCE
CALL APL_ARPEGE_ALBEDO_COMPUTATION
CALL APL_ARPEGE_AEROSOLS_FOR_RADIATION
CALL APL_ARPEGE_CLOUDINESS
CALL APL_ARPEGE_RADIATION
CALL APL_ARPEGE_SOIL_HYDRO
CALL APL_ARPEGE_SURFACE
  CALL ACDNSHF          &
CALL ACDRAG
  CALL ACPLUIS (
```

```
CALL APL_ARPEGE_DEEP_CONVECTION
CALL APL_ARPEGE_PRECIPITATION       &
CALL QNGCOR
CALL APL_ARPEGE_HYDRO_BUDGET
CALL ACDRME
  CALL APLPAR_FLEXDIA
  CALL ACEVADCAPE
  CALL ACCLDIA
CALL ACVISIH
CALL PPWETPOINT                     &
CALL APL_ARPEGE_DPRECIPS
CALL MF_PHYS_MOCON
  CALL MF_PHYS_CORWAT
  CALL CPQSOL
CALL APL_ARPEGE_ATMOSPHERE_UPDATE
CALL MF_PHYS_FPL_PART2
CALL MF_PHYS_TRANSFER
CALL APL_ARPEGE_SURFACE_UPDATE
  CALL MF_PHYS_SAVE_PHSURF_PART2
CALL MF_PHYS_BAYRAD
CALL MF_PHYS_PRECIPS
```

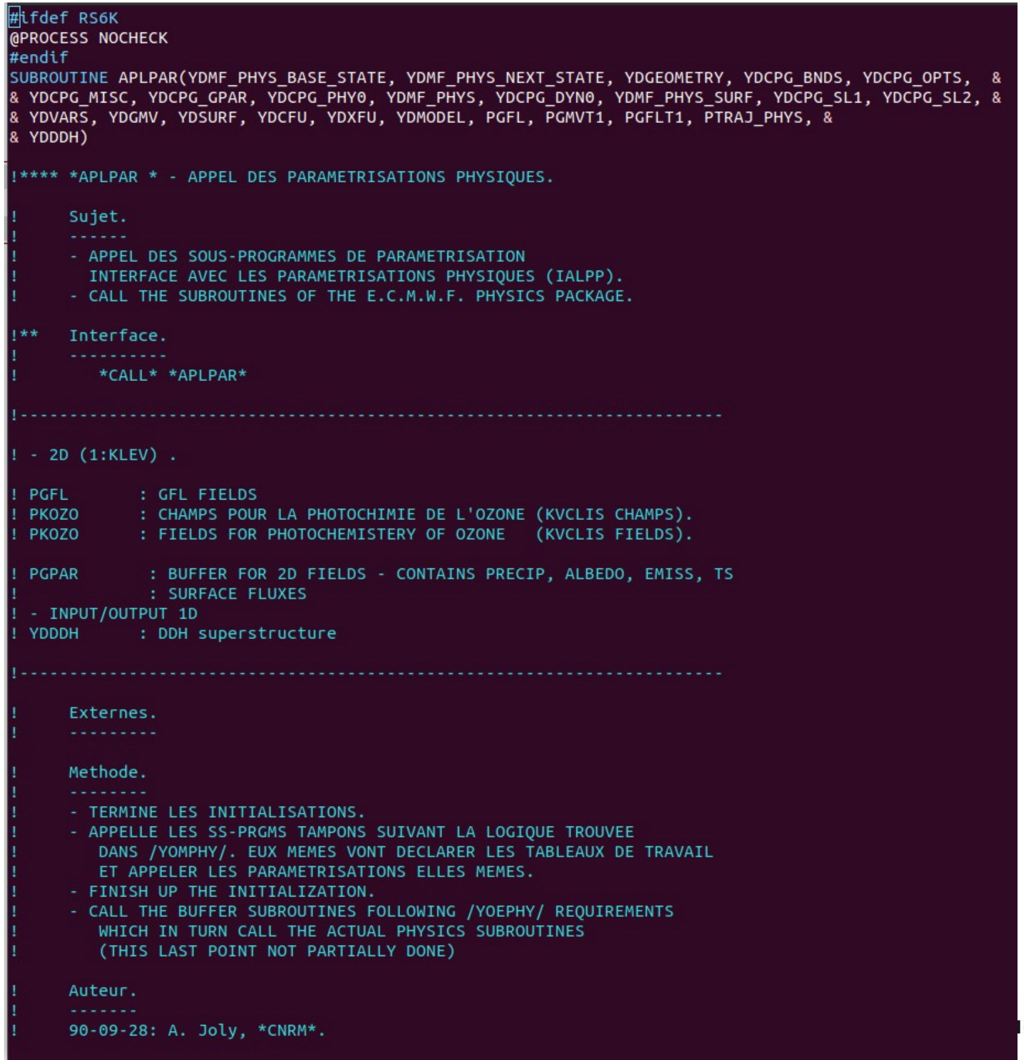
New version of APLPAR and APL_ARPEGE



```
#ifdef RS6K
@PROCESS NOCHECK
#endif
SUBROUTINE APLPAR(YDMF_PHYS_BASE_STATE, YDMF_PHYS_NEXT_STATE, YDGEOMETRY, YDCPG_BNDS, YDCPG_OPTS,
& YDCPG_MISC, YDCPG_GPAR, YDCPG_PHY0, YDMF_PHYS, YDCPG_DYN0, YDMF_PHYS_SURF, YDCPG_SL1, YDCPG_SL2,
& YDVARS, YDGMV, YDSURF, YDCFU, YDXFU, YDMODEL, PGFL, PGMVT1, PGFLT1, PTRAJ_PHYS, &
& YDDDH)

!**** *APLPAR * - APPEL DES PARAMETRISATIONS PHYSIQUES.

!     Sujet.
!     ------
!     - APPEL DES SOUS-PROGRAMMES DE PARAMETRISATION
!       INTERFACE AVEC LES PARAMETRISATIONS PHYSIQUES (IALPP).
!     - CALL THE SUBROUTINES OF THE E.C.M.W.F. PHYSICS PACKAGE.

!**   Interface.
!     ----------
!        *CALL* *APLPAR*

!-----------------------------------------------------------------------

! - 2D (1:KLEV) .

! PGFL       : GFL FIELDS
! PKOZO      : CHAMPS POUR LA PHOTOCHIMIE DE L'OZONE (KVCLIS CHAMPS).
! PKOZO      : FIELDS FOR PHOTOCHEMISTERY OF OZONE   (KVCLIS FIELDS).

! PGPAR       : BUFFER FOR 2D FIELDS - CONTAINS PRECIP, ALBEDO, EMISS, TS
!             : SURFACE FLUXES
! - INPUT/OUTPUT 1D
! YDDDH      : DDH superstructure

!-----------------------------------------------------------------------

!     Externes.
!     ---------

!     Methode.
!     --------
!     - TERMINE LES INITIALISATIONS.
!     - APPELLE LES SS-PRGMS TAMPONS SUIVANT LA LOGIQUE TROUVEE
!        DANS /YOMPHY/. EUX MEMES VONT DECLARER LES TABLEAUX DE TRAVAIL
!        ET APPELER LES PARAMETRISATIONS ELLES MEMES.
!     - FINISH UP THE INITIALIZATION.
!     - CALL THE BUFFER SUBROUTINES FOLLOWING /YOEPHY/ REQUIREMENTS
!        WHICH IN TURN CALL THE ACTUAL PHYSICS SUBROUTINES
!        (THIS LAST POINT NOT PARTIALLY DONE)

!     Auteur.
!     -------
aplpar.F90                                                   1,1            Top
```

```
SUBROUTINE APL_ARPEGE(YDMF_PHYS_BASE_STATE, YDMF_PHYS_NEXT_STATE, YDGEOMETRY, YDCPG_BNDS, YDCPG_OPT
& YDCPG_MISC, YDCPG_GPAR, YDCPG_PHY0, YDMF_PHYS, YDCPG_DYN0, YDMF_PHYS_SURF, YDCPG_SL2, YDVARS,
& YDMODEL, YDDDH, YDSPP, YDSPP_CONFIG)

!**** *APL_ARPEGE*  - Call ARPEGE physics

!     Author.
!     -------
!      Philippe Marguinaud *METEO-FRANCE*
!      Original : 28-04-2021
apl_arpege.F90                                               1,1            Top
```

New version of APLPAR and APL_ARPEGE



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#ifdef RS6K
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#endif
SUBROUTINE APLPAR(YDMF_PHYS_BASE_STATE, YDMF_PHYS_NEXT_STATE, YDGEOMETRY, YDCPG_BNDS, YDCPG_OPTS,  &
& YDCPG_MISC, YDCPG_GPAR, YDCPG_PHY0, YDMF_PHYS, YDCPG_DYN0, YDMF_PHYS_SURF, YDCPG_SL1, YDCPG_SL2, &
& YDVARS, YDGMV, YDSURF, YDCFU, YDXFU, YDMODEL, PGFL, PGMVT1, PGFLT1, PTRAJ_PHYS, &
& YDDDH)

!**** *APLPAR * - APPEL DES PARAMETRISATIONS PHYSIQUES.

!     Sujet.
!     ------
!     - APPEL DES SOUS-PROGRAMMES DE PARAMETRISATION
!       INTERFACE AVEC LES PARAMETRISATIONS PHYSIQUES (IALPP).
!     - CALL THE SUBROUTINES OF THE E.C.M.W.F. PHYSICS PACKAGE.

!**   Interface.
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! - 2D (1:KLEV) .

! PGFL       : GFL FIELDS
! PKOZO      : CHAMPS POUR LA PHOTOCHIMIE DE L'OZONE (KVCLIS CHAMPS).
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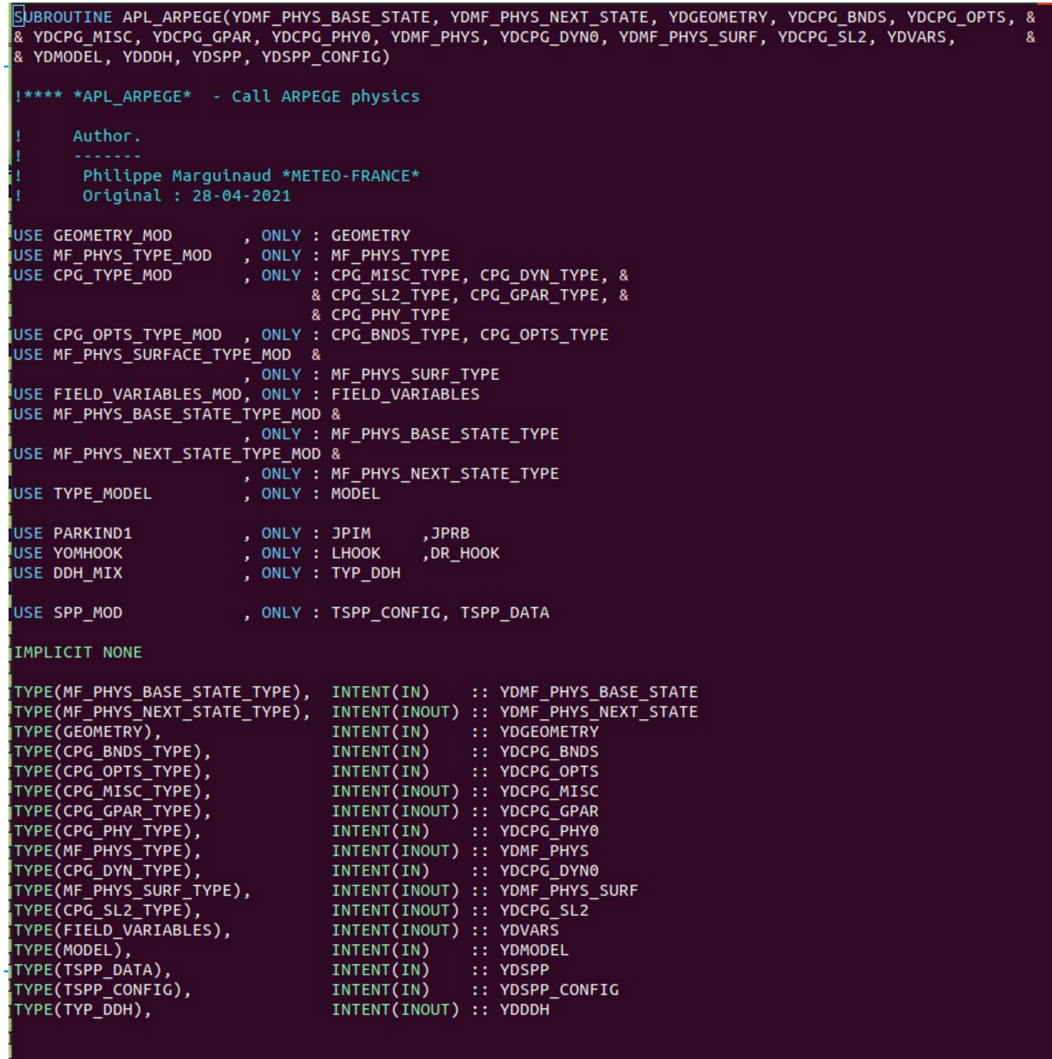
! PGPAR       : BUFFER FOR 2D FIELDS - CONTAINS PRECIP, ALBEDO, EMISS, TS
!             : SURFACE FLUXES
! - INPUT/OUTPUT 1D
! YDDDH      : DDH superstructure

!-----------------------------------------------------------------------

!     Externes.
!     ---------

!     Methode.
!     --------
!     - TERMINE LES INITIALISATIONS.
!     - APPELLE LES SS-PRGMS TAMPONS SUIVANT LA LOGIQUE TROUVEE
!        DANS /YOMPHY/. EUX MEMES VONT DECLARER LES TABLEAUX DE TRAVAIL
!        ET APPELER LES PARAMETRISATIONS ELLES MEMES.
!     - FINISH UP THE INITIALIZATION.
!     - CALL THE BUFFER SUBROUTINES FOLLOWING /YOEPHY/ REQUIREMENTS
!        WHICH IN TURN CALL THE ACTUAL PHYSICS SUBROUTINES
!        (THIS LAST POINT NOT PARTIALLY DONE)

!     Auteur.
!     -------
!     90-09-28: A. Joly, *CNRM*.
```



```
SUBROUTINE APL_ARPEGE(YDMF_PHYS_BASE_STATE, YDMF_PHYS_NEXT_STATE, YDGEOMETRY, YDCPG_BNDS, YDCPG_OPTS, &
& YDCPG_MISC, YDCPG_GPAR, YDCPG_PHY0, YDMF_PHYS, YDCPG_DYN0, YDMF_PHYS_SURF, YDCPG_SL2, YDVARS,      &
& YDMODEL, YDDDH, YDSPP, YDSPP_CONFIG)

!**** *APL_ARPEGE*  - Call ARPEGE physics

!     Author.
!     -------
!      Philippe Marguinaud *METEO-FRANCE*
!      Original : 28-04-2021

USE GEOMETRY_MOD        , ONLY : GEOMETRY
USE MF_PHYS_TYPE_MOD    , ONLY : MF_PHYS_TYPE
USE CPG_TYPE_MOD        , ONLY : CPG_MISC_TYPE, CPG_DYN_TYPE, &
                               & CPG_SL2_TYPE, CPG_GPAR_TYPE, &
                               & CPG_PHY_TYPE
USE CPG_OPTS_TYPE_MOD   , ONLY : CPG_BNDS_TYPE, CPG_OPTS_TYPE
USE MF_PHYS_SURFACE_TYPE_MOD  &
                        , ONLY : MF_PHYS_SURF_TYPE
USE FIELD_VARIABLES_MOD, ONLY : FIELD_VARIABLES
USE MF_PHYS_BASE_STATE_TYPE_MOD &
                        , ONLY : MF_PHYS_BASE_STATE_TYPE
USE MF_PHYS_NEXT_STATE_TYPE_MOD &
                        , ONLY : MF_PHYS_NEXT_STATE_TYPE
USE TYPE_MODEL          , ONLY : MODEL

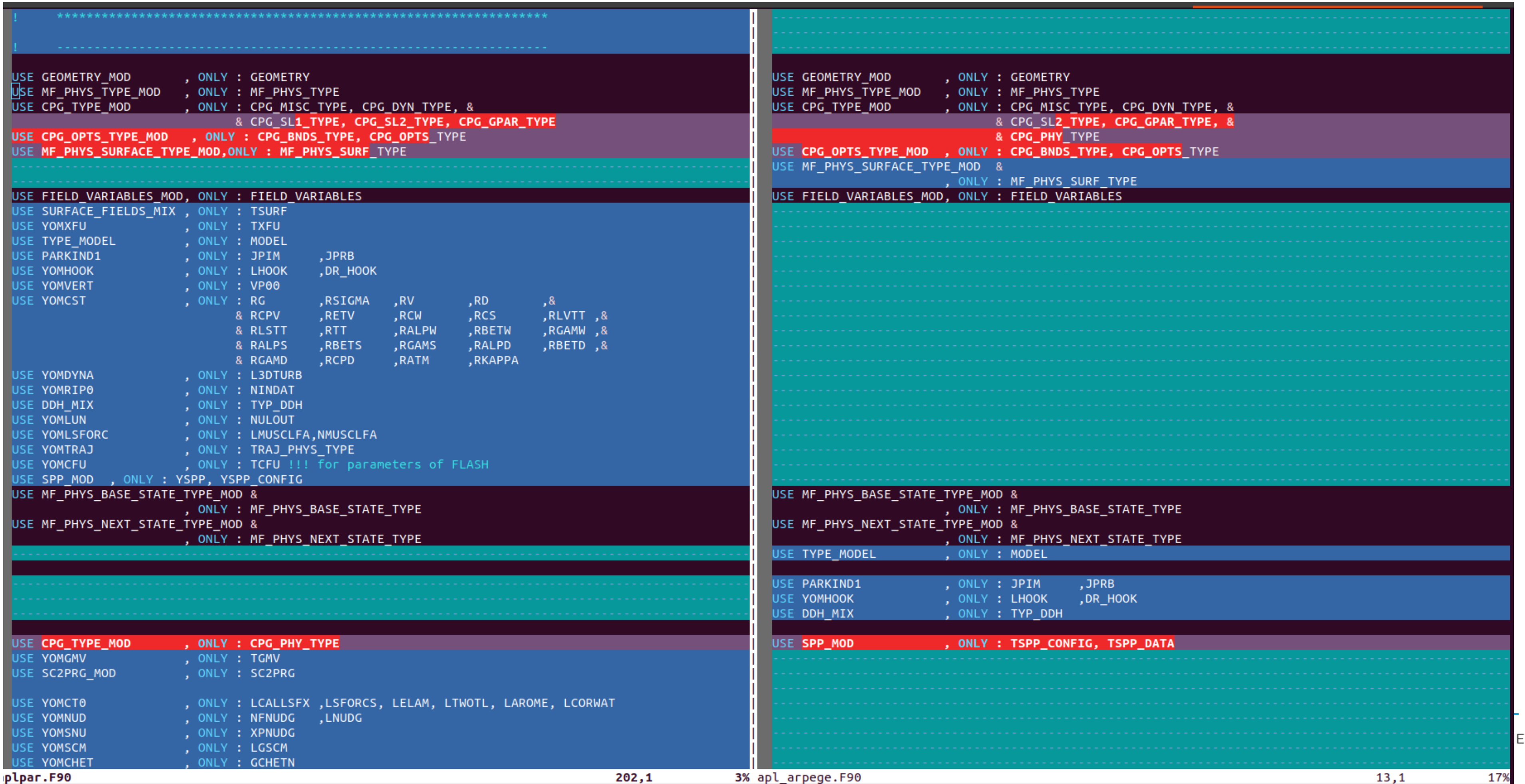
USE PARKIND1            , ONLY : JPIM     ,JPRB
USE YOMHOOK             , ONLY : LHOOK    ,DR_HOOK
USE DDH_MIX             , ONLY : TYP_DDH

USE SPP_MOD             , ONLY : TSPP_CONFIG, TSPP_DATA

IMPLICIT NONE

TYPE(MF_PHYS_BASE_STATE_TYPE),  INTENT(IN)    :: YDMF_PHYS_BASE_STATE
TYPE(MF_PHYS_NEXT_STATE_TYPE),  INTENT(INOUT) :: YDMF_PHYS_NEXT_STATE
TYPE(GEOMETRY),                 INTENT(IN)    :: YDGEOMETRY
TYPE(CPG_BNDS_TYPE),            INTENT(IN)    :: YDCPG_BNDS
TYPE(CPG_OPTS_TYPE),            INTENT(IN)    :: YDCPG_OPTS
TYPE(CPG_MISC_TYPE),            INTENT(INOUT) :: YDCPG_MISC
TYPE(CPG_GPAR_TYPE),            INTENT(INOUT) :: YDCPG_GPAR
TYPE(CPG_PHY_TYPE),             INTENT(IN)    :: YDCPG_PHY0
TYPE(MF_PHYS_TYPE),             INTENT(INOUT) :: YDMF_PHYS
TYPE(CPG_DYN_TYPE),             INTENT(IN)    :: YDCPG_DYN0
TYPE(MF_PHYS_SURF_TYPE),        INTENT(INOUT) :: YDMF_PHYS_SURF
TYPE(CPG_SL2_TYPE),             INTENT(INOUT) :: YDCPG_SL2
TYPE(FIELD_VARIABLES),          INTENT(INOUT) :: YDVARS
TYPE(MODEL),                    INTENT(IN)    :: YDMODEL
TYPE(TSPP_DATA),                INTENT(IN)    :: YDSPP
TYPE(TSPP_CONFIG),              INTENT(IN)    :: YDSPP_CONFIG
TYPE(TYP_DDH),                  INTENT(INOUT) :: YDDDH
```

New version of APLPAR and APL_ARPEGE



```
!      ******************************************************************

!      ------------------------------------------------------------------

USE GEOMETRY_MOD        , ONLY : GEOMETRY
USE MF_PHYS_TYPE_MOD    , ONLY : MF_PHYS_TYPE
USE CPG_TYPE_MOD        , ONLY : CPG_MISC_TYPE, CPG_DYN_TYPE, &
                               & CPG_SL1_TYPE, CPG_SL2_TYPE, CPG_GPAR_TYPE
USE CPG_OPTS_TYPE_MOD    , ONLY : CPG_BNDS_TYPE, CPG_OPTS_TYPE
USE MF_PHYS_SURFACE_TYPE_MOD,ONLY : MF_PHYS_SURF_TYPE
USE FIELD_VARIABLES_MOD, ONLY : FIELD_VARIABLES
USE SURFACE_FIELDS_MIX , ONLY : TSURF
USE YOMXFU              , ONLY : TXFU
USE TYPE_MODEL          , ONLY : MODEL
USE PARKIND1            , ONLY : JPIM     ,JPRB
USE YOMHOOK             , ONLY : LHOOK    ,DR_HOOK
USE YOMVERT             , ONLY : VP00
USE YOMCST              , ONLY : RG       ,RSIGMA   ,RV       ,RD       ,&
                               & RCPV     ,RETV     ,RCW      ,RCS      ,RLVTT ,&
                               & RLSTT    ,RTT      ,RALPW    ,RBETW    ,RGAMW ,&
                               & RALPS    ,RBETS    ,RGAMS    ,RALPD    ,RBETD ,&
                               & RGAMD    ,RCPD     ,RATM     ,RKAPPA
USE YOMDYNA             , ONLY : L3DTURB
USE YOMRIP0             , ONLY : NINDAT
USE DDH_MIX             , ONLY : TYP_DDH
USE YOMLUN              , ONLY : NULOUT
USE YOMLSFORC           , ONLY : LMUSCLFA,NMUSCLFA
USE YOMTRAJ             , ONLY : TRAJ_PHYS_TYPE
USE YOMCFU              , ONLY : TCFU !!! for parameters of FLASH
USE SPP_MOD   , ONLY : YSPP, YSPP_CONFIG
USE MF_PHYS_BASE_STATE_TYPE_MOD &
                        , ONLY : MF_PHYS_BASE_STATE_TYPE
USE MF_PHYS_NEXT_STATE_TYPE_MOD &
                        , ONLY : MF_PHYS_NEXT_STATE_TYPE

USE CPG_TYPE_MOD        , ONLY : CPG_PHY_TYPE
USE YOMGMV              , ONLY : TGMV
USE SC2PRG_MOD          , ONLY : SC2PRG

USE YOMCT0              , ONLY : LCALLSFX ,LSFORCS, LELAM, LTWOTL, LAROME, LCORWAT
USE YOMNUD              , ONLY : NFNUDG   ,LNUDG
USE YOMSNU              , ONLY : XPNUDG
USE YOMSCM              , ONLY : LGSCM
USE YOMCHET             , ONLY : GCHETN
```

```
plpar.F90                                                        202,1          3%
```

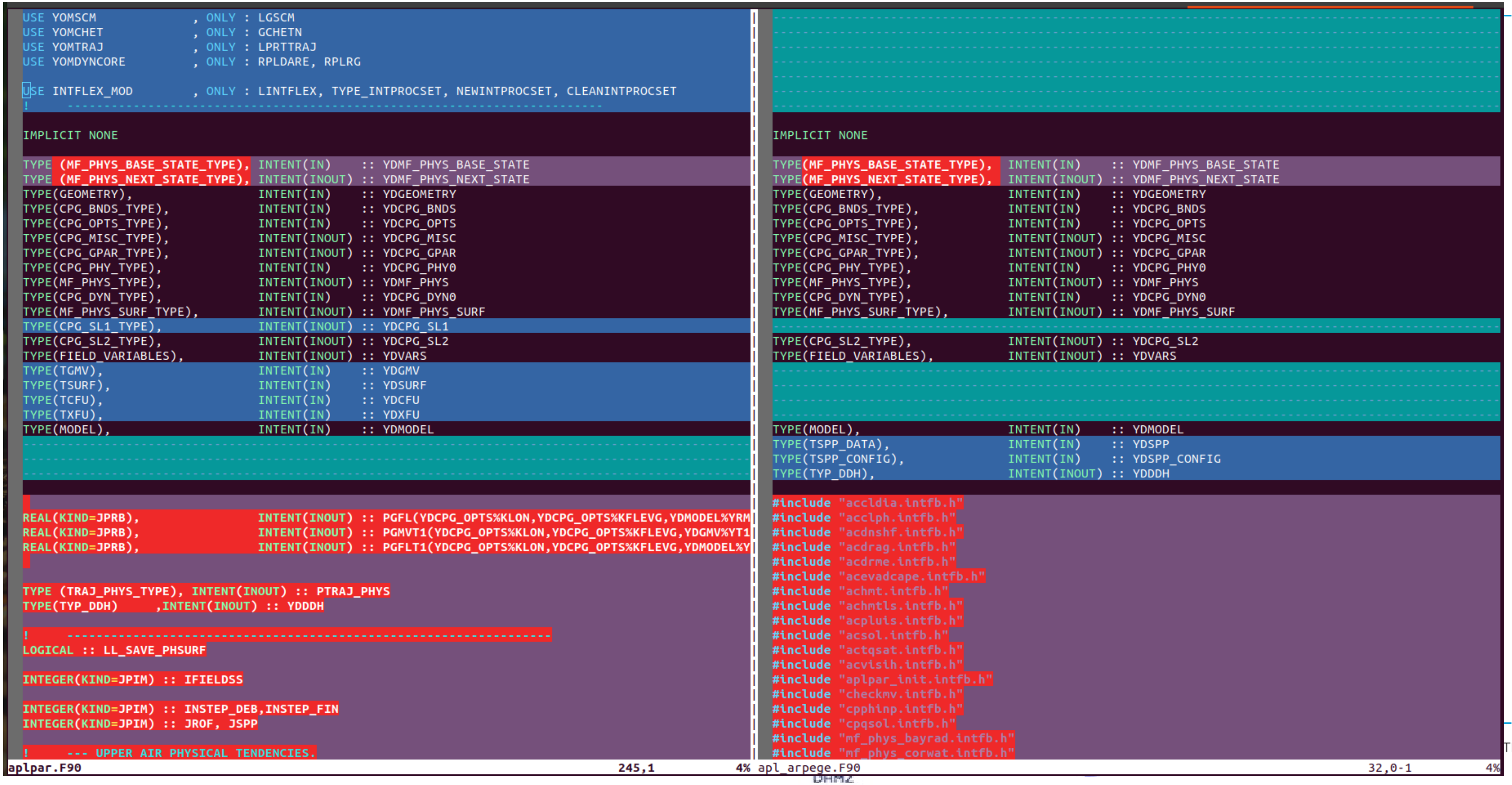
```
USE GEOMETRY_MOD        , ONLY : GEOMETRY
USE MF_PHYS_TYPE_MOD    , ONLY : MF_PHYS_TYPE
USE CPG_TYPE_MOD        , ONLY : CPG_MISC_TYPE, CPG_DYN_TYPE, &
                               & CPG_SL2_TYPE, CPG_GPAR_TYPE, &
                               & CPG_PHY_TYPE
USE CPG_OPTS_TYPE_MOD   , ONLY : CPG_BNDS_TYPE, CPG_OPTS_TYPE
USE MF_PHYS_SURFACE_TYPE_MOD  &
                        , ONLY : MF_PHYS_SURF_TYPE
USE FIELD_VARIABLES_MOD, ONLY : FIELD_VARIABLES
USE MF_PHYS_BASE_STATE_TYPE_MOD &
                        , ONLY : MF_PHYS_BASE_STATE_TYPE
USE MF_PHYS_NEXT_STATE_TYPE_MOD &
                        , ONLY : MF_PHYS_NEXT_STATE_TYPE
USE TYPE_MODEL          , ONLY : MODEL

USE PARKIND1            , ONLY : JPIM     ,JPRB
USE YOMHOOK             , ONLY : LHOOK    ,DR_HOOK
USE DDH_MIX             , ONLY : TYP_DDH

USE SPP_MOD             , ONLY : TSPP_CONFIG, TSPP_DATA
```

```
apl_arpege.F90                                                   13,1          17%
```

New version of APLPAR and APL_ARPEGE



```
USE YOMSCM              , ONLY : LGSCM
USE YOMCHET             , ONLY : GCHETN
USE YOMTRAJ             , ONLY : LPRTTRAJ
USE YOMDYNCORE          , ONLY : RPLDARE, RPLRG

USE INTFLEX_MOD         , ONLY : LINTFLEX, TYPE_INTPROCSET, NEWINTPROCSET, CLEANINTPROCSET
!     -----------------------------------------------------------------------

IMPLICIT NONE

TYPE (MF_PHYS_BASE_STATE_TYPE), INTENT(IN)    :: YDMF_PHYS_BASE_STATE
TYPE (MF_PHYS_NEXT_STATE_TYPE), INTENT(INOUT) :: YDMF_PHYS_NEXT_STATE
TYPE(GEOMETRY),                 INTENT(IN)    :: YDGEOMETRY
TYPE(CPG_BNDS_TYPE),            INTENT(IN)    :: YDCPG_BNDS
TYPE(CPG_OPTS_TYPE),            INTENT(IN)    :: YDCPG_OPTS
TYPE(CPG_MISC_TYPE),            INTENT(INOUT) :: YDCPG_MISC
TYPE(CPG_GPAR_TYPE),            INTENT(INOUT) :: YDCPG_GPAR
TYPE(CPG_PHY_TYPE),             INTENT(IN)    :: YDCPG_PHY0
TYPE(MF_PHYS_TYPE),             INTENT(INOUT) :: YDMF_PHYS
TYPE(CPG_DYN_TYPE),             INTENT(IN)    :: YDCPG_DYN0
TYPE(MF_PHYS_SURF_TYPE),        INTENT(INOUT) :: YDMF_PHYS_SURF
TYPE(CPG_SL1_TYPE),             INTENT(INOUT) :: YDCPG_SL1
TYPE(CPG_SL2_TYPE),             INTENT(INOUT) :: YDCPG_SL2
TYPE(FIELD_VARIABLES),          INTENT(INOUT) :: YDVARS
TYPE(TGMV),                     INTENT(IN)    :: YDGMV
TYPE(TSURF),                    INTENT(IN)    :: YDSURF
TYPE(TCFU),                     INTENT(IN)    :: YDCFU
TYPE(TXFU),                     INTENT(IN)    :: YDXFU
TYPE(MODEL),                    INTENT(IN)    :: YDMODEL



REAL(KIND=JPRB),                INTENT(INOUT) :: PGFL(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG,YDMODEL%YRM
REAL(KIND=JPRB),                INTENT(INOUT) :: PGMVT1(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG,YDGMV%YT1
REAL(KIND=JPRB),                INTENT(INOUT) :: PGFLT1(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG,YDMODEL%Y


TYPE (TRAJ_PHYS_TYPE), INTENT(INOUT) :: PTRAJ_PHYS
TYPE(TYP_DDH)      ,INTENT(INOUT) :: YDDDH

!     -----------------------------------------------------------------------
LOGICAL :: LL_SAVE_PHSURF

INTEGER(KIND=JPIM) :: IFIELDSS

INTEGER(KIND=JPIM) :: INSTEP_DEB,INSTEP_FIN
INTEGER(KIND=JPIM) :: JROF, JSPP

!     --- UPPER AIR PHYSICAL TENDENCIES.
aplpar.F90                                                                  245,1          4%
```

```
IMPLICIT NONE

TYPE(MF_PHYS_BASE_STATE_TYPE),  INTENT(IN)    :: YDMF_PHYS_BASE_STATE
TYPE(MF_PHYS_NEXT_STATE_TYPE),  INTENT(INOUT) :: YDMF_PHYS_NEXT_STATE
TYPE(GEOMETRY),                 INTENT(IN)    :: YDGEOMETRY
TYPE(CPG_BNDS_TYPE),            INTENT(IN)    :: YDCPG_BNDS
TYPE(CPG_OPTS_TYPE),            INTENT(IN)    :: YDCPG_OPTS
TYPE(CPG_MISC_TYPE),            INTENT(INOUT) :: YDCPG_MISC
TYPE(CPG_GPAR_TYPE),            INTENT(INOUT) :: YDCPG_GPAR
TYPE(CPG_PHY_TYPE),             INTENT(IN)    :: YDCPG_PHY0
TYPE(MF_PHYS_TYPE),             INTENT(INOUT) :: YDMF_PHYS
TYPE(CPG_DYN_TYPE),             INTENT(IN)    :: YDCPG_DYN0
TYPE(MF_PHYS_SURF_TYPE),        INTENT(INOUT) :: YDMF_PHYS_SURF

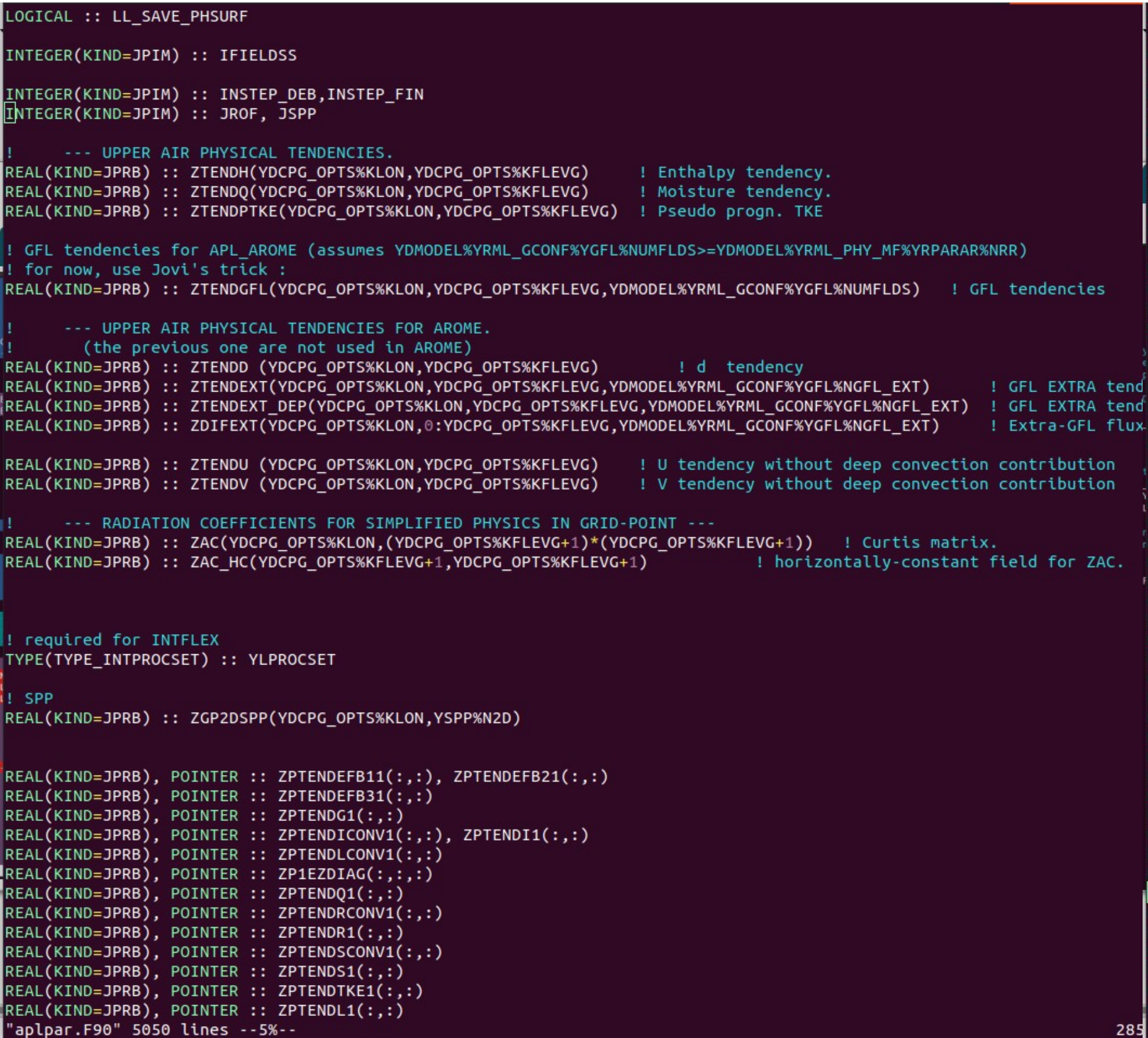
TYPE(CPG_SL2_TYPE),             INTENT(INOUT) :: YDCPG_SL2
TYPE(FIELD_VARIABLES),          INTENT(INOUT) :: YDVARS




TYPE(MODEL),                    INTENT(IN)    :: YDMODEL
TYPE(TSPP_DATA),                INTENT(IN)    :: YDSPP
TYPE(TSPP_CONFIG),              INTENT(IN)    :: YDSPP_CONFIG
TYPE(TYP_DDH),                  INTENT(INOUT) :: YDDDH

#include "accldia.intfb.h"
#include "acclph.intfb.h"
#include "acdnshf.intfb.h"
#include "acdrag.intfb.h"
#include "acdrme.intfb.h"
#include "acevadcape.intfb.h"
#include "achmt.intfb.h"
#include "achmtls.intfb.h"
#include "acpluis.intfb.h"
#include "acsol.intfb.h"
#include "actqsat.intfb.h"
#include "acvisih.intfb.h"
#include "aplpar_init.intfb.h"
#include "checkmv.intfb.h"
#include "cpphinp.intfb.h"
#include "cpqsol.intfb.h"
#include "mf_phys_bayrad.intfb.h"
#include "mf_phys_corwat.intfb.h"
4% apl_arpege.F90                                                           32,0-1         4%
```

New version of APLPAR and APL_ARPEGE



```
LOGICAL :: LL_SAVE_PHSURF

INTEGER(KIND=JPIM) :: IFIELDSS

INTEGER(KIND=JPIM) :: INSTEP_DEB,INSTEP_FIN
INTEGER(KIND=JPIM) :: JROF, JSPP

!     --- UPPER AIR PHYSICAL TENDENCIES.
REAL(KIND=JPRB) :: ZTENDH(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)      ! Enthalpy tendency.
REAL(KIND=JPRB) :: ZTENDQ(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)      ! Moisture tendency.
REAL(KIND=JPRB) :: ZTENDPTKE(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)   ! Pseudo progn. TKE

! GFL tendencies for APL_AROME (assumes YDMODEL%YRML_GCONF%YGFL%NUMFLDS>=YDMODEL%YRML_PHY_MF%YRPARAR%NRR)
! for now, use Jovi's trick :
REAL(KIND=JPRB) :: ZTENDGFL(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG,YDMODEL%YRML_GCONF%YGFL%NUMFLDS)   ! GFL tendencies

!     --- UPPER AIR PHYSICAL TENDENCIES FOR AROME.
!       (the previous one are not used in AROME)
REAL(KIND=JPRB) :: ZTENDD (YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)         ! d  tendency
REAL(KIND=JPRB) :: ZTENDEXT(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG,YDMODEL%YRML_GCONF%YGFL%NGFL_EXT)      ! GFL EXTRA tend
REAL(KIND=JPRB) :: ZTENDEXT_DEP(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG,YDMODEL%YRML_GCONF%YGFL%NGFL_EXT)  ! GFL EXTRA tend
REAL(KIND=JPRB) :: ZDIFEXT(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG,YDMODEL%YRML_GCONF%YGFL%NGFL_EXT)     ! Extra-GFL flux

REAL(KIND=JPRB) :: ZTENDU (YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)     ! U tendency without deep convection contribution
REAL(KIND=JPRB) :: ZTENDV (YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)     ! V tendency without deep convection contribution

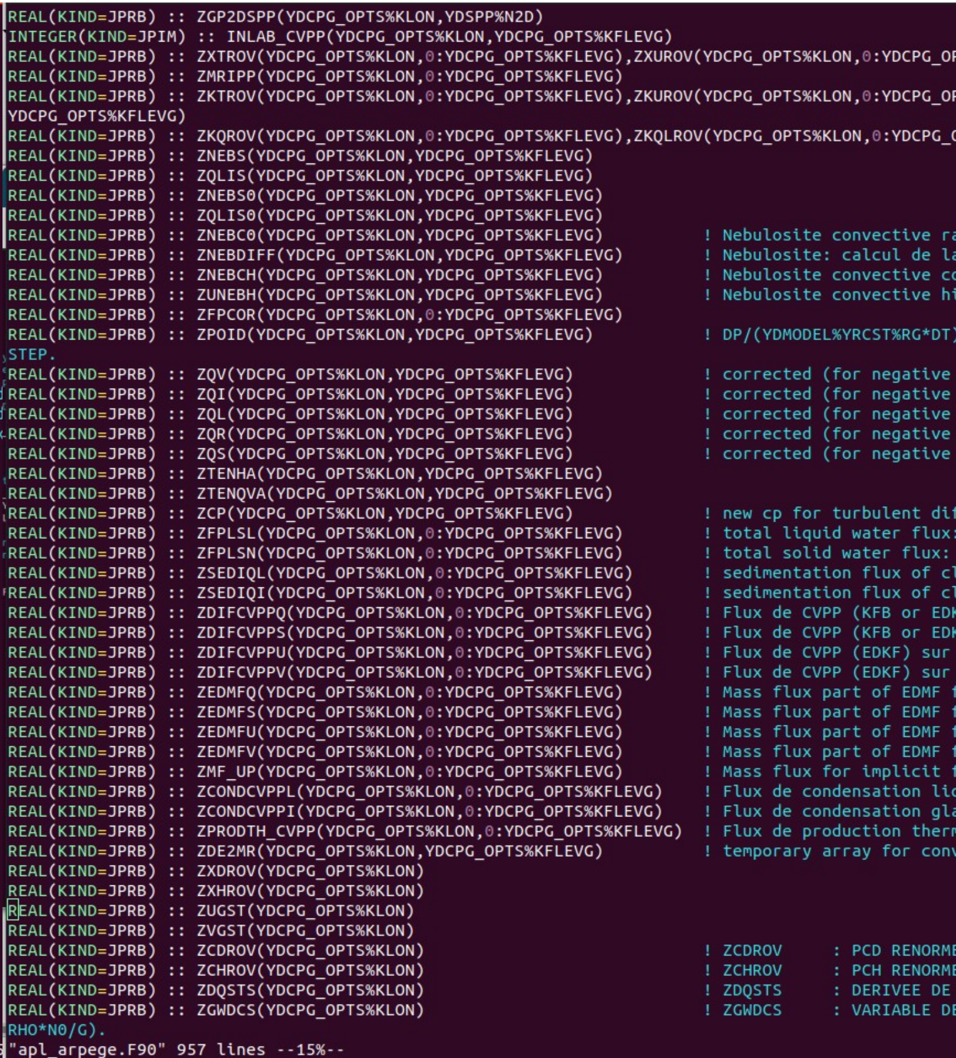
!     --- RADIATION COEFFICIENTS FOR SIMPLIFIED PHYSICS IN GRID-POINT ---
REAL(KIND=JPRB) :: ZAC(YDCPG_OPTS%KLON,(YDCPG_OPTS%KFLEVG+1)*(YDCPG_OPTS%KFLEVG+1))    ! Curtis matrix.
REAL(KIND=JPRB) :: ZAC_HC(YDCPG_OPTS%KFLEVG+1,YDCPG_OPTS%KFLEVG+1)            ! horizontally-constant field for ZAC.



! required for INTFLEX
TYPE(TYPE_INTPROCSET) :: YLPROCSET

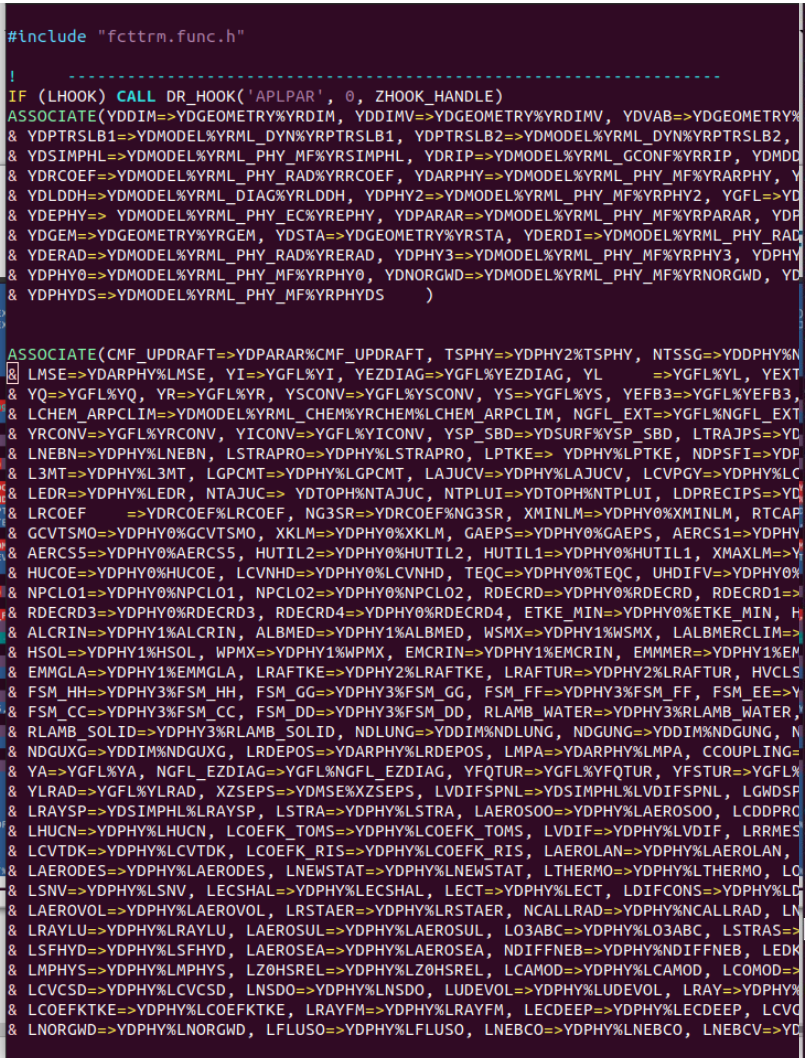
! SPP
REAL(KIND=JPRB) :: ZGP2DSPP(YDCPG_OPTS%KLON,YSPP%N2D)


REAL(KIND=JPRB), POINTER :: ZPTENDEFB11(:,:), ZPTENDEFB21(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDEFB31(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDG1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDICONV1(:,:), ZPTENDI1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDLCONV1(:,:)
REAL(KIND=JPRB), POINTER :: ZP1EZDIAG(:,:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDQ1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDRCONV1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDR1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDSCONV1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDS1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDTKE1(:,:)
REAL(KIND=JPRB), POINTER :: ZPTENDL1(:,:)
"aplpar.F90" 5050 lines --5%--                                                                      285
```



```
REAL(KIND=JPRB) :: ZGP2DSPP(YDCPG_OPTS%KLON,YDSPP%N2D)
INTEGER(KIND=JPIM) :: INLAB_CVPP(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZXTROV(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG),ZXUROV(YDCPG_OPTS%KLON,0:YDCPG_OP
REAL(KIND=JPRB) :: ZMRIPP(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZKTROV(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG),ZKUROV(YDCPG_OPTS%KLON,0:YDCPG_OP
YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZKQROV(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG),ZKQLROV(YDCPG_OPTS%KLON,0:YDCPG_O
REAL(KIND=JPRB) :: ZNEBS(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZQLIS(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZNEBS0(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZQLIS0(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZNEBC0(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)             ! Nebulosite convective ra
REAL(KIND=JPRB) :: ZNEBDIFF(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)           ! Nebulosite: calcul de la
REAL(KIND=JPRB) :: ZNEBCH(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)             ! Nebulosite convective co
REAL(KIND=JPRB) :: ZUNEBH(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)             ! Nebulosite convective hi
REAL(KIND=JPRB) :: ZFPCOR(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZPOID(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)              ! DP/(YDMODEL%YRCST%RG*DT)
STEP.
REAL(KIND=JPRB) :: ZQV(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)                ! corrected (for negative
REAL(KIND=JPRB) :: ZQI(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)                ! corrected (for negative
REAL(KIND=JPRB) :: ZQL(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)                ! corrected (for negative
REAL(KIND=JPRB) :: ZQR(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)                ! corrected (for negative
REAL(KIND=JPRB) :: ZQS(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)                ! corrected (for negative
REAL(KIND=JPRB) :: ZTENHA(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZTENQVA(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)
REAL(KIND=JPRB) :: ZCP(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)                ! new cp for turbulent dif
REAL(KIND=JPRB) :: ZFPLSL(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! total liquid water flux:
REAL(KIND=JPRB) :: ZFPLSN(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! total solid water flux:
REAL(KIND=JPRB) :: ZSEDIQL(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)          ! sedimentation flux of cl
REAL(KIND=JPRB) :: ZSEDIQI(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)          ! sedimentation flux of cl
REAL(KIND=JPRB) :: ZDIFCVPPQ(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)        ! Flux de CVPP (KFB or EDK
REAL(KIND=JPRB) :: ZDIFCVPPS(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)        ! Flux de CVPP (KFB or EDK
REAL(KIND=JPRB) :: ZDIFCVPPU(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)        ! Flux de CVPP (EDKF) sur
REAL(KIND=JPRB) :: ZDIFCVPPV(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)        ! Flux de CVPP (EDKF) sur
REAL(KIND=JPRB) :: ZEDMFQ(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! Mass flux part of EDMF f
REAL(KIND=JPRB) :: ZEDMFS(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! Mass flux part of EDMF f
REAL(KIND=JPRB) :: ZEDMFU(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! Mass flux part of EDMF f
REAL(KIND=JPRB) :: ZEDMFV(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! Mass flux part of EDMF f
REAL(KIND=JPRB) :: ZMF_UP(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)           ! Mass flux for implicit f
REAL(KIND=JPRB) :: ZCONDCVPPL(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)       ! Flux de condensation lic
REAL(KIND=JPRB) :: ZCONDCVPPI(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)       ! Flux de condensation gla
REAL(KIND=JPRB) :: ZPRODTH_CVPP(YDCPG_OPTS%KLON,0:YDCPG_OPTS%KFLEVG)     ! Flux de production therr
REAL(KIND=JPRB) :: ZDE2MR(YDCPG_OPTS%KLON,YDCPG_OPTS%KFLEVG)             ! temporary array for conv
REAL(KIND=JPRB) :: ZXDROV(YDCPG_OPTS%KLON)
REAL(KIND=JPRB) :: ZXHROV(YDCPG_OPTS%KLON)
REAL(KIND=JPRB) :: ZUGST(YDCPG_OPTS%KLON)
REAL(KIND=JPRB) :: ZVGST(YDCPG_OPTS%KLON)
REAL(KIND=JPRB) :: ZCDROV(YDCPG_OPTS%KLON)                               ! ZCDROV     : PCD RENORME
REAL(KIND=JPRB) :: ZCHROV(YDCPG_OPTS%KLON)                               ! ZCHROV     : PCH RENORME
REAL(KIND=JPRB) :: ZDQSTS(YDCPG_OPTS%KLON)                               ! ZDQSTS     : DERIVEE DE
REAL(KIND=JPRB) :: ZGWDCS(YDCPG_OPTS%KLON)                               ! ZGWDCS     : VARIABLE DE
RHO*N0/G).
"apl_arpege.F90" 957 lines --15%--
```

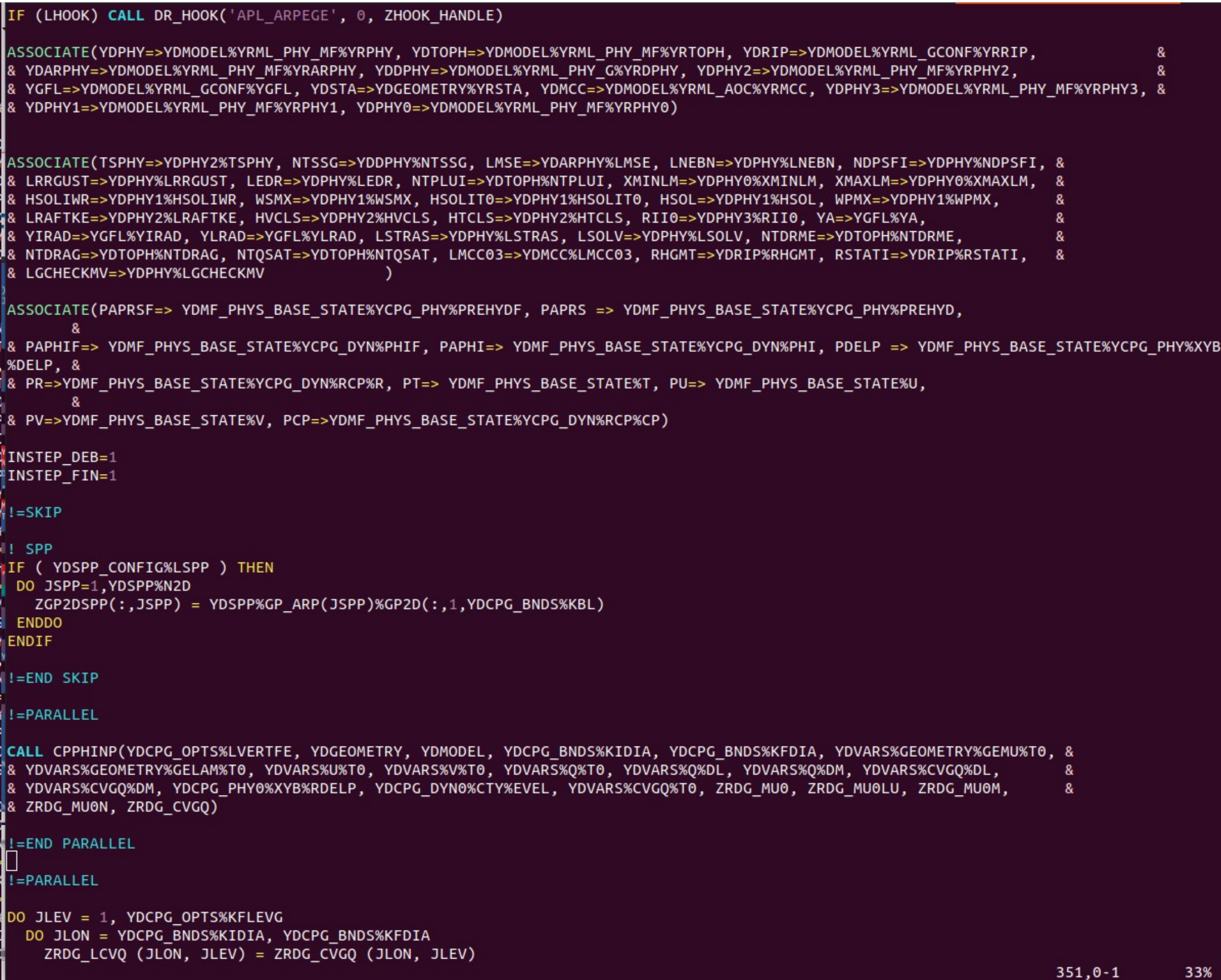
New version of APLPAR and APL_ARPEGE



```
#include "fcttrm.func.h"

!     ----------------------------------------------------------------------
IF (LHOOK) CALL DR_HOOK('APLPAR', 0, ZHOOK_HANDLE)
ASSOCIATE(YDDIM=>YDGEOMETRY%YRDIM, YDDIMV=>YDGEOMETRY%YRDIMV, YDVAB=>YDGEOMETRY%
& YDPTRSLB1=>YDMODEL%YRML_DYN%YRPTRSLB1, YDPTRSLB2=>YDMODEL%YRML_DYN%YRPTRSLB2,
& YDSIMPHL=>YDMODEL%YRML_PHY_MF%YRSIMPHL, YDRIP=>YDMODEL%YRML_GCONF%YRRIP, YDMDD
& YDRCOEF=>YDMODEL%YRML_PHY_RAD%YRRCOEF, YDARPHY=>YDMODEL%YRML_PHY_MF%YRARPHY, Y
& YDLDDH=>YDMODEL%YRML_DIAG%YRLDDH, YDPHY2=>YDMODEL%YRML_PHY_MF%YRPHY2, YGFL=>YD
& YDEPHY=> YDMODEL%YRML_PHY_EC%YREPHY, YDPARAR=>YDMODEL%YRML_PHY_MF%YRPARAR, YDP
& YDGEM=>YDGEOMETRY%YRGEM, YDSTA=>YDGEOMETRY%YRSTA, YDERDI=>YDMODEL%YRML_PHY_RAD
& YDERAD=>YDMODEL%YRML_PHY_RAD%YRERAD, YDPHY3=>YDMODEL%YRML_PHY_MF%YRPHY3, YDPHY
& YDPHY0=>YDMODEL%YRML_PHY_MF%YRPHY0, YDNORGWD=>YDMODEL%YRML_PHY_MF%YRNORGWD, YD
& YDPHYDS=>YDMODEL%YRML_PHY_MF%YRPHYDS     )


ASSOCIATE(CMF_UPDRAFT=>YDPARAR%CMF_UPDRAFT, TSPHY=>YDPHY2%TSPHY, NTSSG=>YDDPHY%N
& LMSE=>YDARPHY%LMSE, YI=>YGFL%YI, YEZDIAG=>YGFL%YEZDIAG, YL      =>YGFL%YL, YEXT
& YQ=>YGFL%YQ, YR=>YGFL%YR, YSCONV=>YGFL%YSCONV, YS=>YGFL%YS, YEFB3=>YGFL%YEFB3,
& LCHEM_ARPCLIM=>YDMODEL%YRML_CHEM%YRCHEM%LCHEM_ARPCLIM, NGFL_EXT=>YGFL%NGFL_EXT
& YRCONV=>YGFL%YRCONV, YICONV=>YGFL%YICONV, YSP_SBD=>YDSURF%YSP_SBD, LTRAJPS=>YD
& LNEBN=>YDPHY%LNEBN, LSTRAPRO=>YDPHY%LSTRAPRO, LPTKE=> YDPHY%LPTKE, NDPSFI=>YDP
& L3MT=>YDPHY%L3MT, LGPCMT=>YDPHY%LGPCMT, LAJUCV=>YDPHY%LAJUCV, LCVPGY=>YDPHY%LC
& LEDR=>YDPHY%LEDR, NTAJUC=> YDTOPH%NTAJUC, NTPLUI=>YDTOPH%NTPLUI, LDPRECIPS=>YD
& LRCOEF    =>YDRCOEF%LRCOEF, NG3SR=>YDRCOEF%NG3SR, XMINLM=>YDPHY0%XMINLM, RTCAP
& GCVTSMO=>YDPHY0%GCVTSMO, XKLM=>YDPHY0%XKLM, GAEPS=>YDPHY0%GAEPS, AERCS1=>YDPHY
& AERCS5=>YDPHY0%AERCS5, HUTIL2=>YDPHY0%HUTIL2, HUTIL1=>YDPHY0%HUTIL1, XMAXLM=>Y
& HUCOE=>YDPHY0%HUCOE, LCVNHD=>YDPHY0%LCVNHD, TEQC=>YDPHY0%TEQC, UHDIFV=>YDPHY0%
& NPCLO1=>YDPHY0%NPCLO1, NPCLO2=>YDPHY0%NPCLO2, RDECRD=>YDPHY0%RDECRD, RDECRD1=>
& RDECRD3=>YDPHY0%RDECRD3, RDECRD4=>YDPHY0%RDECRD4, ETKE_MIN=>YDPHY0%ETKE_MIN, H
& ALCRIN=>YDPHY1%ALCRIN, ALBMED=>YDPHY1%ALBMED, WSMX=>YDPHY1%WSMX, LALBMERCLIM=>
& HSOL=>YDPHY1%HSOL, WPMX=>YDPHY1%WPMX, EMCRIN=>YDPHY1%EMCRIN, EMMMER=>YDPHY1%EM
& EMMGLA=>YDPHY1%EMMGLA, LRAFTKE=>YDPHY2%LRAFTKE, LRAFTUR=>YDPHY2%LRAFTUR, HVCLS
& FSM_HH=>YDPHY3%FSM_HH, FSM_GG=>YDPHY3%FSM_GG, FSM_FF=>YDPHY3%FSM_FF, FSM_EE=>Y
& FSM_CC=>YDPHY3%FSM_CC, FSM_DD=>YDPHY3%FSM_DD, RLAMB_WATER=>YDPHY3%RLAMB_WATER,
& RLAMB_SOLID=>YDPHY3%RLAMB_SOLID, NDLUNG=>YDDIM%NDLUNG, NDGUNG=>YDDIM%NDGUNG, N
& NDGUXG=>YDDIM%NDGUXG, LRDEPOS=>YDARPHY%LRDEPOS, LMPA=>YDARPHY%LMPA, CCOUPLING=
& YA=>YGFL%YA, NGFL_EZDIAG=>YGFL%NGFL_EZDIAG, YFQTUR=>YGFL%YFQTUR, YFSTUR=>YGFL%
& YLRAD=>YGFL%YLRAD, XZSEPS=>YDMSE%XZSEPS, LVDIFSPNL=>YDSIMPHL%LVDIFSPNL, LGWDSP
& LRAYSP=>YDSIMPHL%LRAYSP, LSTRA=>YDPHY%LSTRA, LAEROSOO=>YDPHY%LAEROSOO, LCDDPRO
& LHUCN=>YDPHY%LHUCN, LCOEFK_TOMS=>YDPHY%LCOEFK_TOMS, LVDIF=>YDPHY%LVDIF, LRRMES
& LCVTDK=>YDPHY%LCVTDK, LCOEFK_RIS=>YDPHY%LCOEFK_RIS, LAEROLAN=>YDPHY%LAEROLAN,
& LAERODES=>YDPHY%LAERODES, LNEWSTAT=>YDPHY%LNEWSTAT, LTHERMO=>YDPHY%LTHERMO, LO
& LSNV=>YDPHY%LSNV, LECSHAL=>YDPHY%LECSHAL, LECT=>YDPHY%LECT, LDIFCONS=>YDPHY%LD
& LAEROVOL=>YDPHY%LAEROVOL, LRSTAER=>YDPHY%LRSTAER, NCALLRAD=>YDPHY%NCALLRAD, LN
& LRAYLU=>YDPHY%LRAYLU, LAEROSUL=>YDPHY%LAEROSUL, LO3ABC=>YDPHY%LO3ABC, LSTRAS=>
& LSFHYD=>YDPHY%LSFHYD, LAEROSEA=>YDPHY%LAEROSEA, NDIFFNEB=>YDPHY%NDIFFNEB, LEDK
& LMPHYS=>YDPHY%LMPHYS, LZ0HSREL=>YDPHY%LZ0HSREL, LCAMOD=>YDPHY%LCAMOD, LCOMOD=>
& LCVCSD=>YDPHY%LCVCSD, LNSDO=>YDPHY%LNSDO, LUDEVOL=>YDPHY%LUDEVOL, LRAY=>YDPHY%
& LCOEFKTKE=>YDPHY%LCOEFKTKE, LRAYFM=>YDPHY%LRAYFM, LECDEEP=>YDPHY%LECDEEP, LCVC
& LNORGWD=>YDPHY%LNORGWD, LFLUSO=>YDPHY%LFLUSO, LNEBCO=>YDPHY%LNEBCO, LNEBCV=>YD
```



```
IF (LHOOK) CALL DR_HOOK('APL_ARPEGE', 0, ZHOOK_HANDLE)

ASSOCIATE(YDPHY=>YDMODEL%YRML_PHY_MF%YRPHY, YDTOPH=>YDMODEL%YRML_PHY_MF%YRTOPH, YDRIP=>YDMODEL%YRML_GCONF%YRRIP,          &
& YDARPHY=>YDMODEL%YRML_PHY_MF%YRARPHY, YDDPHY=>YDMODEL%YRML_PHY_G%YRDPHY, YDPHY2=>YDMODEL%YRML_PHY_MF%YRPHY2,            &
& YGFL=>YDMODEL%YRML_GCONF%YGFL, YDSTA=>YDGEOMETRY%YRSTA, YDMCC=>YDMODEL%YRML_AOC%YRMCC, YDPHY3=>YDMODEL%YRML_PHY_MF%YRPHY3, &
& YDPHY1=>YDMODEL%YRML_PHY_MF%YRPHY1, YDPHY0=>YDMODEL%YRML_PHY_MF%YRPHY0)


ASSOCIATE(TSPHY=>YDPHY2%TSPHY, NTSSG=>YDDPHY%NTSSG, LMSE=>YDARPHY%LMSE, LNEBN=>YDPHY%LNEBN, NDPSFI=>YDPHY%NDPSFI, &
& LRRGUST=>YDPHY%LRRGUST, LEDR=>YDPHY%LEDR, NTPLUI=>YDTOPH%NTPLUI, XMINLM=>YDPHY0%XMINLM, XMAXLM=>YDPHY0%XMAXLM,  &
& HSOLIWR=>YDPHY1%HSOLIWR, WSMX=>YDPHY1%WSMX, HSOLIT0=>YDPHY1%HSOLIT0, HSOL=>YDPHY1%HSOL, WPMX=>YDPHY1%WPMX,       &
& LRAFTKE=>YDPHY2%LRAFTKE, HVCLS=>YDPHY2%HVCLS, HTCLS=>YDPHY2%HTCLS, RII0=>YDPHY3%RII0, YA=>YGFL%YA,             &
& YIRAD=>YGFL%YIRAD, YLRAD=>YGFL%YLRAD, LSTRAS=>YDPHY%LSTRAS, LSOLV=>YDPHY%LSOLV, NTDRME=>YDTOPH%NTDRME,          &
& NTDRAG=>YDTOPH%NTDRAG, NTQSAT=>YDTOPH%NTQSAT, LMCC03=>YDMCC%LMCC03, RHGMT=>YDRIP%RHGMT, RSTATI=>YDRIP%RSTATI,   &
& LGCHECKMV=>YDPHY%LGCHECKMV              )

ASSOCIATE(PAPRSF=> YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYDF, PAPRS => YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYD,
       &
& PAPHIF=> YDMF_PHYS_BASE_STATE%YCPG_DYN%PHIF, PAPHI=> YDMF_PHYS_BASE_STATE%YCPG_DYN%PHI, PDELP => YDMF_PHYS_BASE_STATE%YCPG_PHY%XYB
%DELP, &
& PR=>YDMF_PHYS_BASE_STATE%YCPG_DYN%RCP%R, PT=> YDMF_PHYS_BASE_STATE%T, PU=> YDMF_PHYS_BASE_STATE%U,
       &
& PV=>YDMF_PHYS_BASE_STATE%V, PCP=>YDMF_PHYS_BASE_STATE%YCPG_DYN%RCP%CP)

INSTEP_DEB=1
INSTEP_FIN=1

!=SKIP

! SPP
IF ( YDSPP_CONFIG%LSPP ) THEN
 DO JSPP=1,YDSPP%N2D
   ZGP2DSPP(:,JSPP) = YDSPP%GP_ARP(JSPP)%GP2D(:,1,YDCPG_BNDS%KBL)
 ENDDO
ENDIF

!=END SKIP

!=PARALLEL

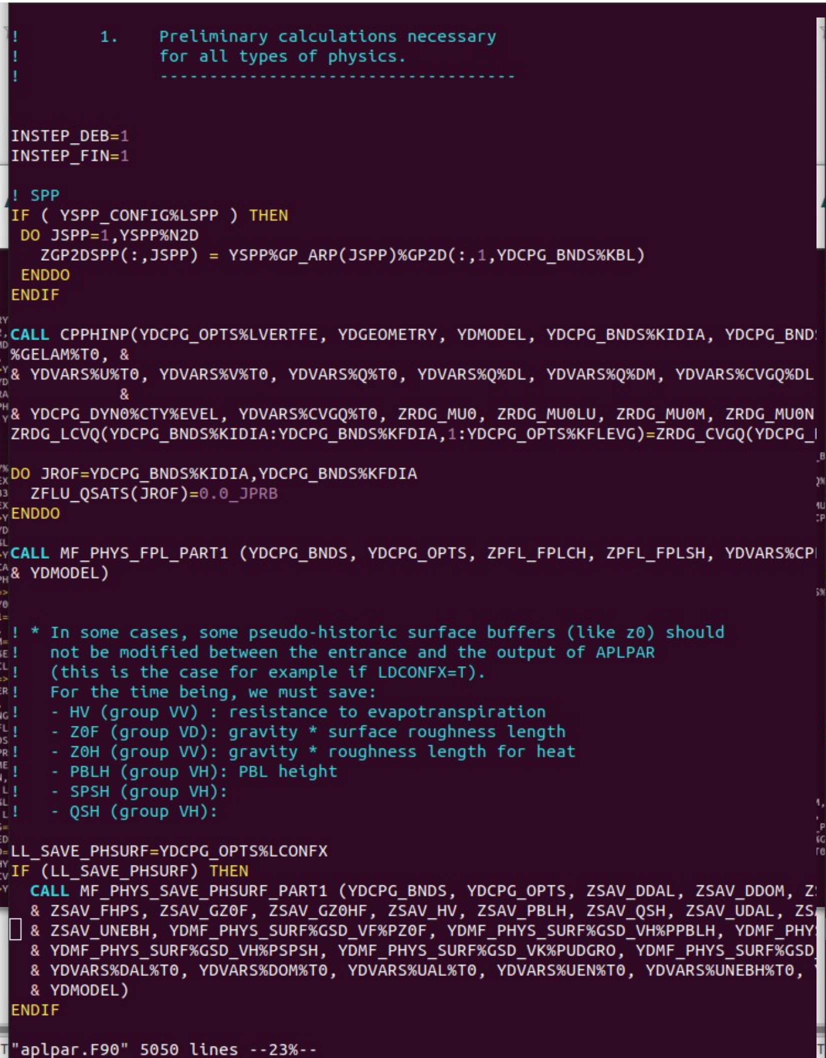
CALL CPPHINP(YDCPG_OPTS%LVERTFE, YDGEOMETRY, YDMODEL, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, YDVARS%GEOMETRY%GEMU%T0, &
& YDVARS%GEOMETRY%GELAM%T0, YDVARS%U%T0, YDVARS%V%T0, YDVARS%Q%T0, YDVARS%Q%DL, YDVARS%Q%DM, YDVARS%CVGQ%DL,       &
& YDVARS%CVGQ%DM, YDCPG_PHY0%XYB%RDELP, YDCPG_DYN0%CTY%EVEL, YDVARS%CVGQ%T0, ZRDG_MU0, ZRDG_MU0LU, ZRDG_MU0M,      &
& ZRDG_MU0N, ZRDG_CVGQ)

!=END PARALLEL

!=PARALLEL

DO JLEV = 1, YDCPG_OPTS%KFLEVG
  DO JLON = YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA
    ZRDG_LCVQ (JLON, JLEV) = ZRDG_CVGQ (JLON, JLEV)
                                                                                                       351,0-1       33%
```

New version of APLPAR and APL_ARPEGE



```
!        1.    Preliminary calculations necessary
!              for all types of physics.
!              ------------------------------------


INSTEP_DEB=1
INSTEP_FIN=1

! SPP
IF ( YSPP_CONFIG%LSPP ) THEN
 DO JSPP=1,YSPP%N2D
   ZGP2DSPP(:,JSPP) = YSPP%GP_ARP(JSPP)%GP2D(:,1,YDCPG_BNDS%KBL)
 ENDDO
ENDIF

CALL CPPHINP(YDCPG_OPTS%LVERTFE, YDGEOMETRY, YDMODEL, YDCPG_BNDS%KIDIA, YDCPG_BND
%GELAM%T0, &
& YDVARS%U%T0, YDVARS%V%T0, YDVARS%Q%T0, YDVARS%Q%DL, YDVARS%Q%DM, YDVARS%CVGQ%DL
           &
& YDCPG_DYN0%CTY%EVEL, YDVARS%CVGQ%T0, ZRDG_MU0, ZRDG_MU0LU, ZRDG_MU0M, ZRDG_MU0N
ZRDG_LCVQ(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG)=ZRDG_CVGQ(YDCPG_

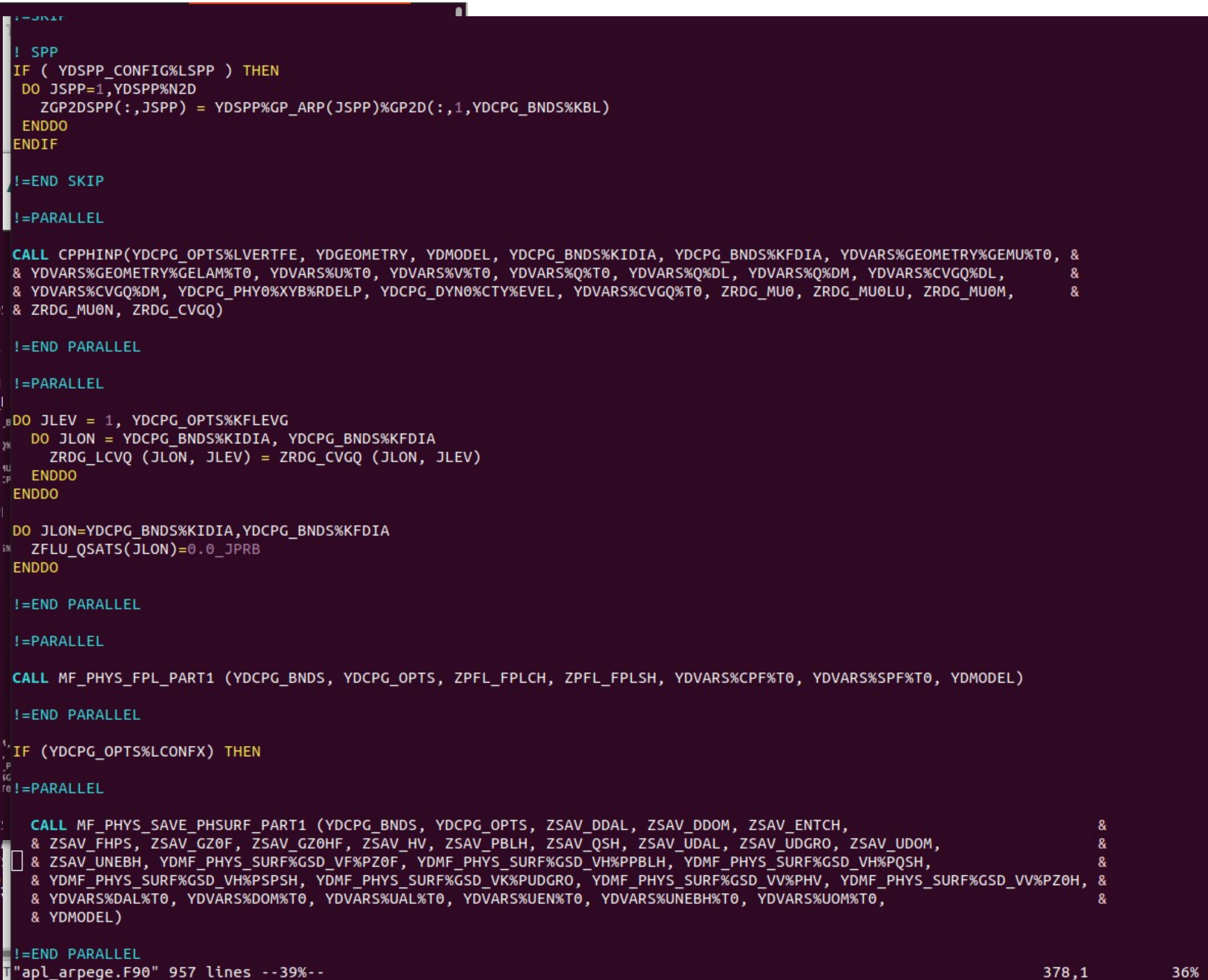
DO JROF=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
  ZFLU_QSATS(JROF)=0.0_JPRB
ENDDO

CALL MF_PHYS_FPL_PART1 (YDCPG_BNDS, YDCPG_OPTS, ZPFL_FPLCH, ZPFL_FPLSH, YDVARS%CP
& YDMODEL)


! * In some cases, some pseudo-historic surface buffers (like z0) should
!   not be modified between the entrance and the output of APLPAR
!   (this is the case for example if LDCONFX=T).
!   For the time being, we must save:
!   - HV (group VV) : resistance to evapotranspiration
!   - Z0F (group VD): gravity * surface roughness length
!   - Z0H (group VV): gravity * roughness length for heat
!   - PBLH (group VH): PBL height
!   - SPSH (group VH):
!   - QSH (group VH):

LL_SAVE_PHSURF=YDCPG_OPTS%LCONFX
IF (LL_SAVE_PHSURF) THEN
  CALL MF_PHYS_SAVE_PHSURF_PART1 (YDCPG_BNDS, YDCPG_OPTS, ZSAV_DDAL, ZSAV_DDOM, Z
  & ZSAV_FHPS, ZSAV_GZ0F, ZSAV_GZ0HF, ZSAV_HV, ZSAV_PBLH, ZSAV_QSH, ZSAV_UDAL, ZS
  & ZSAV_UNEBH, YDMF_PHYS_SURF%GSD_VF%PZ0F, YDMF_PHYS_SURF%GSD_VH%PPBLH, YDMF_PHY
  & YDMF_PHYS_SURF%GSD_VH%PSPSH, YDMF_PHYS_SURF%GSD_VK%PUDGRO, YDMF_PHYS_SURF%GSD
  & YDVARS%DAL%T0, YDVARS%DOM%T0, YDVARS%UAL%T0, YDVARS%UEN%T0, YDVARS%UNEBH%T0,
  & YDMODEL)
ENDIF

"aplpar.F90" 5050 lines --23%--
```



```
!=SKIP

! SPP
IF ( YDSPP_CONFIG%LSPP ) THEN
 DO JSPP=1,YDSPP%N2D
   ZGP2DSPP(:,JSPP) = YDSPP%GP_ARP(JSPP)%GP2D(:,1,YDCPG_BNDS%KBL)
 ENDDO
ENDIF

!=END SKIP

!=PARALLEL

CALL CPPHINP(YDCPG_OPTS%LVERTFE, YDGEOMETRY, YDMODEL, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, YDVARS%GEOMETRY%GEMU%T0, &
& YDVARS%GEOMETRY%GELAM%T0, YDVARS%U%T0, YDVARS%V%T0, YDVARS%Q%T0, YDVARS%Q%DL, YDVARS%Q%DM, YDVARS%CVGQ%DL,       &
& YDVARS%CVGQ%DM, YDCPG_PHY0%XYB%RDELP, YDCPG_DYN0%CTY%EVEL, YDVARS%CVGQ%T0, ZRDG_MU0, ZRDG_MU0LU, ZRDG_MU0M,      &
& ZRDG_MU0N, ZRDG_CVGQ)

!=END PARALLEL

!=PARALLEL

DO JLEV = 1, YDCPG_OPTS%KFLEVG
  DO JLON = YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA
    ZRDG_LCVQ (JLON, JLEV) = ZRDG_CVGQ (JLON, JLEV)
  ENDDO
ENDDO

DO JLON=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
  ZFLU_QSATS(JLON)=0.0_JPRB
ENDDO

!=END PARALLEL

!=PARALLEL

CALL MF_PHYS_FPL_PART1 (YDCPG_BNDS, YDCPG_OPTS, ZPFL_FPLCH, ZPFL_FPLSH, YDVARS%CPF%T0, YDVARS%SPF%T0, YDMODEL)

!=END PARALLEL

IF (YDCPG_OPTS%LCONFX) THEN

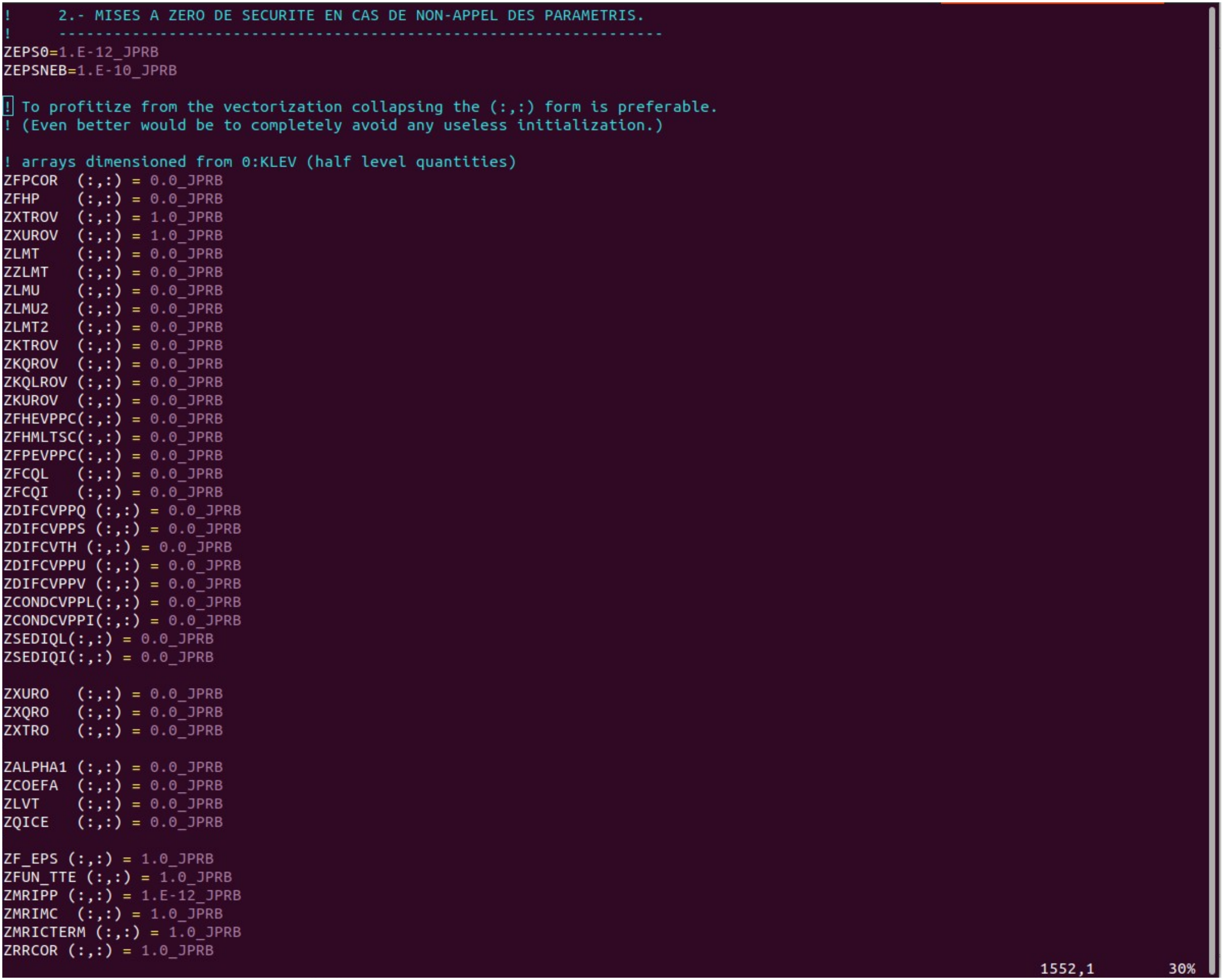
!=PARALLEL

  CALL MF_PHYS_SAVE_PHSURF_PART1 (YDCPG_BNDS, YDCPG_OPTS, ZSAV_DDAL, ZSAV_DDOM, ZSAV_ENTCH,                                &
  & ZSAV_FHPS, ZSAV_GZ0F, ZSAV_GZ0HF, ZSAV_HV, ZSAV_PBLH, ZSAV_QSH, ZSAV_UDAL, ZSAV_UDGRO, ZSAV_UDOM,                     &
  & ZSAV_UNEBH, YDMF_PHYS_SURF%GSD_VF%PZ0F, YDMF_PHYS_SURF%GSD_VH%PPBLH, YDMF_PHYS_SURF%GSD_VH%PQSH,                    &
  & YDMF_PHYS_SURF%GSD_VH%PSPSH, YDMF_PHYS_SURF%GSD_VK%PUDGRO, YDMF_PHYS_SURF%GSD_VV%PHV, YDMF_PHYS_SURF%GSD_VV%PZ0H, &
  & YDVARS%DAL%T0, YDVARS%DOM%T0, YDVARS%UAL%T0, YDVARS%UEN%T0, YDVARS%UNEBH%T0, YDVARS%UOM%T0,                       &
  & YDMODEL)

!=END PARALLEL
"apl_arpege.F90" 957 lines --39%--                                                                          378,1         36%
```

New version of APLPAR and APL_ARPEGE

This part of aplpar
Now in
apl_arpege_init



```
!     2.- MISES A ZERO DE SECURITE EN CAS DE NON-APPEL DES PARAMETRIS.
!     -----------------------------------------------------------------
ZEPS0=1.E-12_JPRB
ZEPSNEB=1.E-10_JPRB

! To profitize from the vectorization collapsing the (:,:) form is preferable.
! (Even better would be to completely avoid any useless initialization.)

! arrays dimensioned from 0:KLEV (half level quantities)
ZFPCOR   (:,:) = 0.0_JPRB
ZFHP     (:,:) = 0.0_JPRB
ZXTROV   (:,:) = 1.0_JPRB
ZXUROV   (:,:) = 1.0_JPRB
ZLMT     (:,:) = 0.0_JPRB
ZZLMT    (:,:) = 0.0_JPRB
ZLMU     (:,:) = 0.0_JPRB
ZLMU2    (:,:) = 0.0_JPRB
ZLMT2    (:,:) = 0.0_JPRB
ZKTROV   (:,:) = 0.0_JPRB
ZKQROV   (:,:) = 0.0_JPRB
ZKQLROV  (:,:) = 0.0_JPRB
ZKUROV   (:,:) = 0.0_JPRB
ZFHEVPPC(:,:) = 0.0_JPRB
ZFHMLTSC(:,:) = 0.0_JPRB
ZFPEVPPC(:,:) = 0.0_JPRB
ZFCQL    (:,:) = 0.0_JPRB
ZFCQI    (:,:) = 0.0_JPRB
ZDIFCVPPQ (:,:) = 0.0_JPRB
ZDIFCVPPS (:,:) = 0.0_JPRB
ZDIFCVTH (:,:) = 0.0_JPRB
ZDIFCVPPU (:,:) = 0.0_JPRB
ZDIFCVPPV (:,:) = 0.0_JPRB
ZCONDCVPPL(:,:) = 0.0_JPRB
ZCONDCVPPI(:,:) = 0.0_JPRB
ZSEDIQL(:,:) = 0.0_JPRB
ZSEDIQI(:,:) = 0.0_JPRB

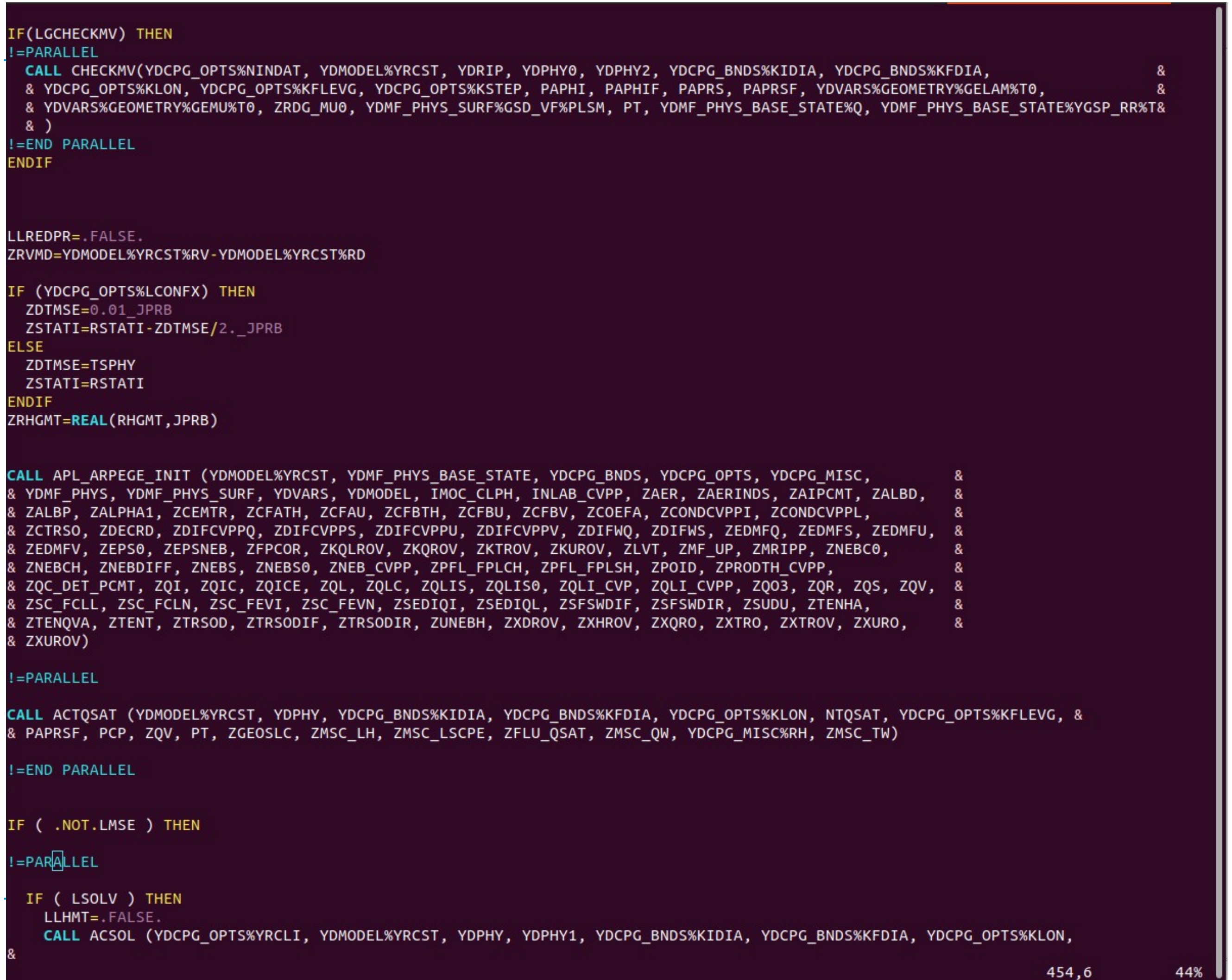
ZXURO    (:,:) = 0.0_JPRB
ZXQRO    (:,:) = 0.0_JPRB
ZXTRO    (:,:) = 0.0_JPRB

ZALPHA1 (:,:) = 0.0_JPRB
ZCOEFA   (:,:) = 0.0_JPRB
ZLVT     (:,:) = 0.0_JPRB
ZQICE    (:,:) = 0.0_JPRB

ZF_EPS (:,:) = 1.0_JPRB
ZFUN_TTE (:,:) = 1.0_JPRB
ZMRIPP (:,:) = 1.E-12_JPRB
ZMRIMC  (:,:) = 1.0_JPRB
ZMRICTERM (:,:) = 1.0_JPRB
ZRRCOR (:,:) = 1.0_JPRB
                                                                   1552,1        30%
```

New version of APLPAR and APL_ARPEGE

apl_arpege



```
IF(LGCHECKMV) THEN
!=PARALLEL
  CALL CHECKMV(YDCPG_OPTS%NINDAT, YDMODEL%YRCST, YDRIP, YDPHY0, YDPHY2, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA,               &
  & YDCPG_OPTS%KLON, YDCPG_OPTS%KFLEVG, YDCPG_OPTS%KSTEP, PAPHI, PAPHIF, PAPRS, PAPRSF, YDVARS%GEOMETRY%GELAM%T0,        &
  & YDVARS%GEOMETRY%GEMU%T0, ZRDG_MU0, YDMF_PHYS_SURF%GSD_VF%PLSM, PT, YDMF_PHYS_BASE_STATE%Q, YDMF_PHYS_BASE_STATE%YGSP_RR%T&
  & )
!=END PARALLEL
ENDIF



LLREDPR=.FALSE.
ZRVMD=YDMODEL%YRCST%RV-YDMODEL%YRCST%RD

IF (YDCPG_OPTS%LCONFX) THEN
  ZDTMSE=0.01_JPRB
  ZSTATI=RSTATI-ZDTMSE/2._JPRB
ELSE
  ZDTMSE=TSPHY
  ZSTATI=RSTATI
ENDIF
ZRHGMT=REAL(RHGMT,JPRB)


CALL APL_ARPEGE_INIT (YDMODEL%YRCST, YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDCPG_MISC,          &
& YDMF_PHYS, YDMF_PHYS_SURF, YDVARS, YDMODEL, IMOC_CLPH, INLAB_CVPP, ZAER, ZAERINDS, ZAIPCMT, ZALBD,   &
& ZALBP, ZALPHA1, ZCEMTR, ZCFATH, ZCFAU, ZCFBTH, ZCFBU, ZCFBV, ZCOEFA, ZCONDCVPPI, ZCONDCVPPL,          &
& ZCTRSO, ZDECRD, ZDIFCVPPQ, ZDIFCVPPS, ZDIFCVPPU, ZDIFCVPPV, ZDIFWQ, ZDIFWS, ZEDMFQ, ZEDMFS, ZEDMFU,  &
& ZEDMFV, ZEPS0, ZEPSNEB, ZFPCOR, ZKQLROV, ZKQROV, ZKTROV, ZKUROV, ZLVT, ZMF_UP, ZMRIPP, ZNEBC0,       &
& ZNEBCH, ZNEBDIFF, ZNEBS, ZNEBS0, ZNEB_CVPP, ZPFL_FPLCH, ZPFL_FPLSH, ZPOID, ZPRODTH_CVPP,              &
& ZQC_DET_PCMT, ZQI, ZQIC, ZQICE, ZQL, ZQLC, ZQLIS, ZQLIS0, ZQLI_CVP, ZQLI_CVPP, ZQO3, ZQR, ZQS, ZQV,  &
& ZSC_FCLL, ZSC_FCLN, ZSC_FEVI, ZSC_FEVN, ZSEDIQI, ZSEDIQL, ZSFSWDIF, ZSFSWDIR, ZSUDU, ZTENHA,          &
& ZTENQVA, ZTENT, ZTRSOD, ZTRSODIF, ZTRSODIR, ZUNEBH, ZXDROV, ZXHROV, ZXQRO, ZXTRO, ZXTROV, ZXURO,     &
& ZXUROV)

!=PARALLEL

CALL ACTQSAT (YDMODEL%YRCST, YDPHY, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, YDCPG_OPTS%KLON, NTQSAT, YDCPG_OPTS%KFLEVG, &
& PAPRSF, PCP, ZQV, PT, ZGEOSLC, ZMSC_LH, ZMSC_LSCPE, ZFLU_QSAT, ZMSC_QW, YDCPG_MISC%RH, ZMSC_TW)

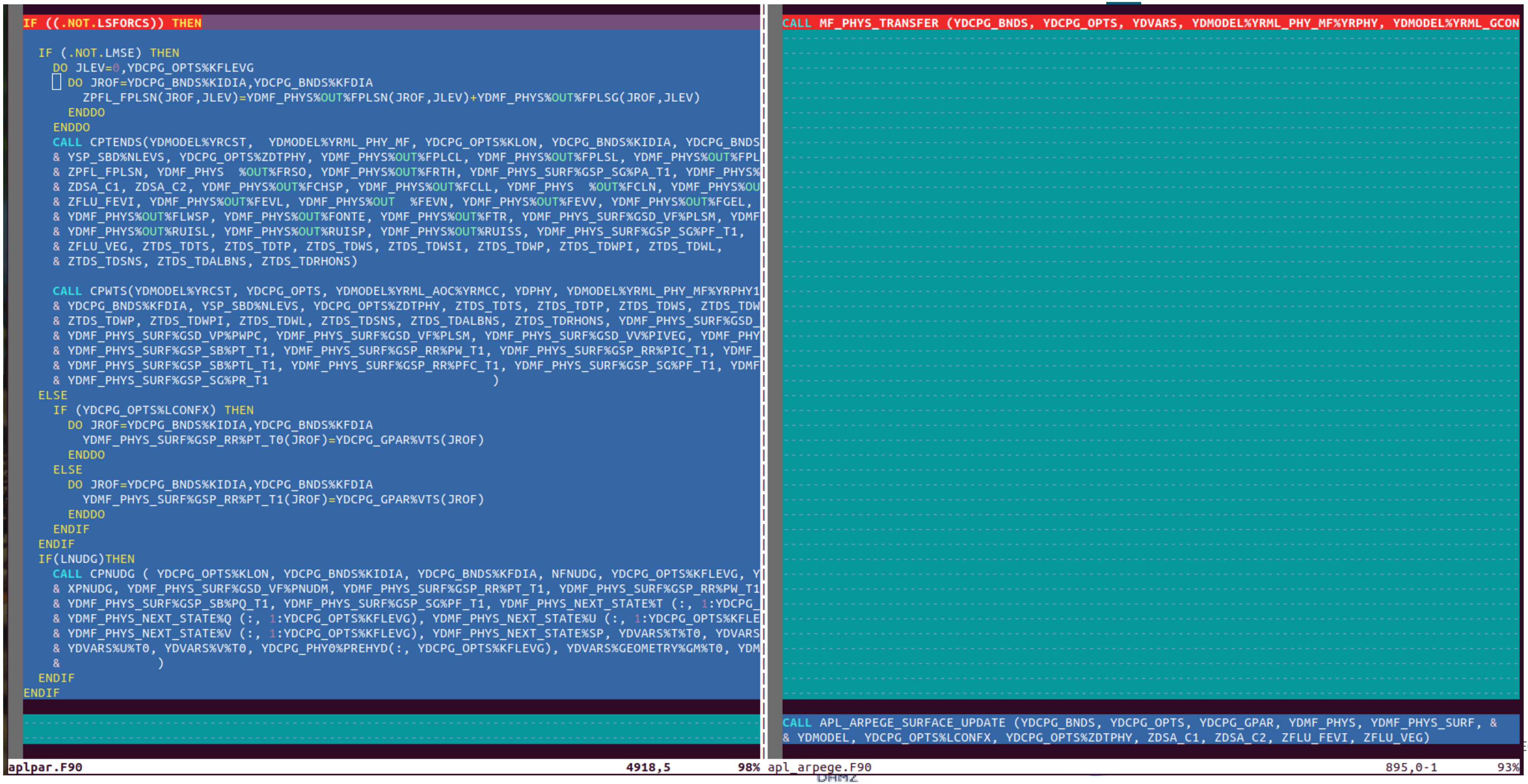
!=END PARALLEL


IF ( .NOT.LMSE ) THEN

!=PARALLEL

  IF ( LSOLV ) THEN
    LLHMT=.FALSE.
    CALL ACSOL (YDCPG_OPTS%YRCLI, YDMODEL%YRCST, YDPHY, YDPHY1, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, YDCPG_OPTS%KLON,
&
                                                                                                          454,6          44%
```

New version of APLPAR and APL_ARPEGE



```
IF ((.NOT.LSFORCS)) THEN

  IF (.NOT.LMSE) THEN
    DO JLEV=0,YDCPG_OPTS%KFLEVG
      DO JROF=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
        ZPFL_FPLSN(JROF,JLEV)=YDMF_PHYS%OUT%FPLSN(JROF,JLEV)+YDMF_PHYS%OUT%FPLSG(JROF,JLEV)
      ENDDO
    ENDDO
    CALL CPTENDS(YDMODEL%YRCST,  YDMODEL%YRML_PHY_MF, YDCPG_OPTS%KLON, YDCPG_BNDS%KIDIA, YDCPG_BNDS
    & YSP_SBD%NLEVS, YDCPG_OPTS%ZDTPHY, YDMF_PHYS%OUT%FPLCL, YDMF_PHYS%OUT%FPLSL, YDMF_PHYS%OUT%FPL
    & ZPFL_FPLSN, YDMF_PHYS  %OUT%FRSO, YDMF_PHYS%OUT%FRTH, YDMF_PHYS_SURF%GSP_SG%PA_T1, YDMF_PHYS%
    & ZDSA_C1, ZDSA_C2, YDMF_PHYS%OUT%FCHSP, YDMF_PHYS%OUT%FCLL, YDMF_PHYS  %OUT%FCLN, YDMF_PHYS%OU
    & ZFLU_FEVI, YDMF_PHYS%OUT%FEVL, YDMF_PHYS%OUT  %FEVN, YDMF_PHYS%OUT%FEVV, YDMF_PHYS%OUT%FGEL,
    & YDMF_PHYS%OUT%FLWSP, YDMF_PHYS%OUT%FONTE, YDMF_PHYS%OUT%FTR, YDMF_PHYS_SURF%GSD_VF%PLSM, YDMF
    & YDMF_PHYS%OUT%RUISL, YDMF_PHYS%OUT%RUISP, YDMF_PHYS%OUT%RUISS, YDMF_PHYS_SURF%GSP_SG%PF_T1,
    & ZFLU_VEG, ZTDS_TDTS, ZTDS_TDTP, ZTDS_TDWS, ZTDS_TDWSI, ZTDS_TDWP, ZTDS_TDWPI, ZTDS_TDWL,
    & ZTDS_TDSNS, ZTDS_TDALBNS, ZTDS_TDRHONS)

    CALL CPWTS(YDMODEL%YRCST, YDCPG_OPTS, YDMODEL%YRML_AOC%YRMCC, YDPHY, YDMODEL%YRML_PHY_MF%YRPHY1
    & YDCPG_BNDS%KFDIA, YSP_SBD%NLEVS, YDCPG_OPTS%ZDTPHY, ZTDS_TDTS, ZTDS_TDTP, ZTDS_TDWS, ZTDS_TDW
    & ZTDS_TDWP, ZTDS_TDWPI, ZTDS_TDWL, ZTDS_TDSNS, ZTDS_TDALBNS, ZTDS_TDRHONS, YDMF_PHYS_SURF%GSD_
    & YDMF_PHYS_SURF%GSD_VP%PWPC, YDMF_PHYS_SURF%GSD_VF%PLSM, YDMF_PHYS_SURF%GSD_VV%PIVEG, YDMF_PHY
    & YDMF_PHYS_SURF%GSP_SB%PT_T1, YDMF_PHYS_SURF%GSP_RR%PW_T1, YDMF_PHYS_SURF%GSP_RR%PIC_T1, YDMF_
    & YDMF_PHYS_SURF%GSP_SB%PTL_T1, YDMF_PHYS_SURF%GSP_RR%PFC_T1, YDMF_PHYS_SURF%GSP_SG%PF_T1, YDMF
    & YDMF_PHYS_SURF%GSP_SG%PR_T1                              )
  ELSE
    IF (YDCPG_OPTS%LCONFX) THEN
      DO JROF=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
        YDMF_PHYS_SURF%GSP_RR%PT_T0(JROF)=YDCPG_GPAR%VTS(JROF)
      ENDDO
    ELSE
      DO JROF=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
        YDMF_PHYS_SURF%GSP_RR%PT_T1(JROF)=YDCPG_GPAR%VTS(JROF)
      ENDDO
    ENDIF
  ENDIF
  IF(LNUDG)THEN
    CALL CPNUDG ( YDCPG_OPTS%KLON, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, NFNUDG, YDCPG_OPTS%KFLEVG, Y
    & XPNUDG, YDMF_PHYS_SURF%GSD_VF%PNUDM, YDMF_PHYS_SURF%GSP_RR%PT_T1, YDMF_PHYS_SURF%GSP_RR%PW_T1
    & YDMF_PHYS_SURF%GSP_SB%PQ_T1, YDMF_PHYS_SURF%GSP_SG%PF_T1, YDMF_PHYS_NEXT_STATE%T (:, 1:YDCPG_
    & YDMF_PHYS_NEXT_STATE%Q (:, 1:YDCPG_OPTS%KFLEVG), YDMF_PHYS_NEXT_STATE%U (:, 1:YDCPG_OPTS%KFLE
    & YDMF_PHYS_NEXT_STATE%V (:, 1:YDCPG_OPTS%KFLEVG), YDMF_PHYS_NEXT_STATE%SP, YDVARS%T%T0, YDVARS
    & YDVARS%U%T0, YDVARS%V%T0, YDCPG_PHY0%PREHYD(:, YDCPG_OPTS%KFLEVG), YDVARS%GEOMETRY%GM%T0, YDM
    &             )
  ENDIF
ENDIF
```

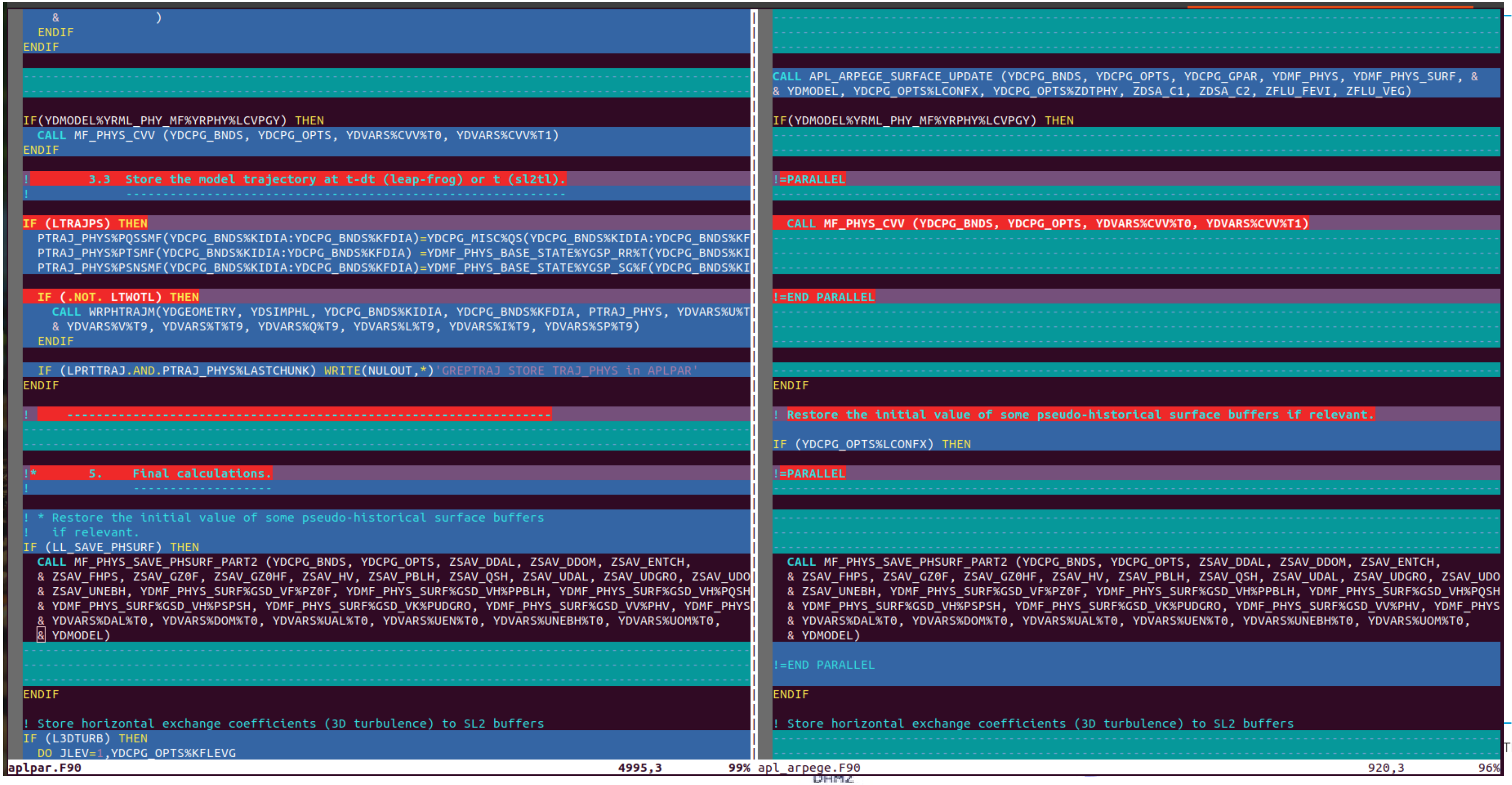
```
aplpar.F90                                                        4918,5         98%
```

```
CALL MF_PHYS_TRANSFER (YDCPG_BNDS, YDCPG_OPTS, YDVARS, YDMODEL%YRML_PHY_MF%YRPHY, YDMODEL%YRML_GCON

CALL APL_ARPEGE_SURFACE_UPDATE (YDCPG_BNDS, YDCPG_OPTS, YDCPG_GPAR, YDMF_PHYS, YDMF_PHYS_SURF, &
& YDMODEL, YDCPG_OPTS%LCONFX, YDCPG_OPTS%ZDTPHY, ZDSA_C1, ZDSA_C2, ZFLU_FEVI, ZFLU_VEG)
```

```
apl_arpege.F90                                                    895,0-1        93%
```

New version of APLPAR and APL_ARPEGE



```
    &                )
  ENDIF
ENDIF


IF(YDMODEL%YRML_PHY_MF%YRPHY%LCVPGY) THEN
  CALL MF_PHYS_CVV (YDCPG_BNDS, YDCPG_OPTS, YDVARS%CVV%T0, YDVARS%CVV%T1)
ENDIF

!        3.3  Store the model trajectory at t-dt (leap-frog) or t (sl2tl).
!             ------------------------------------------------------------

IF (LTRAJPS) THEN
  PTRAJ_PHYS%PQSSMF(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA)=YDCPG_MISC%QS(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KF
  PTRAJ_PHYS%PTSMF(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA) =YDMF_PHYS_BASE_STATE%YGSP_RR%T(YDCPG_BNDS%KI
  PTRAJ_PHYS%PSNSMF(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA)=YDMF_PHYS_BASE_STATE%YGSP_SG%F(YDCPG_BNDS%KI

  IF (.NOT. LTWOTL) THEN
    CALL WRPHTRAJM(YDGEOMETRY, YDSIMPHL, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, PTRAJ_PHYS, YDVARS%U%T
    & YDVARS%V%T9, YDVARS%T%T9, YDVARS%Q%T9, YDVARS%L%T9, YDVARS%I%T9, YDVARS%SP%T9)
  ENDIF

  IF (LPRTTRAJ.AND.PTRAJ_PHYS%LASTCHUNK) WRITE(NULOUT,*)'GREPTRAJ STORE TRAJ_PHYS in APLPAR'
ENDIF

!     -----------------------------------------------------------------


!*        5.    Final calculations.
!               -------------------

! * Restore the initial value of some pseudo-historical surface buffers
!   if relevant.
IF (LL_SAVE_PHSURF) THEN
  CALL MF_PHYS_SAVE_PHSURF_PART2 (YDCPG_BNDS, YDCPG_OPTS, ZSAV_DDAL, ZSAV_DDOM, ZSAV_ENTCH,
  & ZSAV_FHPS, ZSAV_GZ0F, ZSAV_GZ0HF, ZSAV_HV, ZSAV_PBLH, ZSAV_QSH, ZSAV_UDAL, ZSAV_UDGRO, ZSAV_UDO
  & ZSAV_UNEBH, YDMF_PHYS_SURF%GSD_VF%PZ0F, YDMF_PHYS_SURF%GSD_VH%PPBLH, YDMF_PHYS_SURF%GSD_VH%PQSH
  & YDMF_PHYS_SURF%GSD_VH%PSPSH, YDMF_PHYS_SURF%GSD_VK%PUDGRO, YDMF_PHYS_SURF%GSD_VV%PHV, YDMF_PHYS
  & YDVARS%DAL%T0, YDVARS%DOM%T0, YDVARS%UAL%T0, YDVARS%UEN%T0, YDVARS%UNEBH%T0, YDVARS%UOM%T0,
  & YDMODEL)

ENDIF

! Store horizontal exchange coefficients (3D turbulence) to SL2 buffers
IF (L3DTURB) THEN
  DO JLEV=1,YDCPG_OPTS%KFLEVG
aplpar.F90                                                  4995,3         99%
```

```

CALL APL_ARPEGE_SURFACE_UPDATE (YDCPG_BNDS, YDCPG_OPTS, YDCPG_GPAR, YDMF_PHYS, YDMF_PHYS_SURF, &
& YDMODEL, YDCPG_OPTS%LCONFX, YDCPG_OPTS%ZDTPHY, ZDSA_C1, ZDSA_C2, ZFLU_FEVI, ZFLU_VEG)

IF(YDMODEL%YRML_PHY_MF%YRPHY%LCVPGY) THEN

!=PARALLEL

  CALL MF_PHYS_CVV (YDCPG_BNDS, YDCPG_OPTS, YDVARS%CVV%T0, YDVARS%CVV%T1)

!=END PARALLEL

ENDIF

! Restore the initial value of some pseudo-historical surface buffers if relevant.

IF (YDCPG_OPTS%LCONFX) THEN

!=PARALLEL

  CALL MF_PHYS_SAVE_PHSURF_PART2 (YDCPG_BNDS, YDCPG_OPTS, ZSAV_DDAL, ZSAV_DDOM, ZSAV_ENTCH,
  & ZSAV_FHPS, ZSAV_GZ0F, ZSAV_GZ0HF, ZSAV_HV, ZSAV_PBLH, ZSAV_QSH, ZSAV_UDAL, ZSAV_UDGRO, ZSAV_UDO
  & ZSAV_UNEBH, YDMF_PHYS_SURF%GSD_VF%PZ0F, YDMF_PHYS_SURF%GSD_VH%PPBLH, YDMF_PHYS_SURF%GSD_VH%PQSH
  & YDMF_PHYS_SURF%GSD_VH%PSPSH, YDMF_PHYS_SURF%GSD_VK%PUDGRO, YDMF_PHYS_SURF%GSD_VV%PHV, YDMF_PHYS
  & YDVARS%DAL%T0, YDVARS%DOM%T0, YDVARS%UAL%T0, YDVARS%UEN%T0, YDVARS%UNEBH%T0, YDVARS%UOM%T0,
  & YDMODEL)

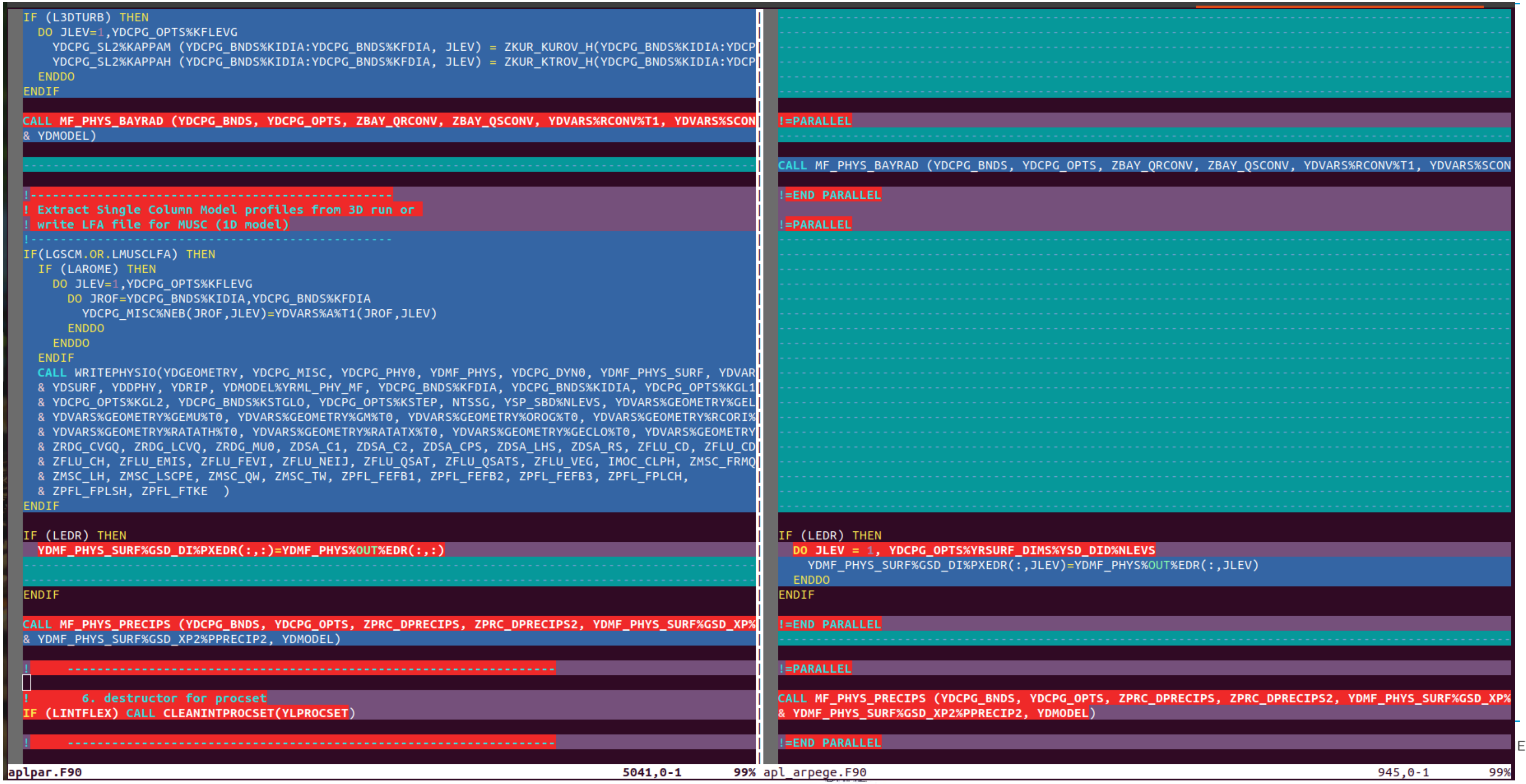
!=END PARALLEL

ENDIF

! Store horizontal exchange coefficients (3D turbulence) to SL2 buffers

apl_arpege.F90                                                  920,3         96%
```

New version of APLPAR and APL_ARPEGE



```
IF (L3DTURB) THEN
  DO JLEV=1,YDCPG_OPTS%KFLEVG
    YDCPG_SL2%KAPPAM (YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA, JLEV) = ZKUR_KUROV_H(YDCPG_BNDS%KIDIA:YDCP
    YDCPG_SL2%KAPPAH (YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA, JLEV) = ZKUR_KTROV_H(YDCPG_BNDS%KIDIA:YDCP
  ENDDO
ENDIF

CALL MF_PHYS_BAYRAD (YDCPG_BNDS, YDCPG_OPTS, ZBAY_QRCONV, ZBAY_QSCONV, YDVARS%RCONV%T1, YDVARS%SCON
& YDMODEL)


!-------------------------------------------------
! Extract Single Column Model profiles from 3D run or
! write LFA file for MUSC (1D model)
!-------------------------------------------------
IF(LGSCM.OR.LMUSCLFA) THEN
  IF (LAROME) THEN
    DO JLEV=1,YDCPG_OPTS%KFLEVG
      DO JROF=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
        YDCPG_MISC%NEB(JROF,JLEV)=YDVARS%A%T1(JROF,JLEV)
      ENDDO
    ENDDO
  ENDIF
  CALL WRITEPHYSIO(YDGEOMETRY, YDCPG_MISC, YDCPG_PHY0, YDMF_PHYS, YDCPG_DYN0, YDMF_PHYS_SURF, YDVAR
  & YDSURF, YDDPHY, YDRIP, YDMODEL%YRML_PHY_MF, YDCPG_BNDS%KFDIA, YDCPG_BNDS%KIDIA, YDCPG_OPTS%KGL1
  & YDCPG_OPTS%KGL2, YDCPG_BNDS%KSTGLO, YDCPG_OPTS%KSTEP, NTSSG, YSP_SBD%NLEVS, YDVARS%GEOMETRY%GEL
  & YDVARS%GEOMETRY%GEMU%T0, YDVARS%GEOMETRY%GM%T0, YDVARS%GEOMETRY%OROG%T0, YDVARS%GEOMETRY%RCORI%
  & YDVARS%GEOMETRY%RATATH%T0, YDVARS%GEOMETRY%RATATX%T0, YDVARS%GEOMETRY%GECLO%T0, YDVARS%GEOMETRY
  & ZRDG_CVGQ, ZRDG_LCVQ, ZRDG_MU0, ZDSA_C1, ZDSA_C2, ZDSA_CPS, ZDSA_LHS, ZDSA_RS, ZFLU_CD, ZFLU_CD
  & ZFLU_CH, ZFLU_EMIS, ZFLU_FEVI, ZFLU_NEIJ, ZFLU_QSAT, ZFLU_QSATS, ZFLU_VEG, IMOC_CLPH, ZMSC_FRMQ
  & ZMSC_LH, ZMSC_LSCPE, ZMSC_QW, ZMSC_TW, ZPFL_FEFB1, ZPFL_FEFB2, ZPFL_FEFB3, ZPFL_FPLCH,
  & ZPFL_FPLSH, ZPFL_FTKE  )
ENDIF

IF (LEDR) THEN
  YDMF_PHYS_SURF%GSD_DI%PXEDR(:,:)=YDMF_PHYS%OUT%EDR(:,:)

ENDIF

CALL MF_PHYS_PRECIPS (YDCPG_BNDS, YDCPG_OPTS, ZPRC_DPRECIPS, ZPRC_DPRECIPS2, YDMF_PHYS_SURF%GSD_XP%
& YDMF_PHYS_SURF%GSD_XP2%PPRECIP2, YDMODEL)

!     ------------------------------------------------------------------


!       6. destructor for procset
IF (LINTFLEX) CALL CLEANINTPROCSET(YLPROCSET)

!     ------------------------------------------------------------------

aplpar.F90                                                     5041,0-1       99%
```

```
!=PARALLEL

CALL MF_PHYS_BAYRAD (YDCPG_BNDS, YDCPG_OPTS, ZBAY_QRCONV, ZBAY_QSCONV, YDVARS%RCONV%T1, YDVARS%SCON

!=END PARALLEL

!=PARALLEL

IF (LEDR) THEN
  DO JLEV = 1, YDCPG_OPTS%YRSURF_DIMS%YSD_DID%NLEVS
    YDMF_PHYS_SURF%GSD_DI%PXEDR(:,JLEV)=YDMF_PHYS%OUT%EDR(:,JLEV)
  ENDDO
ENDIF

!=END PARALLEL

!=PARALLEL

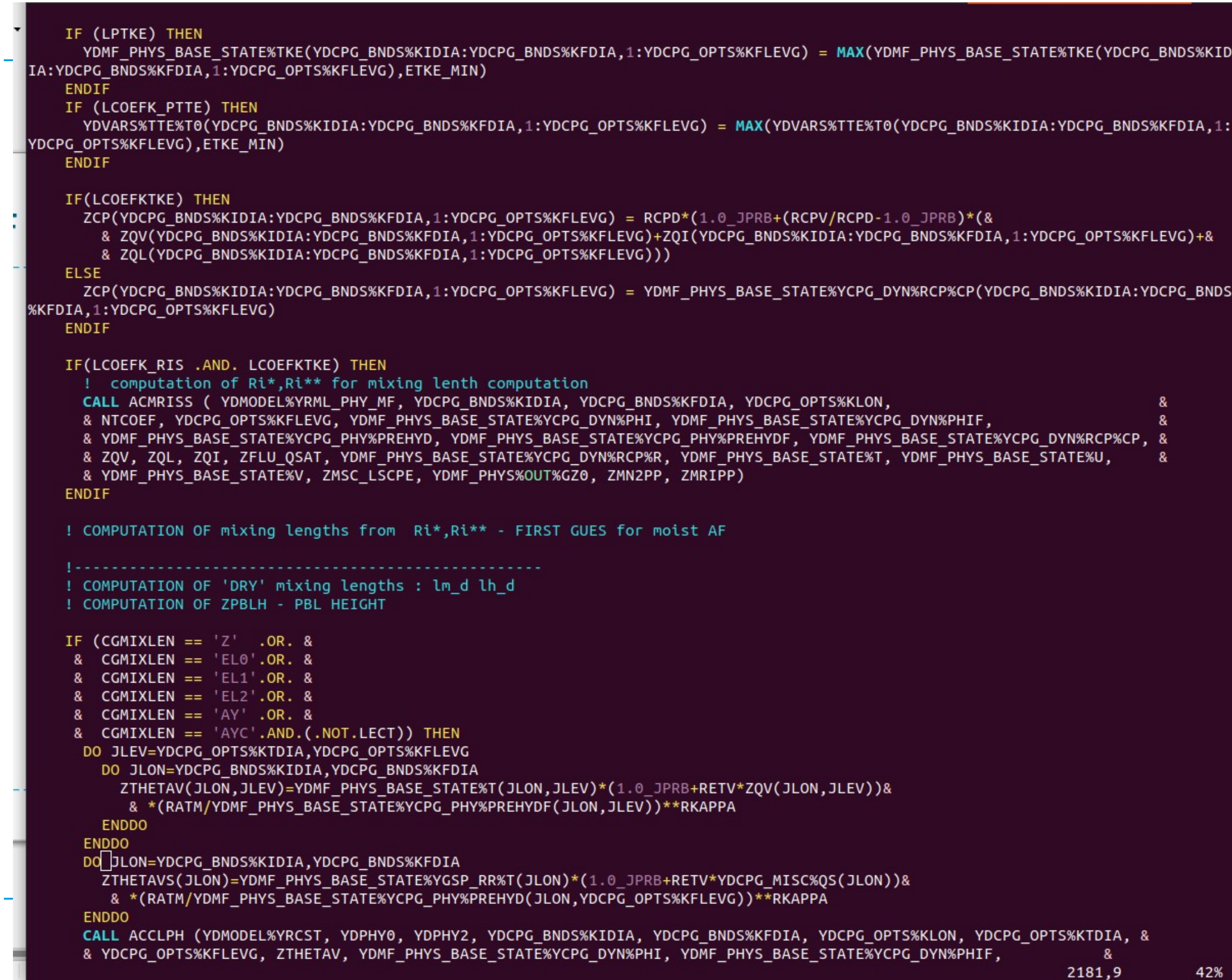
CALL MF_PHYS_PRECIPS (YDCPG_BNDS, YDCPG_OPTS, ZPRC_DPRECIPS, ZPRC_DPRECIPS2, YDMF_PHYS_SURF%GSD_XP%
& YDMF_PHYS_SURF%GSD_XP2%PPRECIP2, YDMODEL)

!=END PARALLEL

apl_arpege.F90                                                  945,0-1        99%
```

New version of APLPAR

Put this part of aplpar
Into a subroutine ...



```
    IF (LPTKE) THEN
      YDMF_PHYS_BASE_STATE%TKE(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG) = MAX(YDMF_PHYS_BASE_STATE%TKE(YDCPG_BNDS%KID
IA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG),ETKE_MIN)
    ENDIF
    IF (LCOEFK_PTTE) THEN
      YDVARS%TTE%T0(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG) = MAX(YDVARS%TTE%T0(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:
YDCPG_OPTS%KFLEVG),ETKE_MIN)
    ENDIF

    IF(LCOEFKTKE) THEN
      ZCP(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG) = RCPD*(1.0_JPRB+(RCPV/RCPD-1.0_JPRB)*(&
        & ZQV(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG)+ZQI(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG)+&
        & ZQL(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG)))
    ELSE
      ZCP(YDCPG_BNDS%KIDIA:YDCPG_BNDS%KFDIA,1:YDCPG_OPTS%KFLEVG) = YDMF_PHYS_BASE_STATE%YCPG_DYN%RCP%CP(YDCPG_BNDS%KIDIA:YDCPG_BNDS
%KFDIA,1:YDCPG_OPTS%KFLEVG)
    ENDIF

    IF(LCOEFK_RIS .AND. LCOEFKTKE) THEN
      !  computation of Ri*,Ri** for mixing lenth computation
      CALL ACMRISS ( YDMODEL%YRML_PHY_MF, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, YDCPG_OPTS%KLON,                              &
      & NTCOEF, YDCPG_OPTS%KFLEVG, YDMF_PHYS_BASE_STATE%YCPG_DYN%PHI, YDMF_PHYS_BASE_STATE%YCPG_DYN%PHIF,                    &
      & YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYD, YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYDF, YDMF_PHYS_BASE_STATE%YCPG_DYN%RCP%CP, &
      & ZQV, ZQL, ZQI, ZFLU_QSAT, YDMF_PHYS_BASE_STATE%YCPG_DYN%RCP%R, YDMF_PHYS_BASE_STATE%T, YDMF_PHYS_BASE_STATE%U,     &
      & YDMF_PHYS_BASE_STATE%V, ZMSC_LSCPE, YDMF_PHYS%OUT%GZ0, ZMN2PP, ZMRIPP)
    ENDIF

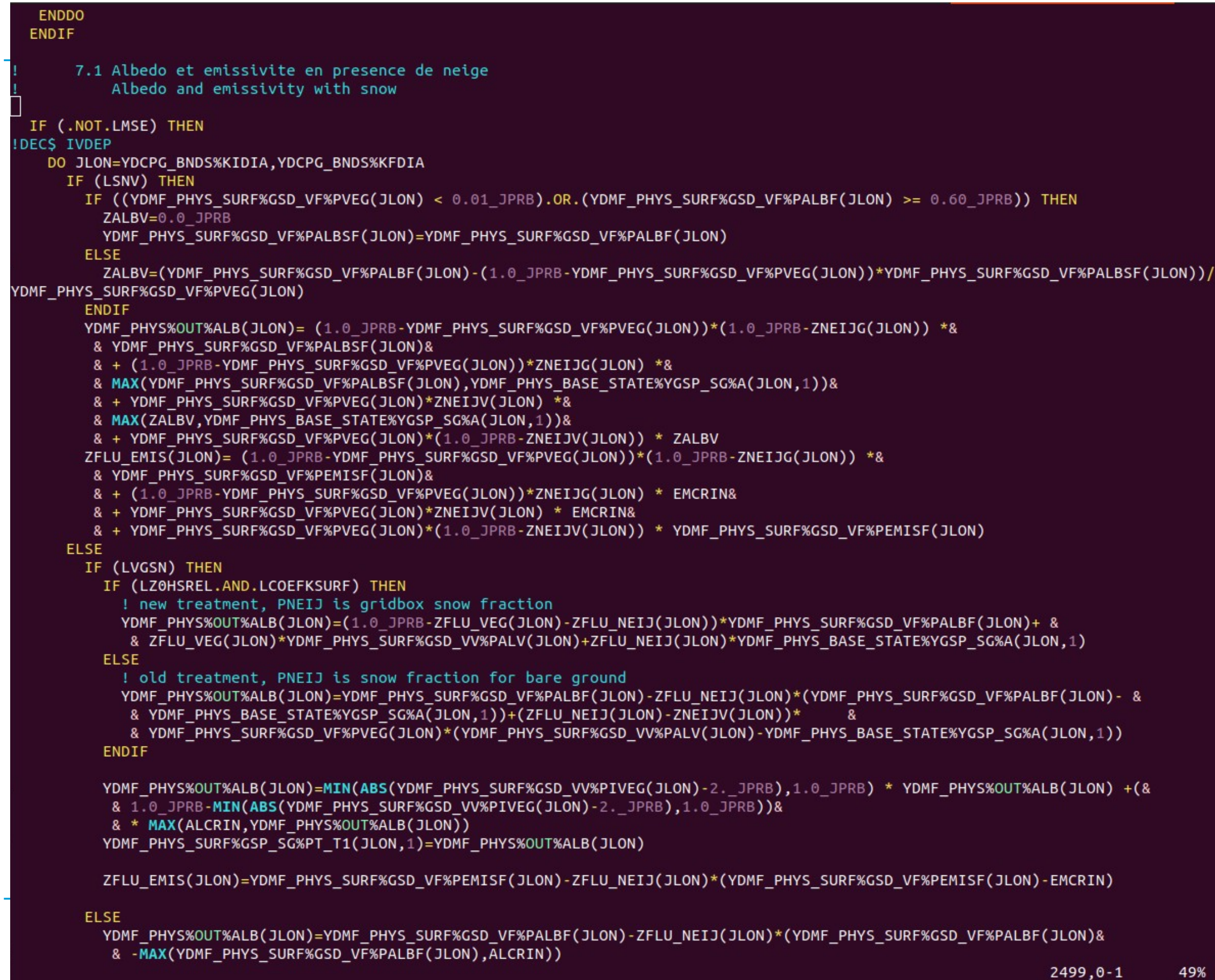
    ! COMPUTATION OF mixing lengths from  Ri*,Ri** - FIRST GUES for moist AF

    !----------------------------------------------------
    ! COMPUTATION OF 'DRY' mixing lengths : lm_d lh_d
    ! COMPUTATION OF ZPBLH - PBL HEIGHT

    IF (CGMIXLEN == 'Z'  .OR. &
     &  CGMIXLEN == 'EL0'.OR. &
     &  CGMIXLEN == 'EL1'.OR. &
     &  CGMIXLEN == 'EL2'.OR. &
     &  CGMIXLEN == 'AY' .OR. &
     &  CGMIXLEN == 'AYC'.AND.(.NOT.LECT)) THEN
      DO JLEV=YDCPG_OPTS%KTDIA,YDCPG_OPTS%KFLEVG
        DO JLON=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
          ZTHETAV(JLON,JLEV)=YDMF_PHYS_BASE_STATE%T(JLON,JLEV)*(1.0_JPRB+RETV*ZQV(JLON,JLEV))&
           & *(RATM/YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYDF(JLON,JLEV))**RKAPPA
        ENDDO
      ENDDO
      DO JLON=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
        ZTHETAVS(JLON)=YDMF_PHYS_BASE_STATE%YGSP_RR%T(JLON)*(1.0_JPRB+RETV*YDCPG_MISC%QS(JLON))&
         & *(RATM/YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYD(JLON,YDCPG_OPTS%KFLEVG))**RKAPPA
      ENDDO
      CALL ACCLPH (YDMODEL%YRCST, YDPHY0, YDPHY2, YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA, YDCPG_OPTS%KLON, YDCPG_OPTS%KTDIA, &
      & YDCPG_OPTS%KFLEVG, ZTHETAV, YDMF_PHYS_BASE_STATE%YCPG_DYN%PHI, YDMF_PHYS_BASE_STATE%YCPG_DYN%PHIF,            &
                                                                                                        2181,9        42%
```

New version of APLPAR

And this one too



```
   ENDDO
  ENDIF

!      7.1 Albedo et emissivite en presence de neige
!          Albedo and emissivity with snow

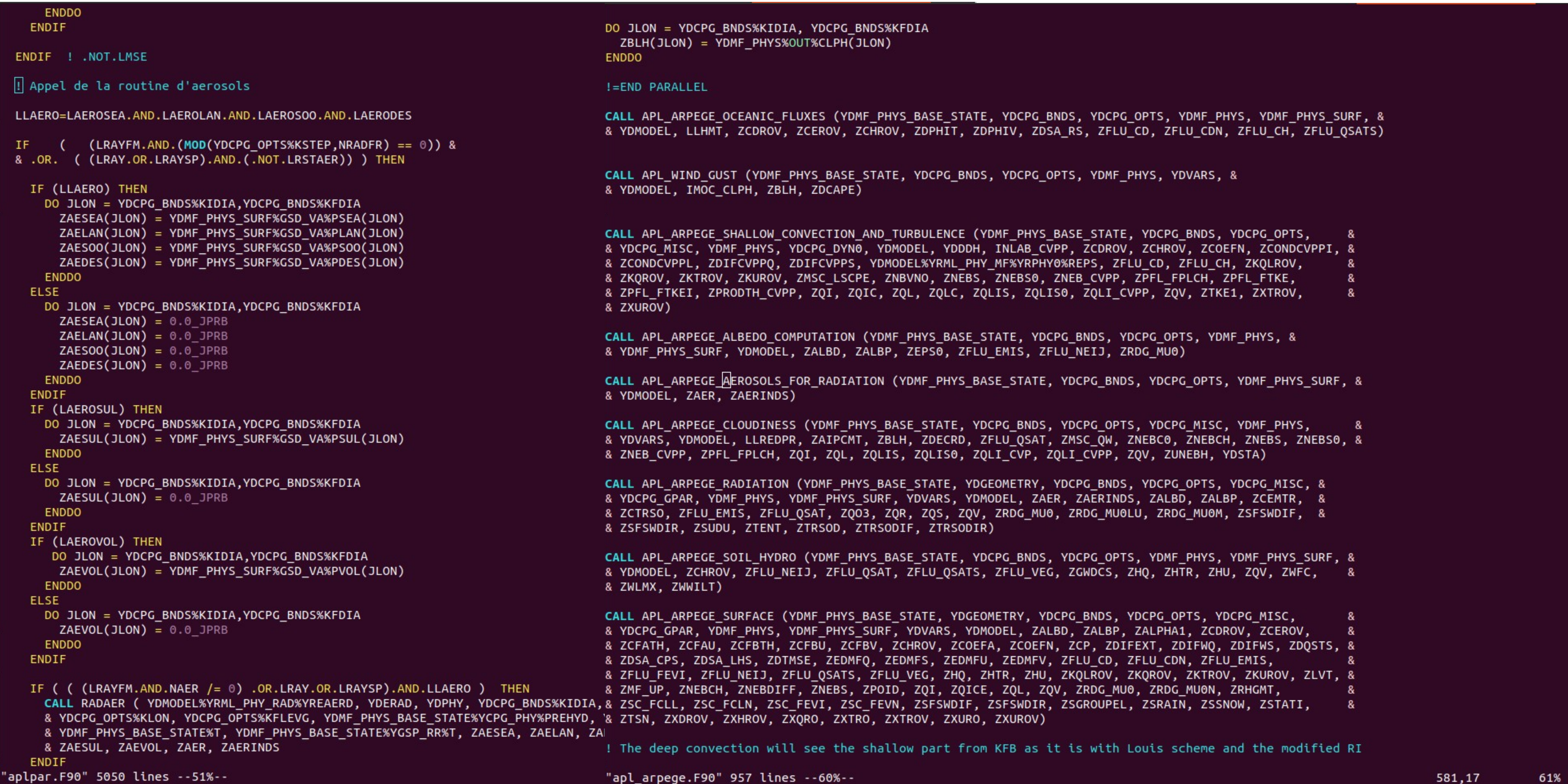
  IF (.NOT.LMSE) THEN
!DEC$ IVDEP
    DO JLON=YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      IF (LSNV) THEN
        IF ((YDMF_PHYS_SURF%GSD_VF%PVEG(JLON) < 0.01_JPRB).OR.(YDMF_PHYS_SURF%GSD_VF%PALBF(JLON) >= 0.60_JPRB)) THEN
          ZALBV=0.0_JPRB
          YDMF_PHYS_SURF%GSD_VF%PALBSF(JLON)=YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)
        ELSE
          ZALBV=(YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)-(1.0_JPRB-YDMF_PHYS_SURF%GSD_VF%PVEG(JLON))*YDMF_PHYS_SURF%GSD_VF%PALBSF(JLON))/
YDMF_PHYS_SURF%GSD_VF%PVEG(JLON)
        ENDIF
        YDMF_PHYS%OUT%ALB(JLON)= (1.0_JPRB-YDMF_PHYS_SURF%GSD_VF%PVEG(JLON))*(1.0_JPRB-ZNEIJG(JLON)) *&
         & YDMF_PHYS_SURF%GSD_VF%PALBSF(JLON)&
         & + (1.0_JPRB-YDMF_PHYS_SURF%GSD_VF%PVEG(JLON))*ZNEIJG(JLON) *&
         & MAX(YDMF_PHYS_SURF%GSD_VF%PALBSF(JLON),YDMF_PHYS_BASE_STATE%YGSP_SG%A(JLON,1))&
         & + YDMF_PHYS_SURF%GSD_VF%PVEG(JLON)*ZNEIJV(JLON) *&
         & MAX(ZALBV,YDMF_PHYS_BASE_STATE%YGSP_SG%A(JLON,1))&
         & + YDMF_PHYS_SURF%GSD_VF%PVEG(JLON)*(1.0_JPRB-ZNEIJV(JLON)) * ZALBV
        ZFLU_EMIS(JLON)= (1.0_JPRB-YDMF_PHYS_SURF%GSD_VF%PVEG(JLON))*(1.0_JPRB-ZNEIJG(JLON)) *&
         & YDMF_PHYS_SURF%GSD_VF%PEMISF(JLON)&
         & + (1.0_JPRB-YDMF_PHYS_SURF%GSD_VF%PVEG(JLON))*ZNEIJG(JLON) * EMCRIN&
         & + YDMF_PHYS_SURF%GSD_VF%PVEG(JLON)*ZNEIJV(JLON) * EMCRIN&
         & + YDMF_PHYS_SURF%GSD_VF%PVEG(JLON)*(1.0_JPRB-ZNEIJV(JLON)) * YDMF_PHYS_SURF%GSD_VF%PEMISF(JLON)
      ELSE
        IF (LVGSN) THEN
          IF (LZ0HSREL.AND.LCOEFKSURF) THEN
            ! new treatment, PNEIJ is gridbox snow fraction
            YDMF_PHYS%OUT%ALB(JLON)=(1.0_JPRB-ZFLU_VEG(JLON)-ZFLU_NEIJ(JLON))*YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)+ &
             & ZFLU_VEG(JLON)*YDMF_PHYS_SURF%GSD_VV%PALV(JLON)+ZFLU_NEIJ(JLON)*YDMF_PHYS_BASE_STATE%YGSP_SG%A(JLON,1)
          ELSE
            ! old treatment, PNEIJ is snow fraction for bare ground
            YDMF_PHYS%OUT%ALB(JLON)=YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)-ZFLU_NEIJ(JLON)*(YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)- &
             & YDMF_PHYS_BASE_STATE%YGSP_SG%A(JLON,1))+(ZFLU_NEIJ(JLON)-ZNEIJV(JLON))*     &
             & YDMF_PHYS_SURF%GSD_VF%PVEG(JLON)*(YDMF_PHYS_SURF%GSD_VV%PALV(JLON)-YDMF_PHYS_BASE_STATE%YGSP_SG%A(JLON,1))
          ENDIF

          YDMF_PHYS%OUT%ALB(JLON)=MIN(ABS(YDMF_PHYS_SURF%GSD_VV%PIVEG(JLON)-2._JPRB),1.0_JPRB) * YDMF_PHYS%OUT%ALB(JLON) +(&
           & 1.0_JPRB-MIN(ABS(YDMF_PHYS_SURF%GSD_VV%PIVEG(JLON)-2._JPRB),1.0_JPRB))&
           & * MAX(ALCRIN,YDMF_PHYS%OUT%ALB(JLON))
          YDMF_PHYS_SURF%GSP_SG%PT_T1(JLON,1)=YDMF_PHYS%OUT%ALB(JLON)

          ZFLU_EMIS(JLON)=YDMF_PHYS_SURF%GSD_VF%PEMISF(JLON)-ZFLU_NEIJ(JLON)*(YDMF_PHYS_SURF%GSD_VF%PEMISF(JLON)-EMCRIN)

        ELSE
          YDMF_PHYS%OUT%ALB(JLON)=YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)-ZFLU_NEIJ(JLON)*(YDMF_PHYS_SURF%GSD_VF%PALBF(JLON)&
           & -MAX(YDMF_PHYS_SURF%GSD_VF%PALBF(JLON),ALCRIN))
                                                                                                   2499,0-1        49%
```

New version of APLPAR



```
    ENDDO
  ENDIF

ENDIF  ! .NOT.LMSE

! Appel de la routine d'aerosols

LLAERO=LAEROSEA.AND.LAEROLAN.AND.LAEROSOO.AND.LAERODES

IF    (   (LRAYFM.AND.(MOD(YDCPG_OPTS%KSTEP,NRADFR) == 0)) &
& .OR.  ( (LRAY.OR.LRAYSP).AND.(.NOT.LRSTAER)) ) THEN

  IF (LLAERO) THEN
    DO JLON = YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      ZAESEA(JLON) = YDMF_PHYS_SURF%GSD_VA%PSEA(JLON)
      ZAELAN(JLON) = YDMF_PHYS_SURF%GSD_VA%PLAN(JLON)
      ZAESOO(JLON) = YDMF_PHYS_SURF%GSD_VA%PSOO(JLON)
      ZAEDES(JLON) = YDMF_PHYS_SURF%GSD_VA%PDES(JLON)
    ENDDO
  ELSE
    DO JLON = YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      ZAESEA(JLON) = 0.0_JPRB
      ZAELAN(JLON) = 0.0_JPRB
      ZAESOO(JLON) = 0.0_JPRB
      ZAEDES(JLON) = 0.0_JPRB
    ENDDO
  ENDIF
  IF (LAEROSUL) THEN
    DO JLON = YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      ZAESUL(JLON) = YDMF_PHYS_SURF%GSD_VA%PSUL(JLON)
    ENDDO
  ELSE
    DO JLON = YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      ZAESUL(JLON) = 0.0_JPRB
    ENDDO
  ENDIF
  IF (LAEROVOL) THEN
     DO JLON = YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      ZAEVOL(JLON) = YDMF_PHYS_SURF%GSD_VA%PVOL(JLON)
    ENDDO
  ELSE
    DO JLON = YDCPG_BNDS%KIDIA,YDCPG_BNDS%KFDIA
      ZAEVOL(JLON) = 0.0_JPRB
    ENDDO
  ENDIF

  IF ( ( (LRAYFM.AND.NAER /= 0) .OR.LRAY.OR.LRAYSP).AND.LLAERO )  THEN
    CALL RADAER ( YDMODEL%YRML_PHY_RAD%YREAERD, YDERAD, YDPHY, YDCPG_BNDS%KIDIA,
    & YDCPG_OPTS%KLON, YDCPG_OPTS%KFLEVG, YDMF_PHYS_BASE_STATE%YCPG_PHY%PREHYD, '
    & YDMF_PHYS_BASE_STATE%T, YDMF_PHYS_BASE_STATE%YGSP_RR%T, ZAESEA, ZAELAN, ZA
    & ZAESUL, ZAEVOL, ZAER, ZAERINDS
  ENDIF
"aplpar.F90" 5050 lines --51%--
```

```
DO JLON = YDCPG_BNDS%KIDIA, YDCPG_BNDS%KFDIA
  ZBLH(JLON) = YDMF_PHYS%OUT%CLPH(JLON)
ENDDO

!=END PARALLEL

CALL APL_ARPEGE_OCEANIC_FLUXES (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDMF_PHYS, YDMF_PHYS_SURF, &
& YDMODEL, LLHMT, ZCDROV, ZCEROV, ZCHROV, ZDPHIT, ZDPHIV, ZDSA_RS, ZFLU_CD, ZFLU_CDN, ZFLU_CH, ZFLU_QSATS)


CALL APL_WIND_GUST (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDMF_PHYS, YDVARS, &
& YDMODEL, IMOC_CLPH, ZBLH, ZDCAPE)


CALL APL_ARPEGE_SHALLOW_CONVECTION_AND_TURBULENCE (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS,     &
& YDCPG_MISC, YDMF_PHYS, YDCPG_DYN0, YDMODEL, YDDDH, INLAB_CVPP, ZCDROV, ZCHROV, ZCOEFN, ZCONDCVPPI, &
& ZCONDCVPPL, ZDIFCVPPQ, ZDIFCVPPS, YDMODEL%YRML_PHY_MF%YRPHY0%REPS, ZFLU_CD, ZFLU_CH, ZKQLROV,      &
& ZKQROV, ZKTROV, ZKUROV, ZMSC_LSCPE, ZNBVNO, ZNEBS, ZNEBS0, ZNEB_CVPP, ZPFL_FPLCH, ZPFL_FTKE,       &
& ZPFL_FTKEI, ZPRODTH_CVPP, ZQI, ZQIC, ZQL, ZQLC, ZQLIS, ZQLIS0, ZQLI_CVPP, ZQV, ZTKE1, ZXTROV,      &
& ZXUROV)

CALL APL_ARPEGE_ALBEDO_COMPUTATION (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDMF_PHYS, &
& YDMF_PHYS_SURF, YDMODEL, ZALBD, ZALBP, ZEPS0, ZFLU_EMIS, ZFLU_NEIJ, ZRDG_MU0)

CALL APL_ARPEGE_AEROSOLS_FOR_RADIATION (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDMF_PHYS_SURF, &
& YDMODEL, ZAER, ZAERINDS)

CALL APL_ARPEGE_CLOUDINESS (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDCPG_MISC, YDMF_PHYS,      &
& YDVARS, YDMODEL, LLREDPR, ZAIPCMT, ZBLH, ZDECRD, ZFLU_QSAT, ZMSC_QW, ZNEBC0, ZNEBCH, ZNEBS, ZNEBS0, &
& ZNEB_CVPP, ZPFL_FPLCH, ZQI, ZQL, ZQLIS, ZQLIS0, ZQLI_CVP, ZQLI_CVPP, ZQV, ZUNEBH, YDSTA)

CALL APL_ARPEGE_RADIATION (YDMF_PHYS_BASE_STATE, YDGEOMETRY, YDCPG_BNDS, YDCPG_OPTS, YDCPG_MISC, &
& YDCPG_GPAR, YDMF_PHYS, YDMF_PHYS_SURF, YDVARS, YDMODEL, ZAER, ZAERINDS, ZALBD, ZALBP, ZCEMTR,  &
& ZCTRSO, ZFLU_EMIS, ZFLU_QSAT, ZQO3, ZQR, ZQS, ZQV, ZRDG_MU0, ZRDG_MU0LU, ZRDG_MU0M, ZSFSWDIF,  &
& ZSFSWDIR, ZSUDU, ZTENT, ZTRSOD, ZTRSODIF, ZTRSODIR)

CALL APL_ARPEGE_SOIL_HYDRO (YDMF_PHYS_BASE_STATE, YDCPG_BNDS, YDCPG_OPTS, YDMF_PHYS, YDMF_PHYS_SURF, &
& YDMODEL, ZCHROV, ZFLU_NEIJ, ZFLU_QSAT, ZFLU_QSATS, ZFLU_VEG, ZGWDCS, ZHQ, ZHTR, ZHU, ZQV, ZWFC,    &
& ZWLMX, ZWWILT)

CALL APL_ARPEGE_SURFACE (YDMF_PHYS_BASE_STATE, YDGEOMETRY, YDCPG_BNDS, YDCPG_OPTS, YDCPG_MISC,       &
& YDCPG_GPAR, YDMF_PHYS, YDMF_PHYS_SURF, YDVARS, YDMODEL, ZALBD, ZALBP, ZALPHA1, ZCDROV, ZCEROV,     &
& ZCFATH, ZCFAU, ZCFBTH, ZCFBU, ZCFBV, ZCHROV, ZCOEFA, ZCOEFN, ZCP, ZDIFEXT, ZDIFWQ, ZDIFWS, ZDQSTS, &
& ZDSA_CPS, ZDSA_LHS, ZDTMSE, ZEDMFQ, ZEDMFS, ZEDMFU, ZEDMFV, ZFLU_CD, ZFLU_CDN, ZFLU_EMIS,          &
& ZFLU_FEVI, ZFLU_NEIJ, ZFLU_QSATS, ZFLU_VEG, ZHQ, ZHTR, ZHU, ZKQLROV, ZKQROV, ZKTROV, ZKUROV, ZLVT, &
& ZMF_UP, ZNEBCH, ZNEBDIFF, ZNEBS, ZPOID, ZQI, ZQICE, ZQL, ZQV, ZRDG_MU0, ZRDG_MU0N, ZRHGMT,         &
& ZSC_FCLL, ZSC_FCLN, ZSC_FEVI, ZSC_FEVN, ZSFSWDIF, ZSFSWDIR, ZSGROUPEL, ZSRAIN, ZSSNOW, ZSTATI,     &
& ZTSN, ZXDROV, ZXHROV, ZXQRO, ZXTRO, ZXTROV, ZXURO, ZXUROV)

! The deep convection will see the shallow part from KFB as it is with Louis scheme and the modified RI

"apl_arpege.F90" 957 lines --60%--                                                  581,17          61%
```

APLPAR split to do for ALARO

APLPAR is still there!
Initial step can be done automatically with a namelist provided
BUT
- we use multiple physics options operationally (A-LAEF)
- we want to leave some options (pTKE)
- can a ‘namelist’ with all usefull switches on (that would never work for running) be used?
- after the automatic step, still lot of work to do manually

We also need an ‘init’ routine (and other helper type routines)

Do we want to create apl_alaro_turb, apl_alaro_deep_cnv …
- at this point?
- maybe later?
- different answer for different parts

CPG and CPG_DRV refactoring

- allows different parts of CPG to be called in different OpenMP loops. Currently:

```
!$OMP PARALLEL DO
DO JBLK=1,NBLK
CALL CPG_GP
CALL MF_PHYS
CALL CPG_DIA
CALL CPG_DYN
CALL CPG_END
ENDDO
!$OMP PARALLEL DO
```

```
!$OMP PARALLEL DO
DO JBLK=1,NBLK
CALL CPG_GP
ENDDO
!$OMP PARALLEL DO
DO JBLK=1,NBLK
CALL MF_PHYS
ENDDO
!$OMP PARALLEL DO
DO JBLK=1,NBLK
CALL CPG_DIA
CALL CPG_DYN
CALL CPG_END
ENDDO
```

CPG and CPG_DRV refactoring

CPG gets an argument that defines the configuration.
This argument defines
 - if the different parts are executed in a single call to cpg
 - or in separate subsequient calls to CPG.
This allows the decsion on which loop structure to use at runtime.

```
!$OMP PARALLEL DO
DO JKGLO = 1, NGPTOT, NPROMA
! cpg_gp.F90
CALL CPG (..., CDPART=”X00”)
ENDDO

!$OMP PARALLEL DO
DO JKGLO = 1, NGPTOT, NPROMA
! mf_phys.F90
CALL CPG (..., CDPART=”0X0”)
ENDDO

!$OMP PARALLEL DO
DO JKGLO = 1, NGPTOT, NPROMA
! cpg_dia/dyn/end.F90
CALL CPG (..., CDPART=”00X”)
ENDDO
```

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!$OMP PARALLEL DO
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! cpg_dia/dyn/end.F90
CALL CPG (..., CDPART=”00X”)
ENDDO
```

Memory consumption increase

When splitting a loop any variable that is passed between the different parts must be allocated with an extra dimension. In the example below, when a loop is split, it is necessary to make X an array. This increases memory consumption.

```
REAL :: X
REAL :: Y(NBLK)
DO JBLK=1,NBLK
X=JBLK
Y(JBLK)=X
ENDDO
```

```
REAL :: X(NBLK)
REAL :: Y(NBLK)
DO JBLK=1,NBLK
X(JBLK)=JBLK
ENDDO
DO IBLK=1,NBLK
Y(JBLK)=X(JBLK)
ENDDO
```

Discussion

mf_phys and apl_alaro

ECMWF moved