

In-code documentation for CVMix

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1 Routine/Function Prologues

1.0.1 `cvmix_driver`

The stand-alone driver for the CVMix package. This driver reads in the `cvmix_nml` namelist to determine what type of mixing has been requested, and also reads in mixing-specific parameters from a `mixingtype_nml` namelist.

REVISION HISTORY:

```
SVN $Id: cvmix_driver.F90 70 2013-02-11 22:38:26Z mike.levy.work@gmail.com $  
SVN $URL: https://cvmix.googlecode.com/svn/trunk/src/cvmix_driver.F90 $
```

INTERFACE:

```
Program cvmix_driver
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8, &  
                                cvmix_strlen
```

1.0.2 cvmix_BL_pointer_driver

A routine to test the Bryan-Lewis implementation of static background mixing. Inputs are BL coefficients in two columns, one that represents tropical latitudes and one that represents subtropical latitudes. All memory is declared in the driver, and the CVMix data type points to the local variables.

REVISION HISTORY:

SVN:\$Id: cvmix_bgrnd_BL_pointer.F90 70 2013-02-11 22:38:26Z mike.levy.work@gmail.com \$
 SVN:\$URL: https://cvmix.googlecode.com/svn/trunk/src/drivers/cvmix_bgrnd_BL_pointer.F90 \$

INTERFACE:

Subroutine `cvmix_BL_pointer_driver(nlev, ocn_depth)`

USES:

```

use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,       &
                                cvmix_global_params_type, &
                                cvmix_bkgnd_params_type
use cvmix_background,      only : cvmix_init_bkgnd,    &
                                cvmix_coeffs_bkgnd
use cvmix_put_get,         only : cvmix_put
use cvmix_output,         only : cvmix_output_open,    &
                                cvmix_output_write,    &
                                cvmix_output_close

```

Implicit None

INPUT PARAMETERS:

```

integer, intent(in)      :: nlev      ! number of levels for column
real(cvmix_r8), intent(in) :: ocn_depth ! Depth of ocn

```

1.0.3 cvmix_BL_memcpy_driver

A routine to test the Bryan-Lewis implementation of static background mixing. Inputs are BL coefficients in two columns, one that represents tropical latitudes and one that represents subtropical latitudes. All memory is declared in the driver and then copied into the CVMix data structures.

REVISION HISTORY:

SVN:\$Id: cvmix_bgrnd_BL_memcpy.F90 70 2013-02-11 22:38:26Z mike.levy.work@gmail.com \$
 SVN:\$URL: https://cvmix.googlecode.com/svn/trunk/src/drivers/cvmix_bgrnd_BL_memcpy.F90 \$

INTERFACE:

Subroutine `cvmix_BL_memcpy_driver(nlev, ocn_depth)`

USES:

```

use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,       &
                                cvmix_global_params_type, &
                                cvmix_bkgnd_params_type
use cvmix_background,      only : cvmix_init_bkgnd,    &
                                cvmix_coeffs_bkgnd
use cvmix_put_get,         only : cvmix_put
use cvmix_output,          only : cvmix_output_open,   &
                                cvmix_output_write,    &
                                cvmix_output_close

```

Implicit None

INPUT PARAMETERS:

```

integer, intent(in)      :: nlev      ! number of levels for column
real(cvmix_r8), intent(in) :: ocn_depth ! Depth of ocn

```

1.0.4 cvmix_shear_driver

A routine to test the Large, et al., implementation of shear mixing. Inputs are the coefficients used in Equation (28) of the paper. The viscosity coefficient is output from a single column to allow recreation of the paper's Figure 3. Note that here each "level" of the column denotes a different local gradient Richardson number rather than a physical ocean level. All memory is declared in the driver, and the CVMix data type points to the local variables.

REVISION HISTORY:

```
SVN:$Id: cvmix_shear_KPP.F90 70 2013-02-11 22:38:26Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/drivers/cvmix_shear_KPP.F90 $
```

INTERFACE:

```
Subroutine cvmix_shear_driver(nlev)
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,      &
                                cvmix_global_params_type, &
                                cvmix_shear_params_type
use cvmix_shear,              only : cvmix_init_shear, &
                                cvmix_coeffs_shear
use cvmix_put_get,            only : cvmix_put
use cvmix_output,             only : cvmix_output_open, &
                                cvmix_output_write,   &
                                cvmix_output_close
```

```
Implicit None
```

INPUT PARAMETERS:

```
integer, intent(in) :: nlev      ! number of Ri points to sample
```

1.0.5 cvmix_tidal_driver

A routine to test the Simmons implementation of tidal mixing.

REVISION HISTORY:

SVN:\$Id: cvmix_tidal_Simmons.F90 70 2013-02-11 22:38:26Z mike.levy.work@gmail.com \$
SVN:\$URL: https://cvmix.googlecode.com/svn/trunk/src/drivers/cvmix_tidal_Simmons.F90 \$

INTERFACE:

Subroutine cvmix_tidal_driver(nlev)

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,       &
                                cvmix_global_params_type, &
                                cvmix_tidal_params_type
use cvmix_tidal,              only : cvmix_init_tidal, &
                                cvmix_coeffs_tidal
use cvmix_put_get,            only : cvmix_put
use cvmix_output,             only : cvmix_output_open, &
                                cvmix_output_write,   &
                                cvmix_output_close
```

Implicit None

!INPUT PARAMETERS

integer, intent(in) :: nlev

1.0.6 cvmix_ddiff_driver

A routine to test the double diffusion mixing module.

REVISION HISTORY:

SVN:\$Id: cvmix_ddiff_drv.F90 70 2013-02-11 22:38:26Z mike.levy.work@gmail.com \$
SVN:\$URL: https://cvmix.googlecode.com/svn/trunk/src/drivers/cvmix_ddiff_drv.F90 \$

INTERFACE:

Subroutine cvmix_ddiff_driver(nlev)

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,       &
                                cvmix_global_params_type, &
                                cvmix_ddiff_params_type
use cvmix_ddiff,              only : cvmix_init_ddiff,   &
                                cvmix_coeffs_ddiff
use cvmix_put_get,            only : cvmix_put
use cvmix_output,             only : cvmix_output_open,  &
                                cvmix_output_write,      &
                                cvmix_output_close
```

Implicit None

INPUT PARAMETERS:

integer, intent(in) :: nlev

1.1 Fortran: Module Interface cvmix_output

This module contains routines to output CVmix variables to data files. Currently only ascii output is supported, but the plan is to also include plain binary and netCDF output as well.

REVISION HISTORY:

```
SVN:$Id: cvmix_output.F90 55 2013-01-16 21:37:20Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/cvmix_output.F90 $
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_data_type
#ifdef _NETCDF
use cvmix_kinds_and_types, only : cvmix_r8
use netcdf
#endif
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_output_open
public :: cvmix_output_write
public :: cvmix_output_close
public :: print_open_files

interface cvmix_output_write
  module procedure cvmix_output_write_single_col
  module procedure cvmix_output_write_multi_col
end interface
```

DEFINED PARAMETERS:

```
integer, parameter :: ASCII_FILE_TYPE = 1
integer, parameter :: BIN_FILE_TYPE   = 2
integer, parameter :: NETCDF_FILE_TYPE = 3
integer, parameter :: FILE_NOT_FOUND  = 404
```

```
! Probably not the best technique, but going to use a linked list to keep
! track of what files are open / what format they are (ascii, bin, or nc)
```

```
type :: cvmix_file_entry
  integer :: file_id
  integer :: file_type
  type(cvmix_file_entry), pointer :: prev
  type(cvmix_file_entry), pointer :: next
end type
```

```
type(cvmix_file_entry), allocatable, target :: file_database(:)
```

1.1.1 `cvmix_output_open`

INTERFACE:

```
subroutine cvmix_output_open(file_id, file_name, file_format)
```

DESCRIPTION:

Routine to open a file for writing. Goal is to support writing files in plain text (currently working), netCDF, and plain binary. Besides opening the file, this routine also adds an entry to `file_database`, a linked list that keeps track of what files are open and what type of file each identifier refers to. So it will be possible to output the same data in ascii and netCDF, for example.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*), intent(in) :: file_name, file_format
```

OUTPUT PARAMETERS:

```
integer, intent(out) :: file_id
```

LOCAL VARIABLES:

```
type(cvmix_file_entry), pointer :: file_index
```

1.1.2 `cvmix_output_write_single_col`

INTERFACE:

```
subroutine cvmix_output_write_single_col(file_id, CVmix_vars, var_names)
```

DESCRIPTION:

Routine to write the requested variables from a single column to a file (file must be opened using `vmix_output_open` to ensure it is written correctly). Called with `vmix_output_write` (see interface in PUBLIC MEMBER FUNCTIONS above).

USES:

Only those used by entire module.

INPUT PARAMETERS:

```

integer,                                intent(in) :: file_id
type(cvmix_data_type),                  intent(in) :: CVmix_vars
character(len=*), dimension(:), intent(in) :: var_names

```

LOCAL VARIABLES:

```

integer :: kw, var
#ifdef _NETCDF
integer                                :: nw, nw_id
integer, dimension(:), allocatable :: var_id
#endif

```

1.1.3 cvmix_output_write_multi_col**INTERFACE:**

```

subroutine cvmix_output_write_multi_col(file_id, CVmix_vars, var_names)

```

DESCRIPTION:

Routine to write the requested variables from multiple columns to a file (file must be opened using vmix_output_open to ensure it is written correctly). Called with vmix_output_write (see interface in PUBLIC MEMBER FUNCTIONS above).

USES:

Only those used by entire module.

INPUT PARAMETERS:

```

integer,                                intent(in) :: file_id
type(cvmix_data_type), dimension(:), intent(in) :: CVmix_vars
character(len=*),      dimension(:), intent(in) :: var_names

```

LOCAL VARIABLES:

```

integer :: ncol, nw, icol, kw, var
logical :: z_err
#ifdef _NETCDF
integer                                :: nw_id, ncol_id
integer,      dimension(:),  allocatable :: var_id
real(kind=cvmix_r8), dimension(:, :), allocatable :: lcl_visc, lcl_diff
#endif

```

1.1.4 `cvmix_output_close`

INTERFACE:

```
subroutine cvmix_output_close(file_id)
```

DESCRIPTION:

Routine to close a file once all writing has been completed. In addition to closing the file, this routine also deletes its entry in `file_database` to avoid trying to write to the file in the future.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
integer, intent(in) :: file_id
```

LOCAL VARIABLES:

```
type(cvmix_file_entry), pointer :: ifile, file_to_close
logical                        :: file_found
integer                       :: file_type
```

1.1.5 `get_file_type`

INTERFACE:

```
function get_file_type(file_id)
```

DESCRIPTION:

Returns the file format (enumerated in `DEFINED PARAMETERS` section) of a given file. If the file is not in the database, returns `FILE_NOT_FOUND`.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
integer, intent(in) :: file_id
```

OUTPUT PARAMETERS:

```
integer          :: get_file_type
```

LOCAL VARIABLES:

```
type(cvmix_file_entry), pointer :: ifile
```

1.2 Fortran: Module Interface *cvmix_kinds_and_types*

This module contains the declarations for all required vertical mixing data types. It also contains several global parameters used by the *cvmix* package, such as kind numbers and string lengths.

REVISION HISTORY:

```
SVN:$Id: cvmix_kinds_and_types.F90 63 2013-02-06 00:24:07Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_kinds_and_types.F90 $
```

USES:

```
uses no other modules
```

DEFINED PARAMETERS:

```
! Kind Types:
! The cvmix package uses double precision for floating point computations.
integer, parameter, public :: cvmix_r8      = selected_real_kind(13), &
                                cvmix_strlen = 256

! Global parameters:
! The value for pi is needed for Bryan-Lewis mixing.
real(cvmix_r8), parameter, public :: cvmix_PI = &
                                2.0_cvmix_r8*acos(0.0_cvmix_r8)
```

PUBLIC TYPES:

```
! cvmix_input_type contains every possible necessary input field for all
! supported types of mixing.
type, public :: cvmix_data_type
    integer :: nlev = -1 ! Number of levels in column
                        ! Setting default to -1 might be F95...

    ! Values on interfaces
    ! nlev+1, 2
    real(cvmix_r8), dimension(:,:), pointer :: diff_iface => NULL()
    ! nlev+1
    real(cvmix_r8), dimension(:),  pointer :: visc_iface => NULL()
    real(cvmix_r8), dimension(:),  pointer :: z_iface   => NULL()
    real(cvmix_r8), dimension(:),  pointer :: dw_iface  => NULL()
    real(cvmix_r8), dimension(:),  pointer :: Ri_iface  => NULL()

    ! Values at tracer points
    ! nlev
    real(cvmix_r8), dimension(:),  pointer :: dens      => NULL()
    real(cvmix_r8), dimension(:),  pointer :: dens_lwr  => NULL()
```

```

        real(cvmix_r8), dimension(:),  pointer :: z          => NULL()
        real(cvmix_r8), dimension(:),  pointer :: dz         => NULL()
end type cvmix_data_type

! cvmix_global_params_type contains global parameters used by multiple
! mixing methods.
type, public :: cvmix_global_params_type
    integer                :: max_nlev  ! maximum number of levels
    real(cvmix_r8)         :: prandtl   ! Prandtl number
end type cvmix_global_params_type

! cvmix_bkgnd_params_type contains the necessary parameters for background
! mixing. Background mixing fields can vary from level to level as well as
! over latitude and longitude.
type, public :: cvmix_bkgnd_params_type
    real(cvmix_r8), allocatable :: static_visc(:, :) ! ncol, nlev+1
    real(cvmix_r8), allocatable :: static_diff(:, :) ! ncol, nlev+1

    ! Note: need to include some logic to avoid excessive memory use
    !       when static_visc and static_diff are constant or 1-D
    logical                :: lvary_vertical  ! True => second dim not 1
    logical                :: lvary_horizontal ! True => first dim not 1
end type cvmix_bkgnd_params_type

! cvmix_shear_params_type contains the necessary parameters for shear mixing
! (currently Pacanowski-Philander or Large et al)
type, public :: cvmix_shear_params_type
    character(len=cvmix_strlen) :: mix_scheme
    real(cvmix_r8)              :: PP_nu_zero
    real(cvmix_r8)              :: PP_alpha
    real(cvmix_r8)              :: PP_exp
    real(cvmix_r8)              :: KPP_nu_zero
    real(cvmix_r8)              :: KPP_Ri_zero
    real(cvmix_r8)              :: KPP_exp
end type cvmix_shear_params_type

! cvmix_tidal_params_type contains the necessary parameters for shear mixing
! (currently just Simmons)
type, public :: cvmix_tidal_params_type
    character(len=cvmix_strlen) :: mix_scheme
end type cvmix_tidal_params_type

! cvmix_ddiff_params_type contains the necessary parameters for double
! diffusion mixing (currently just a place-holder variable)
type, public :: cvmix_ddiff_params_type
    real(cvmix_r8) :: deleteme
end type cvmix_ddiff_params_type

```

```
! cvmix_conv_params_type contains the necessary parameters for convective
! mixing.
type, public :: cvmix_conv_params_type
    real(cvmix_r8)          :: convect_diff
    real(cvmix_r8)          :: convect_visc
end type cvmix_conv_params_type
```

1.3 Fortran: Module Interface *cvmix_background*

This module contains routines to initialize the derived types needed for time independent static background mixing coefficients. It specifies either a scalar, 1D, or 2D field for viscosity and diffusivity. It also calculates the background diffusivity using the Bryan-Lewis method. It then sets the viscosity and diffusivity to the specified value.

REVISION HISTORY:

```
SVN:$Id: cvmix_background.F90 55 2013-01-16 21:37:20Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_background.F90 $
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_PI,           &
                                cvmix_r8,             &
                                cvmix_data_type,       &
                                cvmix_global_params_type, &
                                cvmix_bkgnd_params_type
use cvmix_put_get, only        : cvmix_put
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_init_bkgnd
public :: cvmix_coeffs_bkgnd

interface cvmix_init_bkgnd
  module procedure cvmix_init_bkgnd_scalar
  module procedure cvmix_init_bkgnd_1D
  module procedure cvmix_init_bkgnd_2D
  module procedure cvmix_init_bkgnd_BryanLewis
end interface cvmix_init_bkgnd
```

1.3.1 *cvmix_init_bkgnd_scalar*

INTERFACE:

```
subroutine cvmix_init_bkgnd_scalar(CVmix_bkgnd_params, bkgnd_visc, bkgnd_diff)
```

DESCRIPTION:

Initialization routine for static background mixing coefficients. For each column, this routine sets the static viscosity / diffusivity to the given scalar constants.

USES:

DESCRIPTION:

Initialization routine for static background mixing coefficients. For each column, this routine sets the static viscosity / diffusivity to the given 2D field.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```

type(cvmix_global_params_type), intent(in) :: CVmix_params
real(cvmix_r8), dimension(:,:), intent(in) :: bkgnd_visc
real(cvmix_r8), dimension(:,:), intent(in) :: bkgnd_diff
integer,                                intent(in) :: ncol

```

OUTPUT PARAMETERS:

```

type(cvmix_bkgnd_params_type), intent(out) :: CVmix_bkgnd_params

```

1.3.4 cvmix_init_bkgnd_BryanLewis**INTERFACE:**

```

subroutine cvmix_init_bkgnd_BryanLewis(CVmfix_vars, CVmix_params,      &
                                       CVmix_bkgnd_params, bl1, bl2, bl3, bl4)

```

DESCRIPTION:

Initialization routine for Bryan-Lewis diffusivity/viscosity calculation. For each column, this routine sets the static viscosity & diffusivity based on the specified parameters. Note that the units of these parameters must be consistent with the units of viscosity and diffusivity – either cgs or mks, but do not mix and match!

The Bryan-Lewis parameterization is based on the following:

$$\kappa_{BL} = \text{bl1} + \frac{\text{bl2}}{\pi} \tan^{-1} \left(\text{bl3}(z - \text{bl4}) \right)$$

$$\nu_{BL} = \text{Pr} \cdot \kappa_{BL}$$

This method is based on the following paper:

A Water Mass Model of the World Ocean

K. Bryan and L. J. Lewis

Journal of Geophysical Research, vol 84 (1979), pages 2503-2517.

In that paper, they recommend the parameters

```

bl1 = 8 · 10-5 m2/s
bl2 = 1.05 · 10-4 m2/s
bl3 = 4.5 · 10-3 m-1
bl4 = 2500 m

```

However, more recent usage of their scheme may warrant different settings. **USES:**

Only those used by entire module.

INPUT PARAMETERS:

```

type(cvmix_data_type),          intent(in) :: CVmix_vars   ! Depth, nlev
type(cvmix_global_params_type), intent(in) :: CVmix_params ! Prandtl

! Units are first column if CVmix_data%depth is m, second if cm
real(cvmix_r8), intent(in) :: bl1,      &! m2/s or cm2/s
                                bl2,      &! m2/s or cm2/s
                                bl3,      &! 1/m    or 1/cm
                                bl4       ! m      or cm

```

OUTPUT PARAMETERS:

```

type(cvmix_bkgnd_params_type), intent(out) :: CVmix_bkgnd_params

```

1.3.5 cvmix_coeffs_bkgnd

INTERFACE:

```

subroutine cvmix_coeffs_bkgnd(CVmixture_vars, CVmix_bkgnd_params, colid)

```

DESCRIPTION:

Computes vertical tracer and velocity mixing coefficients for static background mixing. This routine simply copies viscosity / diffusivity values from CVmix_bkgnd_params to CVmix_vars.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```

type(cvmix_bkgnd_params_type), intent(in) :: CVmix_bkgnd_params
! Need to know column for pulling data from static_visc and _diff
integer,                        intent(in) :: colid

```

INPUT/OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.4 Fortran: Module Interface *cvmix_shear*

This module contains routines to initialize the derived types needed for shear mixing, and to set the viscosity and diffusivity coefficients. Presently this scheme has implemented the shear mixing parameterizations from Pacanowski & Philander (1981) and Large, McWilliams, & Doney (1994).

REVISION HISTORY:

```
SVN:$Id: cvmix_shear.F90 63 2013-02-06 00:24:07Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_shear.F90 $
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,      &
                                cvmix_bkgnd_params_type, &
                                cvmix_shear_params_type
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_init_shear
public :: cvmix_coeffs_shear
```

1.4.1 *cvmix_init_shear*

INTERFACE:

```
subroutine cvmix_init_shear(CVmix_shear_params, mix_scheme, &
                           PP_nu_zero, PP_alpha, PP_exp, &
                           KPP_nu_zero, KPP_Ri_zero, KPP_exp)
```

DESCRIPTION:

Initialization routine for shear (Richardson number-based) mixing. There are currently two supported schemes - set `mix_scheme = 'PP'` to use the Pacanowski-Philander mixing scheme or set `mix_scheme = 'KPP'` to use the interior mixing scheme laid out in Large et al.

PP requires setting ν_0 (`PP_nu_zero` in this routine), α (`PP_alpha`), and n (`PP_exp`), and returns

$$\begin{aligned}\nu_{PP} &= \frac{\nu_0}{(1 + \alpha Ri)^n} + \nu_b \\ \kappa_{PP} &= \frac{\nu}{1 + \alpha Ri} + \kappa_b\end{aligned}$$

Note that ν_b and κ_b are set in `cvmix_init_bkgnd()`, which needs to be called separately from this routine.

KPP requires setting ν^0 (KPP_nu_zero, Ri₀(KPP_Ri_zero), and p_1 (KPP_exp), and returns

$$\nu_{KPP} = \begin{cases} \nu^0 & \text{Ri} < 0 \\ \nu^0 \left[1 - \frac{\text{Ri}}{\text{Ri}_0}\right]^{p_1} & 0 < \text{Ri} < \text{Ri}_0 \\ 0 & \text{Ri}_0 < \text{Ri} \end{cases}$$

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*),          intent(in) :: mix_scheme
real(cvmix_r8), optional, intent(in) :: PP_nu_zero, PP_alpha, PP_exp, &
                                KPP_nu_zero, KPP_Ri_zero, KPP_exp
```

OUTPUT PARAMETERS:

```
type(cvmix_shear_params_type), intent(inout) :: CVmix_shear_params
```

1.4.2 cvmix_coeffs_shear

INTERFACE:

```
subroutine cvmix_coeffs_shear(CVmix_vars, CVmix_shear_params,    &
                             CVmix_bkgnd_params, colid, no_diff)
```

DESCRIPTION:

Computes vertical tracer and velocity mixing coefficients for shear-type mixing parameterizations. Note that Richardson number is needed at both T-points and U-points.

USES:

only those used by entire module.

INPUT PARAMETERS:

```
type(cvmix_shear_params_type),          intent(in) :: CVmix_shear_params
! PP mixing requires CVmix_bkgnd_params
type(cvmix_bkgnd_params_type), optional, intent(in) :: CVmix_bkgnd_params
! colid is only needed if CVmix_bkgnd_params%lvary_horizontal is true
integer,                                optional, intent(in) :: colid
logical,                                optional, intent(in) :: no_diff
```

INPUT/OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.5 Fortran: Module Interface *cvmix_tidal*

This module contains routines to initialize the derived types needed for tidal mixing (currently just the Simmons scheme) and to set the viscosity and diffusivity coefficients accordingly.

REVISION HISTORY:

```
SVN:$Id: cvmix_tidal.F90 55 2013-01-16 21:37:20Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_tidal.F90 $
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,       &
                                cvmix_tidal_params_type
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_init_tidal
public :: cvmix_coeffs_tidal
```

1.5.1 *cvmix_init_tidal*

INTERFACE:

```
subroutine cvmix_init_tidal(CVmix_tidal_params, mix_scheme)
```

DESCRIPTION:

Initialization routine for tidal mixing. There is currently just one supported schemes - set `mix_scheme = 'simmons'` to use the Simmons mixing scheme. **USES:**

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*), intent(in) :: mix_scheme
```

OUTPUT PARAMETERS:

```
type(cvmix_tidal_params_type), intent(inout) :: CVmix_tidal_params
```

1.5.2 cvmix_coeffs_tidal

INTERFACE:

```
subroutine cvmix_coeffs_tidal(CVmix_vars, CVmix_tidal_params)
```

DESCRIPTION:

Computes vertical diffusion coefficients for tidal mixing parameterizations.

USES:

only those used by entire module.

INPUT PARAMETERS:

```
type(cvmix_tidal_params_type), intent(in) :: CVmix_tidal_params
```

INPUT/OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.6 Fortran: Module Interface *cvmix_ddiff*

This module contains routines to initialize the derived types needed for double diffusion mixing and to set the viscosity and diffusivity coefficients accordingly.

REVISION HISTORY:

SVN:\$Id: cvmix_ddiff.F90 55 2013-01-16 21:37:20Z mike.levy.work@gmail.com \$
SVN:\$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_ddiff.F90 \$

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &  
                                cvmix_data_type,       &  
                                cvmix_ddiff_params_type
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_init_ddiff  
public :: cvmix_coeffs_ddiff
```

1.6.1 *cvmix_init_ddiff*

INTERFACE:

```
subroutine cvmix_init_ddiff(CVmix_ddiff_params)
```

DESCRIPTION:

Initialization routine for double diffusion mixing. **USES:**

Only those used by entire module.

OUTPUT PARAMETERS:

```
type(cvmix_ddiff_params_type), intent(inout) :: CVmix_ddiff_params
```

1.6.2 *cvmix_coeffs_ddiff*

INTERFACE:

```
subroutine cvmix_coeffs_ddiff(CVmix_vars, CVmix_ddiff_params)
```

DESCRIPTION:

Computes vertical diffusion coefficients for the double diffusion mixing parameterization.

USES:

only those used by entire module.

INPUT PARAMETERS:

```
type(cvmix_ddiff_params_type), intent(in) :: CVmix_ddiff_params
```

INPUT/OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.7 Fortran: Module Interface *cvmix_convection*

This module contains routines to initialize the derived types needed for specifying mixing coefficients to parameterize vertical convective mixing, and to set the viscosity and diffusivity in gravitationally unstable portions of the water column.

REVISION HISTORY:

```
SVN:$Id: cvmix_convection.F90 55 2013-01-16 21:37:20Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_convection.F90 $
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_data_type,      &
                                cvmix_conv_params_type
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_init_conv
public :: cvmix_coeffs_conv
```

1.7.1 *cvmix_init_conv*

INTERFACE:

```
subroutine cvmix_init_conv(CVmix_conv_params, convect_diff, convect_visc)
```

DESCRIPTION:

Initialization routine for specifying convective mixing coefficients.

USES:

Only those used by entire module.

OUTPUT PARAMETERS:

```
type (cvmix_conv_params_type), intent(out) :: CVmix_conv_params
```

INPUT PARAMETERS:

```
real(cvmix_r8), intent(in) :: &
    convect_diff,      &! diffusivity to parameterize convection
    convect_visc      ! viscosity to parameterize convection
```

1.7.2 cvmix_coeffs_conv

INTERFACE:

```
subroutine cvmix_coeffs_conv(CVmix_vars, CVmix_conv_params)
```

DESCRIPTION:

Computes vertical diffusion coefficients for convective mixing.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
type (cvmix_conv_params_type), intent(in)  :: CVmix_conv_params
```

INPUT/OUTPUT PARAMETERS:

```
type (cvmix_data_type), intent(inout) :: CVmix_vars
```

1.8 Fortran: Module Interface *cvmix_put_get*

This module contains routines to pack data into the *cvmix* datatypes (allocating memory as necessary) and then unpack the data out. If we switch to pointers, the pack will just point at the right target and the unpack will be un-necessary.

REVISION HISTORY:

```
SVN:$Id: cvmix_put_get.F90 55 2013-01-16 21:37:20Z mike.levy.work@gmail.com $
SVN:$URL: https://cvmix.googlecode.com/svn/trunk/src/shared/cvmix_put_get.F90 $
```

USES:

```
use cvmix_kinds_and_types, only : cvmix_r8,           &
                                cvmix_strlen,         &
                                cvmix_data_type,       &
                                cvmix_global_params_type, &
                                cvmix_bkgnd_params_type
```

PUBLIC MEMBER FUNCTIONS:

```
public :: cvmix_put

interface cvmix_put
  module procedure cvmix_put_int
  module procedure cvmix_put_real
  module procedure cvmix_put_real_1D
  module procedure cvmix_put_bkgnd_real    ! untested
  module procedure cvmix_put_bkgnd_real_1D
  module procedure cvmix_put_bkgnd_real_2D ! untested
  module procedure cvmix_put_global_params_int
  module procedure cvmix_put_global_params_real
end interface cvmix_put
```

1.8.1 *cvmix_put_int*

INTERFACE:

```
subroutine cvmix_put_int(CVmix_vars, varname, val, opts)
```

DESCRIPTION:

Write an integer value into a *cvmix_data_type* variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*),          intent(in) :: varname
integer,              intent(in) :: val
character(len=*), optional, intent(in) :: opts
```

OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.8.2 cvmix_put_real**INTERFACE:**

```
subroutine cvmix_put_real(CVmix_vars, varname, val, opts)
```

DESCRIPTION:

Write a real value into a `cvmix_data_type` variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*),          intent(in) :: varname
real(cvmix_r8),           intent(in) :: val
character(len=*), optional, intent(in) :: opts
```

OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.8.3 cvmix_put_real_1D**INTERFACE:**

```
subroutine cvmix_put_real_1D(CVmix_vars, varname, val, opts)
```

DESCRIPTION:

Write an array of real values into a `cvmix_data_type` variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*),          intent(in) :: varname
real(cvmix_r8), dimension(:), intent(in) :: val
character(len=*), optional, intent(in) :: opts
```

OUTPUT PARAMETERS:

```
type(cvmix_data_type), intent(inout) :: CVmix_vars
```

1.8.4 cvmix_put_bkgnd_real

INTERFACE:

```
subroutine cvmix_put_bkgnd_real(CVmix_bkgnd_params, varname, val)
```

DESCRIPTION:

Write a real value into a cvmix.bkgnd_params.type variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=cvmix_strlen), intent(in) :: varname
real(cvmix_r8),              intent(in) :: val
```

OUTPUT PARAMETERS:

```
type(cvmix_bkgnd_params_type), intent(inout) :: CVmix_bkgnd_params
```

1.8.5 cvmix_put_bkgnd_real_1D

INTERFACE:

```
subroutine cvmix_put_bkgnd_real_1D(CVmix_bkgnd_params, varname, val, &
                                   ncol, nlev)
```


DESCRIPTION:

Write an array of real values into a `cvmix_bkgnd_params_type` variable. You must use `opt='horiz'` to specify that the field varies in the horizontal direction, otherwise it is assumed to vary in the vertical.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*),          intent(in) :: varname
real(cvmix_r8), dimension(:), intent(in) :: val
integer, optional,         intent(in) :: ncol, nlev
```

OUTPUT PARAMETERS:

```
type (cvmix_bkgnd_params_type), intent(inout) :: CVmix_bkgnd_params
```

1.8.6 cvmix_put_bkgnd_real_2D**INTERFACE:**

```
subroutine cvmix_put_bkgnd_real_2D(CVmix_bkgnd_params, varname, val, &
                                   ncol, nlev)
```

DESCRIPTION:

Write a 2D array of real values into a `cvmix_bkgnd_params_type` variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=cvmix_strlen), intent(in) :: varname
real(cvmix_r8), dimension(:,:), intent(in) :: val
integer,                   intent(in) :: ncol, nlev
```

OUTPUT PARAMETERS:

```
type (cvmix_bkgnd_params_type), intent(out) :: CVmix_bkgnd_params
```

1.8.7 `cvmix_put_global_params_int`

INTERFACE:

```
subroutine cvmix_put_global_params_int(CVmix_params, varname, val)
```

DESCRIPTION:

Write an integer value into a `cvmix_global_params_type` variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*), intent(in) :: varname  
integer,          intent(in) :: val
```

OUTPUT PARAMETERS:

```
type (cvmix_global_params_type), intent(inout) :: CVmix_params
```

1.8.8 `cvmix_put_global_params_real`

INTERFACE:

```
subroutine cvmix_put_global_params_real(CVmix_params, varname, val)
```

DESCRIPTION:

Write a real value into a `cvmix_global_params_type` variable.

USES:

Only those used by entire module.

INPUT PARAMETERS:

```
character(len=*), intent(in) :: varname  
real(cvmix_r8),   intent(in) :: val
```

OUTPUT PARAMETERS:

```
type(cvmix_global_params_type), intent(inout) :: CVmix_params
```