EMPIRE DA

0.1

Generated by Doxygen 1.8.6

Mon Sep 22 2014 16:04:35

Contents

Chapter 1

Main Page

This is where we put the stuff to go at the top of the documentation. looks like this

Chapter 2

Data Type Index

2.1 Data Types List

Here are the data types with brief descriptions:

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

Chapter 4

Data Type Documentation

4.1 comms Module Reference

Module containing EMPIRE coupling data.

Public Member Functions

- subroutine allocate_data
- subroutine deallocate_data
- subroutine initialise_mpi

  subroutine to make EMPIRE connections and saves details into pf_control module

Public Attributes

- integer cpl_mpi_comm
- integer mype_id
- integer myrank
- integer nproc
- integer pf_mpi_comm
- integer pfrank
- integer npfs
- integer, dimension(:), allocatable gblcount
- integer, dimension(:), allocatable gbldisp

4.1.1 Detailed Description

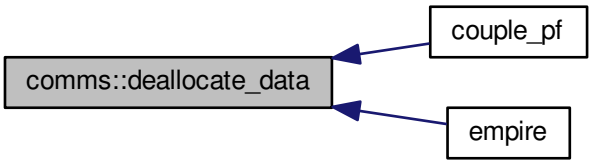
Module containing EMPIRE coupling data.

4.1.2 Member Function/Subroutine Documentation

4.1.2.1 subroutine comms::allocate_data ( )

4.1.2.2 subroutine comms::deallocate_data ( )

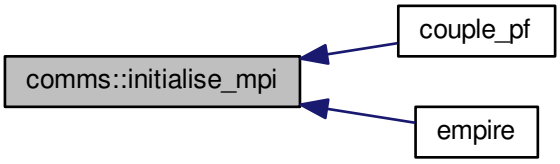
Here is the caller graph for this function:



4.1.2.3 subroutine comms::initialise_mpi ( )

subroutine to make EMPIRE connections and saves details into pf_control module

Here is the caller graph for this function:



4.1.3 Member Data Documentation

4.1.3.1 integer comms::cpl_mpi_comm

4.1.3.2 integer, dimension(:), allocatable comms::gblcount

4.1.3.3 integer, dimension(:), allocatable comms::gbldisp

4.1.3.4 integer comms::mype_id

4.1.3.5 integer comms::myrank

4.1.3.6 integer comms::npfs

4.1.3.7 integer comms::nproc

4.1.3.8 integer comms::pf_mpi_comm

4.1.3.9 integer comms::pfrank

The documentation for this module was generated from the following file:

- src/utils/comms.f90

4.2 histogram_data Module Reference

Module to control what variables are used to generate rank histograms.

Public Member Functions

- subroutine load_histogram_data

  subroutine to read from variables_hist.dat which variables to be used to make the rank histograms
- subroutine kill_histogram_data

  subroutine to clean up arrays used in rank histograms

Public Attributes

- integer, dimension(:), allocatable rank_hist_list
- integer, dimension(:), allocatable rank_hist_nums
- integer rhl_n
- integer rhn_n

4.2.1 Detailed Description

Module to control what variables are used to generate rank histograms.

4.2.2 Member Function/Subroutine Documentation

4.2.2.1 subroutine histogram_data::kill_histogram_data ( )

subroutine to clean up arrays used in rank histograms

4.2.2.2 subroutine histogram_data::load_histogram_data ( )

subroutine to read from variables_hist.dat which variables to be used to make the rank histograms

4.2.3 Member Data Documentation

4.2.3.1 integer, dimension(:), allocatable histogram_data::rank_hist_list

4.2.3.2 integer, dimension(:), allocatable histogram_data::rank_hist_nums

4.2.3.3 integer histogram_data::rhl_n

4.2.3.4 integer histogram_data::rhn_n

The documentation for this module was generated from the following file:

- src/utils/histogram.f90

4.3 hqht_plus_r Module Reference

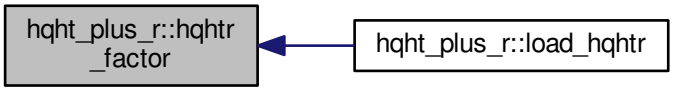
Public Member Functions

- subroutine load_hqhtr
- subroutine hqhtr_factor
- subroutine kill_hqhtr

4.3.1 Member Function/Subroutine Documentation

4.3.1.1 subroutine hqht_plus_r::hqhtr_factor ( )

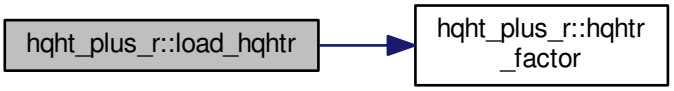
Here is the caller graph for this function:



4.3.1.2 subroutine hqht_plus_r::kill_hqhtr ( )

4.3.1.3 subroutine hqht_plus_r::load_hqhtr ( )

Here is the call graph for this function:



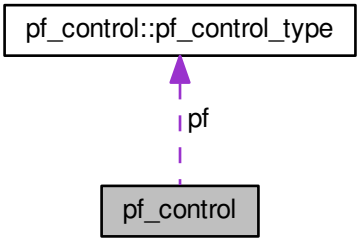
The documentation for this module was generated from the following file:

- src/data/Rdata.f90

4.4 pf_control Module Reference

module to hold all the information to control the the main program

Collaboration diagram for pf_control:



Data Types

- type pf_control_type

Public Member Functions

- subroutine set_pf_controls
- subroutine allocate_pf
- subroutine deallocate_pf

Public Attributes

- type(pf_control_type) pf

  the derived data type holding all controlling data

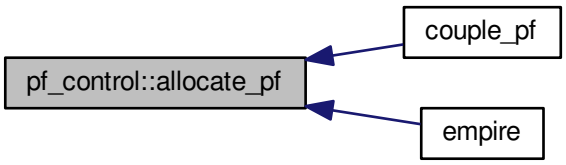
4.4.1 Detailed Description

module to hold all the information to control the the main program

4.4.2 Member Function/Subroutine Documentation

4.4.2.1 subroutine pf_control::allocate_pf ( )

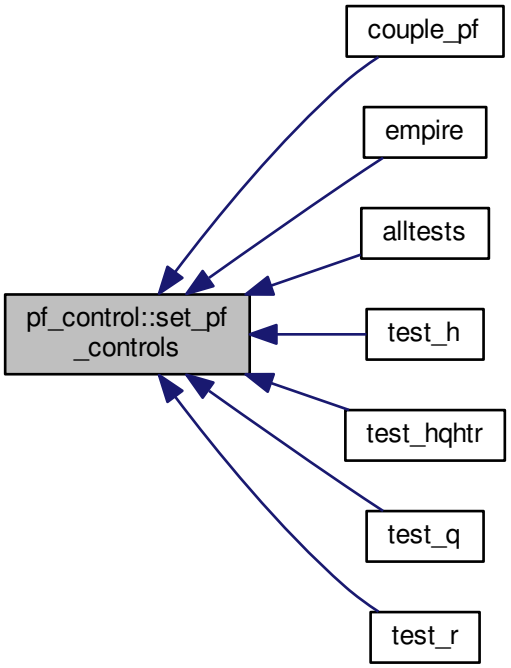
Here is the caller graph for this function:



4.4.2.2 subroutine pf_control::deallocate_pf ( )

4.4.2.3 subroutine pf_control::set_pf_controls ( )

Here is the caller graph for this function:



4.4.3 Member Data Documentation

4.4.3.1 type(pf_control_type) pf_control::pf

the derived data type holding all controlling data

The documentation for this module was generated from the following file:

- src/controlers/pf_control.f90

4.5 pf_control::pf_control_type Type Reference

Public Attributes

- integer nens
  the total number of ensemble members
- real(kind=kind(1.0d0)), dimension(:), allocatable weight
  the negative log of the weights of the particles
- integer time_obs
  the number of observations we will assimilate
- integer time_bwn_obs
  the number of model timesteps between observations
- real(kind=kind(1.0d0)) nudgefac
  the nudging factor
- logical gen_data
  true generates synthetic obs for a twin experiment
- logical gen_q
  true attempts to build up Q from long model run
- logical human_readable
  unused
- integer timestep =0
  the current timestep as the model progresses
- real(kind=kind(1.0d0)), dimension(:,:), allocatable psi
  state vector of ensemble members on this mpi process
- real(kind=kind(1.0d0)), dimension(:), allocatable mean
  mean state vector
- real(kind=kind(1.0d0)) nfac
  standard deviation of normal distribution in mixture density
- real(kind=kind(1.0d0)) ufac
  half width of the uniform distribution in mixture density
- real(kind=kind(1.0d0)) efac
- real(kind=kind(1.0d0)) keep
  proportion of particles to keep in EWPF EW step
- real(kind=kind(1.0d0)) time
  dunno
- real(kind=kind(1.0d0)) qscale
  scalar to multiply Q by
- integer couple_root
  empire master processor
- logical use_talagrand
  switch if true outputs rank histograms
- logical use_weak
  switch unused

- logical use_mean
  switch if true outputs ensemble mean
- logical use_var
  switch if true outputs ensemble variance
- logical use_traj
  switch if true outputs trajectories
- logical use_rmse
  switch if true outputs Root Mean Square Errors
- integer, dimension(:,:), allocatable talagrand
  storage for rank histograms
- integer count
  number of ensemble members associated with this MPI process
- integer, dimension(:), allocatable particles
  particles associates with this MPI process
- character(2) type
  which filter to use
- character(1) init
  which method to initialise ensemble

4.5.1 Member Data Documentation

4.5.1.1 integer pf_control::pf_control_type::count

number of ensemble members associated with this MPI process

4.5.1.2 integer pf_control::pf_control_type::couple_root

empire master processor

4.5.1.3 real(kind=kind(1.0d0)) pf_control::pf_control_type::efac

4.5.1.4 logical pf_control::pf_control_type::gen_data

true generates synthetic obs for a twin experiment

4.5.1.5 logical pf_control::pf_control_type::gen_q

true attempts to build up Q from long model run

4.5.1.6 logical pf_control::pf_control_type::human_readable

unused

4.5.1.7 character(1) pf_control::pf_control_type::init

which method to initialise ensemble

4.5.1.8 real(kind=kind(1.0d0)) pf_control::pf_control_type::keep

proportion of particles to keep in EWPF EW step

4.5.1.9 real(kind=kind(1.0d0)), dimension(:), allocatable pf_control::pf_control_type::mean

mean state vector

4.5.1.10 integer pf_control::pf_control_type::nens

the total number of ensemble members

4.5.1.11 real(kind=kind(1.0d0)) pf_control::pf_control_type::nfac

standard deviation of normal distribution in mixture density

4.5.1.12 real(kind=kind(1.0d0)) pf_control::pf_control_type::nudgefac

the nudging factor

4.5.1.13 integer, dimension(:), allocatable pf_control::pf_control_type::particles

particles associates with this MPI process

4.5.1.14 real(kind=kind(1.0d0)), dimension(:,:), allocatable pf_control::pf_control_type::psi

state vector of ensemble members on this mpi process

4.5.1.15 real(kind=kind(1.0d0)) pf_control::pf_control_type::qscale

scalar to multiply Q by

4.5.1.16 integer, dimension(:,:), allocatable pf_control::pf_control_type::talagrand

storage for rank histograms

4.5.1.17 real(kind=kind(1.0d0)) pf_control::pf_control_type::time

dunno

4.5.1.18 integer pf_control::pf_control_type::time_bwn_obs

the number of model timesteps between observations

4.5.1.19 integer pf_control::pf_control_type::time_obs

the number of observations we will assimilate

4.5.1.20 integer pf_control::pf_control_type::timestep =0

the current timestep as the model progresses

4.5.1.21 character(2) pf_control::pf_control_type::type

which filter to use

4.5.1.22 real(kind=kind(1.0d0)) pf_control::pf_control_type::ufac

half width of the uniform distribution in mixture density

4.5.1.23 logical pf_control::pf_control_type::use_mean

switch if true outputs ensemble mean

4.5.1.24 logical pf_control::pf_control_type::use_rmse

switch if true outputs Root Mean Square Errors

4.5.1.25 logical pf_control::pf_control_type::use_talagrand

switch if true outputs rank histograms

4.5.1.26 logical pf_control::pf_control_type::use_traj

switch if true outputs trajectories

4.5.1.27 logical pf_control::pf_control_type::use_var

switch if true outputs ensemble variance

4.5.1.28 logical pf_control::pf_control_type::use_weak

switch unused

4.5.1.29 real(kind=kind(1.0d0)), dimension(:), allocatable pf_control::pf_control_type::weight

the negative log of the weights of the particles

The documentation for this type was generated from the following file:

- src/controlers/pf_control.f90

4.6 qdata Module Reference

Module as a place to store user specified data for Q.

Public Member Functions

- subroutine loadq

  Subroutine to load in user data for Q.
- subroutine killq

Public Attributes

- integer qn
- integer qne
- integer, dimension(:), allocatable qrow
- integer, dimension(:), allocatable qcol
- real(kind=kind(1.0d0)), dimension(:), allocatable qval
- real(kind=kind(1.0d0)), dimension(:), allocatable qdiag
- real(kind=kind(1.0d0)) qscale

4.6.1 Detailed Description

Module as a place to store user specified data for Q.

- the model error covariance matrix

4.6.2 Member Function/Subroutine Documentation

4.6.2.1 subroutine qdata::killq ( )

SUbroutine to deallocate user data for Q

4.6.2.2 subroutine qdata::loadq ( )

Subroutine to load in user data for Q.

4.6.3 Member Data Documentation

4.6.3.1 integer, dimension(:), allocatable qdata::qcol

4.6.3.2 real(kind=kind(1.0d0)), dimension(:), allocatable qdata::qdiag

4.6.3.3 integer qdata::qn

4.6.3.4 integer qdata::qne

4.6.3.5 integer, dimension(:), allocatable qdata::qrow

4.6.3.6 real(kind=kind(1.0d0)) qdata::qscale

4.6.3.7 real(kind=kind(1.0d0)), dimension(:), allocatable qdata::qval

The documentation for this module was generated from the following file:

- src/data/Qdata.f90

4.7 random Module Reference

A module for random number generation from the following distributions:

Public Member Functions

- real(kind=kind(1.0d+0)) function random_normal ()

  function to get random normal with zero mean and stdev 1
- real(kind=kind(1.0d+0)) function random_gamma (s, first)
- real(kind=kind(1.0d+0)) function random_gamma1 (s, first)
- real(kind=kind(1.0d+0)) function random_gamma2 (s, first)
- real(kind=kind(1.0d+0)) function random_chisq (ndf, first)
- real(kind=kind(1.0d+0)) function random_exponential ()
- real(kind=kind(1.0d+0)) function random_weibull (a)
- real(kind=kind(1.0d+0)) function random_beta (aa, bb, first)
- real(kind=kind(1.0d+0)) function random_t (m)
- subroutine random_mvnorm (n, h, d, f, first, x, ier)
- real(kind=kind(1.0d+0)) function random_inv_gauss (h, b, first)
- integer function random_poisson (mu, first)
- integer function random_binomial1 (n, p, first)
- real(kind=kind(1.0d+0)) function bin_prob (n, p, r)
- real(dp) function lngamma (x)
- integer function random_binomial2 (n, pp, first)
- integer function random_neg_binomial (sk, p)
- real(kind=kind(1.0d+0)) function random_von_mises (k, first)
- real(kind=kind(1.0d+0)) function random_cauchy ()
- subroutine random_order (order, n)
- subroutine seed_random_number (iounit)

Public Attributes

- integer, parameter dp = SELECTED_REAL_KIND(12, 60)

4.7.1 Detailed Description

A module for random number generation from the following distributions:

Distribution Function/subroutine name

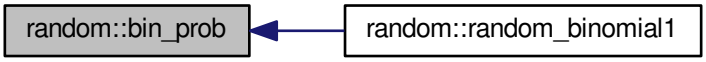
Normal (Gaussian) random_normal Gamma random_gamma Chi-squared random_chisq Exponential random_exponential Weibull random_Weibull Beta random_beta t random_t Multivariate normal random_mvnorm Generalized inverse Gaussian random_inv_gauss Poisson random_Poisson Binomial random_binomial1 ∗ random_binomial2 ∗ Negative binomial random_neg_binomial von Mises random_von_Mises Cauchy random_Cauchy

4.7.2 Member Function/Subroutine Documentation

4.7.2.1 real(kind=kind(1.0d+0)) function random::bin_prob (integer, intent(in) *n*, real(kind=kind(1.0d+0)), intent(in) *p*, integer, intent(in) *r*)

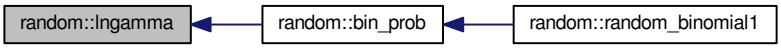
Here is the call graph for this function:

Here is the caller graph for this function:



4.7.2.2 real (dp) function random::lngamma (real (dp), intent(in) *x*)

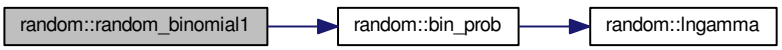
Here is the caller graph for this function:



4.7.2.3 real(kind=kind(1.0d+0)) function random::random_beta (real(kind=kind(1.0d+0)), intent(in) *aa,* real(kind=kind(1.0d+0)), intent(in) *bb,* logical, intent(in) *first*)

4.7.2.4 integer function random::random_binomial1 (integer, intent(in) *n,* real(kind=kind(1.0d+0)), intent(in) *p,* logical, intent(in) *first*)

Here is the call graph for this function:



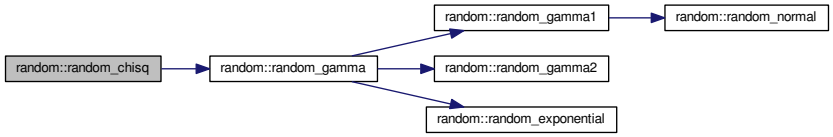
4.7.2.5 integer function random::random_binomial2 (integer, intent(in) *n,* real(kind=kind(1.0d+0)), intent(in) *pp,* logical, intent(in) *first*)

Here is the call graph for this function:

4.7.2.6 real(kind=kind(1.0d+0)) function random::random_cauchy ( )

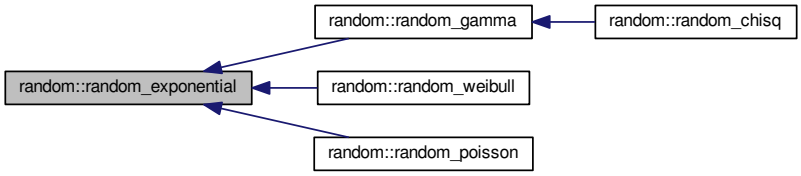
4.7.2.7 real(kind=kind(1.0d+0)) function random::random_chisq (integer, intent(in) *ndf,* logical, intent(in) *first*)

Here is the call graph for this function:



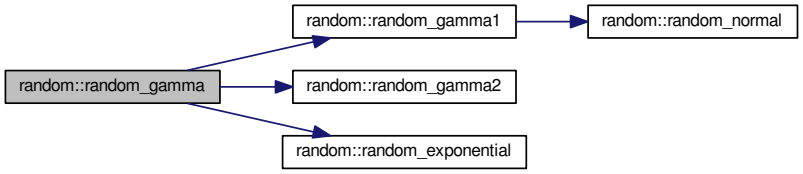
4.7.2.8 real(kind=kind(1.0d+0)) function random::random_exponential ( )

Here is the caller graph for this function:



4.7.2.9 real(kind=kind(1.0d+0)) function random::random_gamma (real(kind=kind(1.0d+0)), intent(in) *s,* logical, intent(in) *first*)

Here is the call graph for this function:

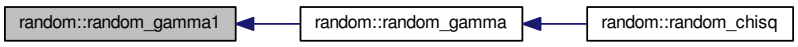


Here is the caller graph for this function:

4.7.2.10 real(kind=kind(1.0d+0)) function random::random_gamma1 (real(kind=kind(1.0d+0)), intent(in) *s,* logical, intent(in) *first*)

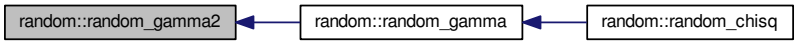
Here is the call graph for this function:

Here is the caller graph for this function:



4.7.2.11 real(kind=kind(1.0d+0)) function random::random_gamma2 (real(kind=kind(1.0d+0)), intent(in) *s,* logical, intent(in) *first*)

Here is the caller graph for this function:



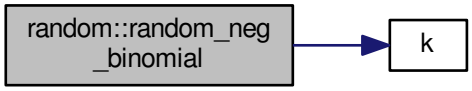
4.7.2.12 real(kind=kind(1.0d+0)) function random::random_inv_gauss (real(kind=kind(1.0d+0)), intent(in) *h,* real(kind=kind(1.0d+0)), intent(in) *b,* logical, intent(in) *first*)

4.7.2.13 subroutine random::random_mvnorm (integer, intent(in) *n,* real(kind=kind(1.0d+0)), dimension(:), intent(in) *h,* real(kind=kind(1.0d+0)), dimension(:), intent(in) *d,* real(kind=kind(1.0d+0)), dimension(:), intent(inout) *f,* logical, intent(in) *first,* real(kind=kind(1.0d+0)), dimension(:), intent(out) *x,* integer, intent(out) *ier*)

Here is the call graph for this function:

4.7.2.14 integer function random::random_neg_binomial (real(kind=kind(1.0d+0)), intent(in) *sk,* real(kind=kind(1.0d+0)), intent(in) *p*)

Here is the call graph for this function:



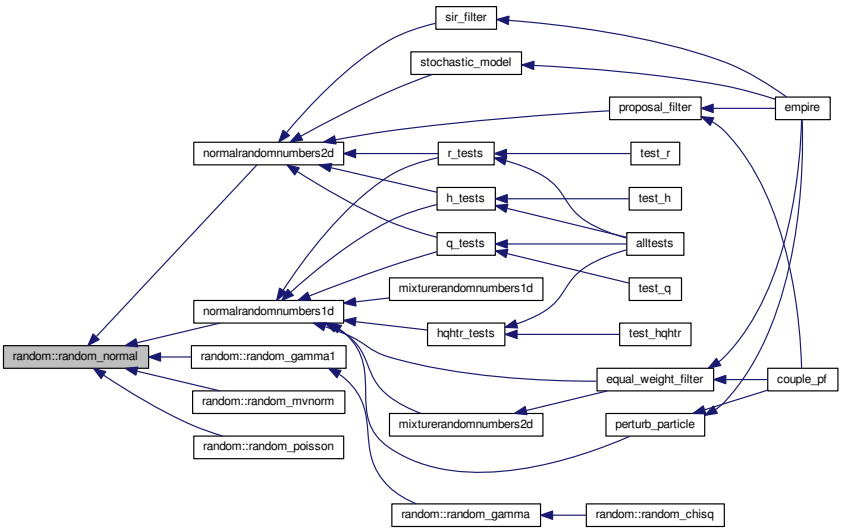
4.7.2.15 real(kind=kind(1.0d+0)) function random::random_normal ( )

function to get random normal with zero mean and stdev 1

Returns

fn_val

Here is the caller graph for this function:

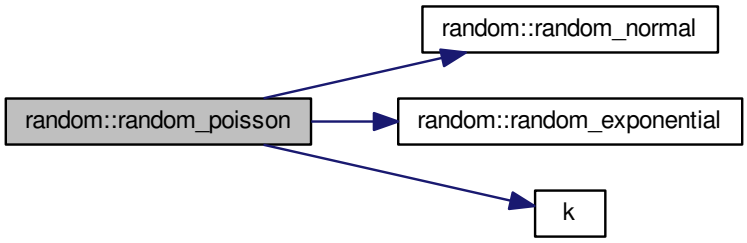


4.7.2.16 subroutine random::random_order (integer, dimension(n), intent(out) *order,* integer, intent(in) *n*)

Here is the call graph for this function:

4.7.2.17 integer function random::random_poisson (real(kind=kind(1.0d+0)), intent(in) *mu,* logical, intent(in) *first*)

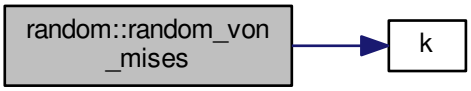
Here is the call graph for this function:



4.7.2.18 real(kind=kind(1.0d+0)) function random::random_t (integer, intent(in) *m*)

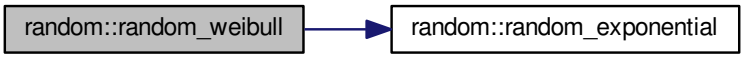
4.7.2.19 real(kind=kind(1.0d+0)) function random::random_von_mises (real(kind=kind(1.0d+0)), intent(in) *k,* logical, intent(in) *first*)

Here is the call graph for this function:



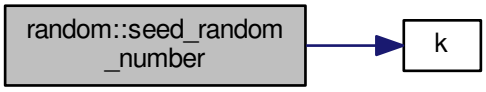
4.7.2.20 real(kind=kind(1.0d+0)) function random::random_weibull (real(kind=kind(1.0d+0)), intent(in) *a*)

Here is the call graph for this function:



4.7.2.21 subroutine random::seed_random_number (integer, intent(in) *iounit*)

Here is the call graph for this function:



4.7.3 Member Data Documentation

4.7.3.1 integer, parameter random::dp = SELECTED_REAL_KIND(12, 60)

The documentation for this module was generated from the following file:

- src/utils/random_d.f90

4.8 rdata Module Reference

Module to hold user supplied data for R observation error covariance matrix.

Public Member Functions

- subroutine loadr

  Subroutine to load data for R.
- subroutine killr

Public Attributes

- integer rn
- integer rne
- integer, dimension(:), allocatable rrow
- integer, dimension(:), allocatable rcol
- real(kind=kind(1.0d0)), dimension(:), allocatable rval
- real(kind=kind(1.0d0)), dimension(:), allocatable rdiag

4.8.1 Detailed Description

Module to hold user supplied data for R observation error covariance matrix.

4.8.2 Member Function/Subroutine Documentation

4.8.2.1 subroutine rdata::killr ( )

SUbroutine to deallocate R data

4.8.2.2 subroutine rdata::loadr ( )

Subroutine to load data for R.

4.8.3 Member Data Documentation

4.8.3.1 integer, dimension(:), allocatable rdata::rcol

4.8.3.2 real(kind=kind(1.0d0)), dimension(:), allocatable rdata::rdiag

4.8.3.3 integer rdata::rn

4.8.3.4 integer rdata::rne

4.8.3.5 integer, dimension(:), allocatable rdata::rrow

4.8.3.6 real(kind=kind(1.0d0)), dimension(:), allocatable rdata::rval

The documentation for this module was generated from the following file:

- src/data/Rdata.f90

4.9 sizes Module Reference

Module that stores the dimension of observation and state spaces.

Public Attributes

- integer obs_dim
  size of the observation space
- integer state_dim
  dimension of the model

4.9.1 Detailed Description

Module that stores the dimension of observation and state spaces.

4.9.2 Member Data Documentation

4.9.2.1 integer sizes::obs_dim

size of the observation space

4.9.2.2 integer sizes::state_dim

dimension of the model

The documentation for this module was generated from the following file:

- src/controlers/sizes.f90

Chapter 5

File Documentation

5.1 src/controlers/old_pf_couple.f90 File Reference

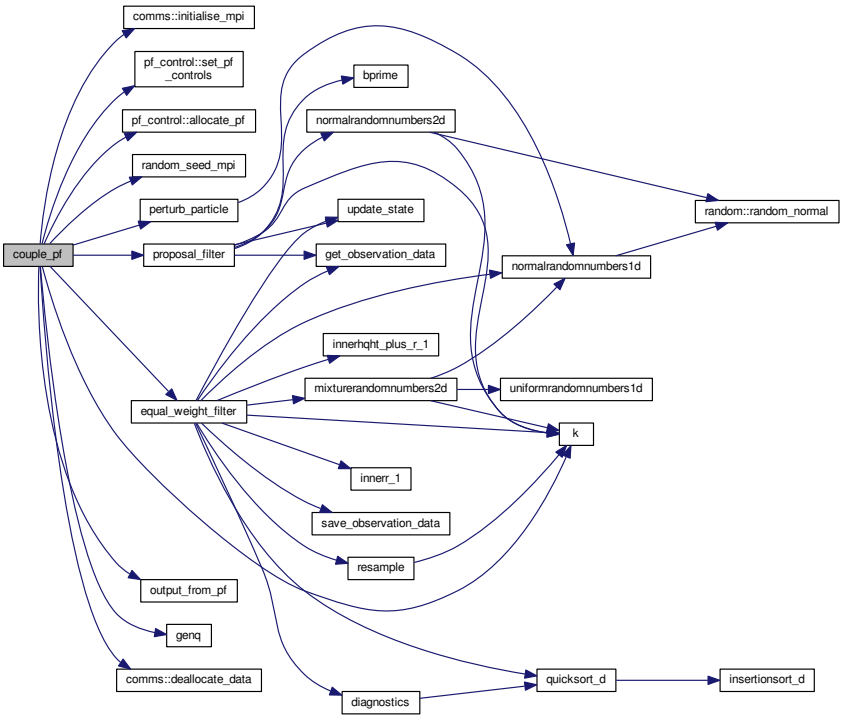
Functions/Subroutines

- program couple_pf

5.1.1 Function/Subroutine Documentation

5.1.1.1 program couple_pf ( )

Here is the call graph for this function:



5.2 src/controlers/pf_control.f90 File Reference

Data Types

- module pf_control

  module to hold all the information to control the the main program
- type pf_control::pf_control_type

5.3 src/controlers/pf_couple.f90 File Reference

Functions/Subroutines

- program empire

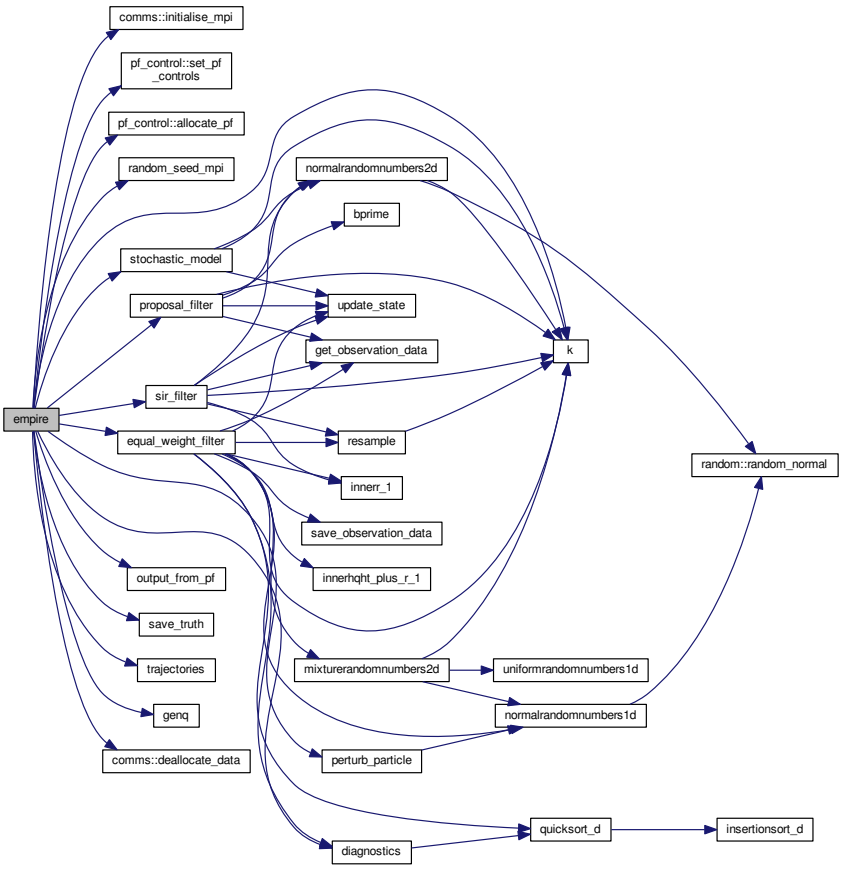
  the main program

5.3.1 Function/Subroutine Documentation

5.3.1.1 program empire ( )

the main program

Here is the call graph for this function:



5.4 src/controlers/sizes.f90 File Reference

Data Types

- module sizes

  Module that stores the dimension of observation and state spaces.

5.5 src/data/Qdata.f90 File Reference

Data Types

- module qdata

  Module as a place to store user specified data for Q.

5.6 src/data/Rdata.f90 File Reference

Data Types

- module rdata

  Module to hold user supplied data for R observation error covariance matrix.
- module hqht_plus_r

5.7 src/filters/eakf_analysis.f90 File Reference

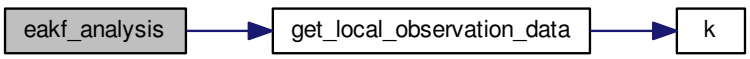
Functions/Subroutines

- subroutine eakf_analysis (num_hor, num_ver, this_hor, this_ver, boundary, x, N, stateDim, obsDim, rho)

5.7.1 Function/Subroutine Documentation

5.7.1.1 subroutine eakf_analysis (integer, intent(in) *num_hor,* integer, intent(in) *num_ver,* integer, intent(in) *this_hor,* integer, intent(in) *this_ver,* integer, intent(in) *boundary,* real(kind=rk), dimension(statedim,n), intent(inout) *x,* integer, intent(in) *N,* integer, intent(in) *stateDim,* integer, intent(in) *obsDim,* real(kind=rk), intent(in) *rho*)

Here is the call graph for this function:



Here is the caller graph for this function:

5.8 src/filters/enkf_specific.f90 File Reference

Functions/Subroutines

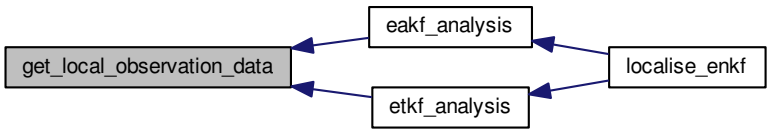
- subroutine h_local (num_hor, num_ver, this_hor, this_ver, boundary, nrhs, stateDim, x, obsDim, y)
- subroutine solve_rhalf_local (num_hor, num_ver, this_hor, this_ver, boundary, nrhs, obsDim, y, v)
- subroutine get_local_observation_data (num_hor, num_ver, this_hor, this_ver, boundary, obsDim, y)
- subroutine localise_enkf (enkf_analysis)

5.8.1 Function/Subroutine Documentation

5.8.1.1 subroutine get_local_observation_data (integer, intent(in) *num_hor,* integer, intent(in) *num_ver,* integer, intent(in) *this_hor,* integer, intent(in) *this_ver,* integer, intent(in) *boundary,* integer, intent(in) *obsDim,* real(kind=rk), dimension(obsdim), intent(out) *y*)

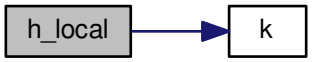
Here is the call graph for this function:

Here is the caller graph for this function:

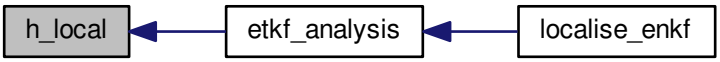


5.8.1.2 subroutine h_local (integer, intent(in) *num_hor,* integer, intent(in) *num_ver,* integer, intent(in) *this_hor,* integer, intent(in) *this_ver,* integer, intent(in) *boundary,* integer, intent(in) *nrhs,* integer, intent(in) *stateDim,* real(kind=rk), dimension(statedim,nrhs), intent(in) *x,* integer, intent(in) *obsDim,* real(kind=rk), dimension(obsdim,nrhs), intent(out) *y*)

Here is the call graph for this function:

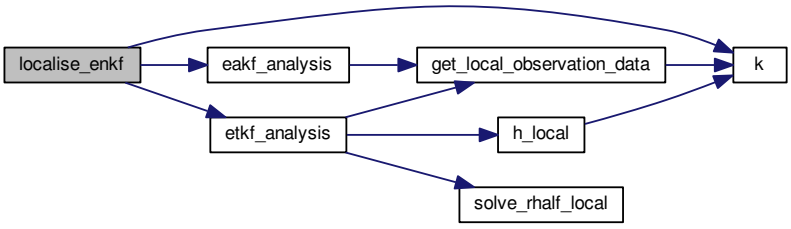


Here is the caller graph for this function:



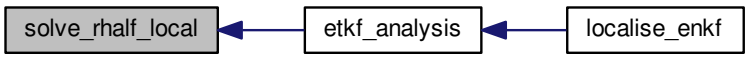
5.8.1.3 subroutine localise_enkf (integer, intent(in) *enkf_analysis*)

Here is the call graph for this function:



5.8.1.4 subroutine solve_rhalf_local (integer, intent(in) *num_hor,* integer, intent(in) *num_ver,* integer, intent(in) *this_hor,* integer, intent(in) *this_ver,* integer, intent(in) *boundary,* integer, intent(in) *nrhs,* integer, intent(in) *obsDim,* real(kind=rk), dimension(obsdim,nrhs), intent(in) *y,* real(kind=rk), dimension(obsdim,nrhs), intent(out) *v*)

Here is the caller graph for this function:



5.9 src/filters/equivalent_weights_step.f90 File Reference

Functions/Subroutines

- subroutine equal_weight_filter

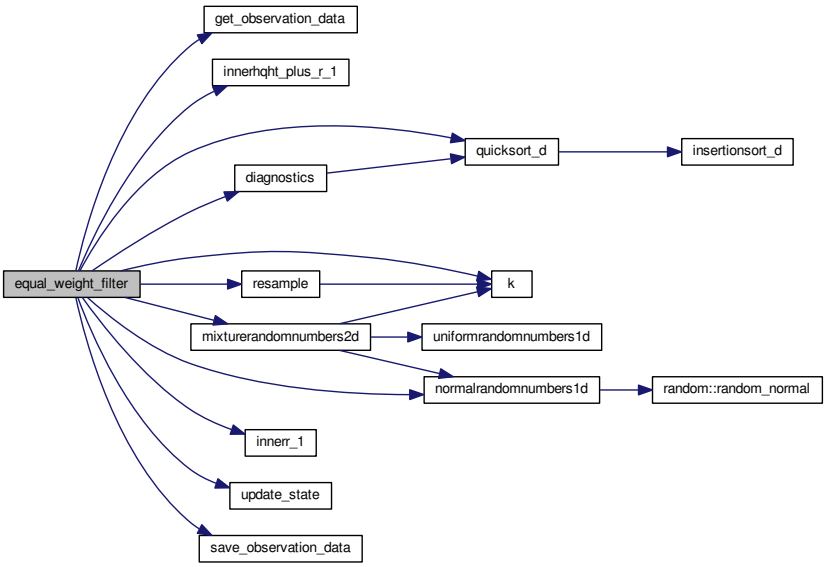
  subroutine to do the equivalent weights step

5.9.1 Function/Subroutine Documentation

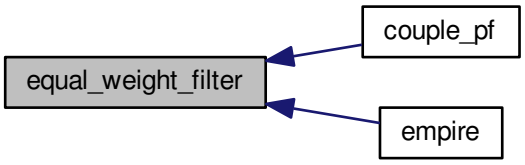
5.9.1.1 subroutine equal_weight_filter ( )

subroutine to do the equivalent weights step

Here is the call graph for this function:



Here is the caller graph for this function:



5.10 src/filters/etkf_analysis.f90 File Reference

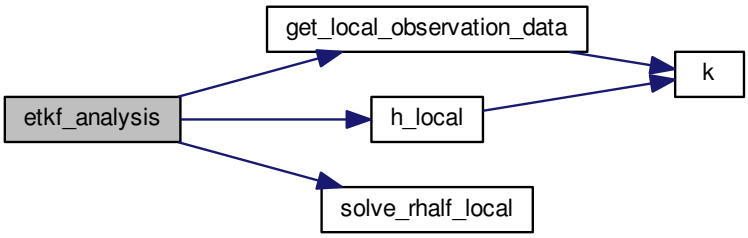
Functions/Subroutines

- subroutine etkf_analysis (num_hor, num_ver, this_hor, this_ver, boundary, x, N, stateDim, obsDim, rho)

5.10.1 Function/Subroutine Documentation

5.10.1.1 subroutine etkf_analysis (integer, intent(in) *num_hor,* integer, intent(in) *num_ver,* integer, intent(in) *this_hor,* integer, intent(in) *this_ver,* integer, intent(in) *boundary,* real(kind=rk), dimension(statedim,n), intent(inout) *x,* integer, intent(in) *N,* integer, intent(in) *stateDim,* integer, intent(in) *obsDim,* real(kind=rk), intent(in) *rho*)

Here is the call graph for this function:



Here is the caller graph for this function:

5.11 src/filters/proposal_filter.f90 File Reference

Functions/Subroutines

- subroutine proposal_filter

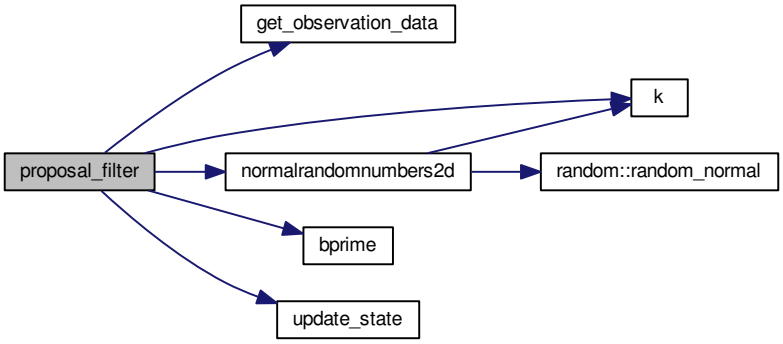
  Subroutine to perform nudging in the proposal step of EWPF.

5.11.1 Function/Subroutine Documentation

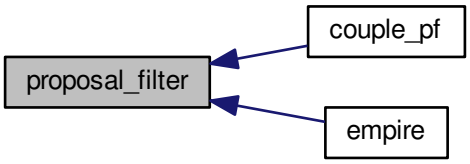
5.11.1.1 subroutine proposal_filter ( )

Subroutine to perform nudging in the proposal step of EWPF.

Here is the call graph for this function:



Here is the caller graph for this function:



5.12 src/filters/sir_filter.f90 File Reference

Functions/Subroutines

- subroutine sir_filter

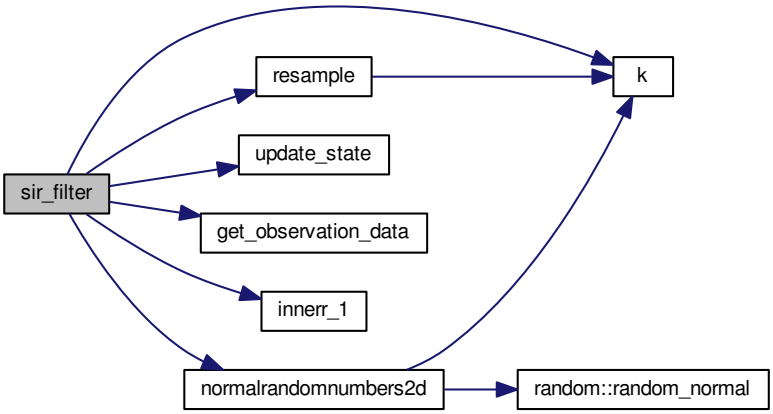
  Subroutine to perform SIR filter (Sequential Importance Resampling)

5.12.1 Function/Subroutine Documentation

5.12.1.1 subroutine sir_filter ( )

Subroutine to perform SIR filter (Sequential Importance Resampling)

Here is the call graph for this function:



Here is the caller graph for this function:

5.13 src/filters/stochastic_model.f90 File Reference

Functions/Subroutines

- subroutine stochastic_model

  subroutine to simply move the model forward in time one timestep PAB 21-05-2013
- subroutine check_scaling (x, fx, b, scales)

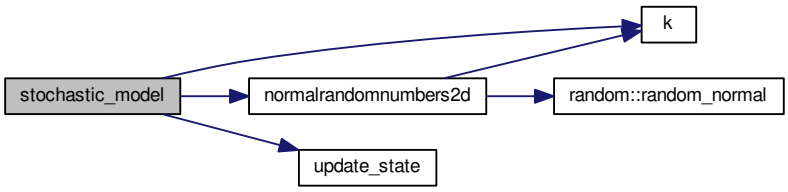
5.13.1 Function/Subroutine Documentation

5.13.1.1 subroutine check_scaling (real(kind=rk), dimension(state_dim), intent(in) *x,* real(kind=rk), dimension(state_dim), intent(in) *fx,* real(kind=rk), dimension(state_dim), intent(in) *b,* real(kind=rk), dimension(9), intent(inout) *scales*)

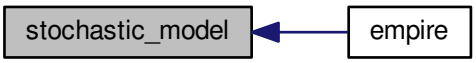
5.13.1.2 subroutine stochastic_model ( )

subroutine to simply move the model forward in time one timestep PAB 21-05-2013

Here is the call graph for this function:



Here is the caller graph for this function:



5.14 src/operations/gen_rand.f90 File Reference

Functions/Subroutines

- subroutine uniformrandomnumbers1d (minv, maxv, n, phi)

  generate one dimension of uniform random numbers
- subroutine normalrandomnumbers1d (mean, stdev, n, phi)

  generate one dimension of Normal random numbers
- subroutine normalrandomnumbers2d (mean, stdev, n, k, phi)

  generate two dimensional Normal random numbers
- subroutine mixturerandomnumbers1d (mean, stdev, ufac, epsi, n, phi, uniform)

  generate one dimensional vector drawn from mixture density
- subroutine mixturerandomnumbers2d (mean, stdev, ufac, epsi, n, k, phi, uniform)

  generate two dimensional vector, each drawn from mixture density
- subroutine random_seed_mpi (pfid)

  Subroutine to set the random seed across MPI threads.

5.14.1 Function/Subroutine Documentation

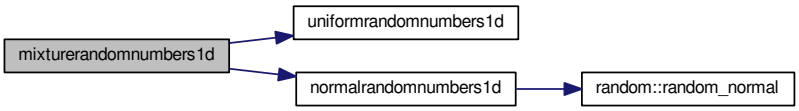
5.14.1.1 subroutine mixturerandomnumbers1d (real(kind=kind(1.0d0)), intent(in) *mean,* real(kind=kind(1.0d0)), intent(in) *stdev,* real(kind=kind(1.0d0)), intent(in) *ufac,* real(kind=kind(1.0d0)), intent(in) *epsi,* integer, intent(in) *n,* real(kind=kind(1.0d0)), dimension(n), intent(out) *phi,* logical, intent(out) *uniform*)

generate one dimensional vector drawn from mixture density

Parameters

in	*mean*	Mean of normal distribution
in	*stdev*	Standard deviation of normal distribution
in	*ufac*	half-width of uniform distribution that is centered on the mean
in	*epsi*	Proportion controlling mixture draw. if random_number $>$ epsi then draw from uniform, else normal
in	*n*	size of output vector
out	*phi*	n dimensional mixture random numbers
out	*uniform*	True if mixture drawn from uniform. False if drawn from normal

Here is the call graph for this function:



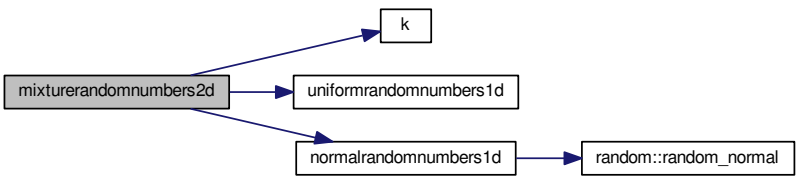
5.14.1.2 subroutine mixturerandomnumbers2d (real(kind=kind(1.0d0)), intent(in) *mean,* real(kind=kind(1.0d0)), intent(in) *stdev,* real(kind=kind(1.0d0)), intent(in) *ufac,* real(kind=kind(1.0d0)), intent(in) *epsi,* integer, intent(in) *n,* integer, intent(in) *k,* real(kind=kind(1.0d0)), dimension(n,k), intent(out) *phi,* logical, dimension(k), intent(out) *uniform*)

generate two dimensional vector, each drawn from mixture density

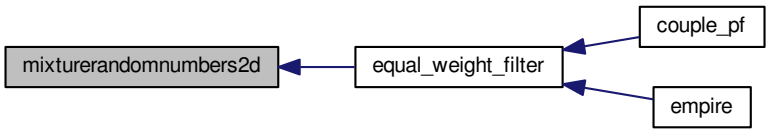
Parameters

in	*mean*	Mean of normal distribution
in	*stdev*	Standard deviation of normal distribution
in	*ufac*	half-width of uniform distribution that is centered on the mean
in	*epsi*	Proportion controlling mixture draw. if random_number $>$ epsi then draw from uniform, else normal
in	*n*	first dimension of output vector
in	*n*	second dimension of output vector
out	*phi*	n,k dimensional mixture random numbers
out	*uniform*	k dimensional logical with uniform(i) True if phi(:,i) drawn from uniform. False if drawn from normal

Here is the call graph for this function:



Here is the caller graph for this function:



5.14.1.3 subroutine normalrandomnumbers1d (real(kind=rk), intent(in) *mean,* real(kind=rk), intent(in) *stdev,* integer, intent(in) *n,* real(kind=rk), dimension(n), intent(out) *phi*)

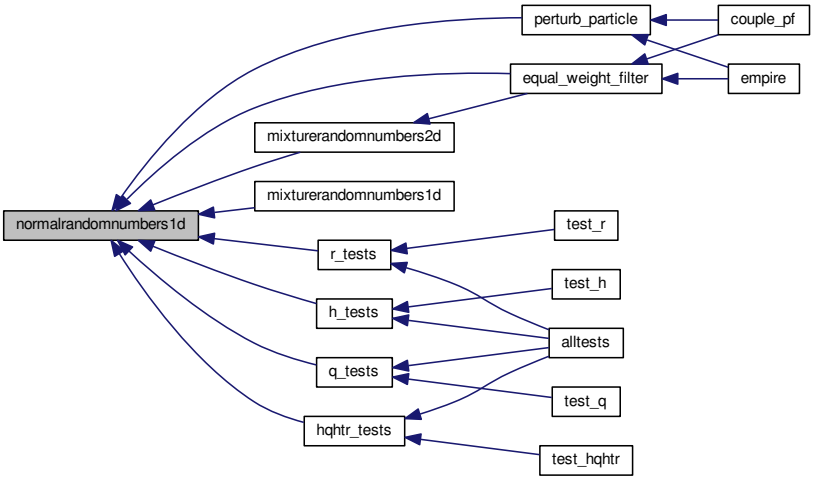
generate one dimension of Normal random numbers

Parameters

in	*n*	size of output vector
in	*mean*	mean of normal distribution
in	*stdev*	Standard Deviation of normal distribution
out	*phi*	n dimensional normal random numbers

Here is the call graph for this function:

Here is the caller graph for this function:



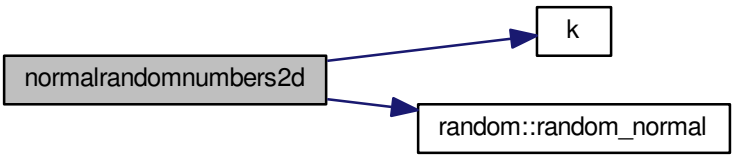
5.14.1.4 subroutine normalrandomnumbers2d (real(kind=rk), intent(in) *mean,* real(kind=rk), intent(in) *stdev,* integer, intent(in) *n,* integer, intent(in) *k,* real(kind=rk), dimension(n,k), intent(out) *phi*)

generate two dimensional Normal random numbers

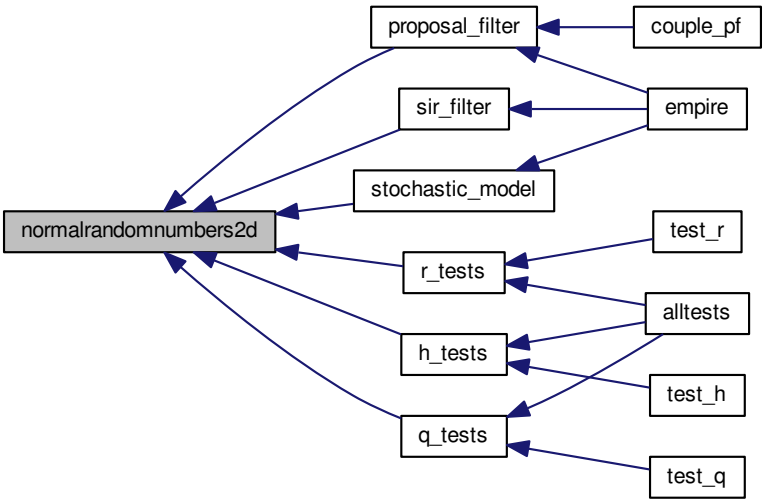
Parameters

in	*n*	first dimension of output vector
in	*n*	second dimension of output vector
in	*mean*	mean of normal distribution
in	*stdev*	Standard Deviation of normal distribution
out	*phi*	n,k dimensional normal random numbers

Here is the call graph for this function:



Here is the caller graph for this function:



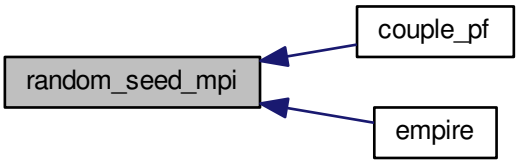
5.14.1.5 subroutine random_seed_mpi (integer, intent(in) *pfid*)

Subroutine to set the random seed across MPI threads.

Parameters

in	*pfid*	The process identifier of the MPI process

Here is the caller graph for this function:



5.14.1.6 subroutine uniformrandomnumbers1d (real(kind=rk), intent(in) *minv,* real(kind=rk), intent(in) *maxv,* integer, intent(in) *n,* real(kind=rk), dimension(n), intent(out) *phi*)

generate one dimension of uniform random numbers

Parameters

in	*n*	size of output vector
in	*minv*	minimum value of uniform distribution
in	*maxv*	maximum value of uniform distribution
out	*phi*	n dimensional uniform random numbers

Here is the caller graph for this function:

5.15 src/operations/operator_wrappers.f90 File Reference

Functions/Subroutines

- subroutine k (y, x)

  Subroutine to apply K to a vector y in observation space where $K := QH^T(HQH^T + R)^{-1}$.

- subroutine innerr_1 (y, w)

  subroutine to compute the inner product with R^{-1}

- subroutine innerhqht_plus_r_1 (y, w)

  subroutine to compute the inner product with $(HQH^T + R)^{-1}$

- subroutine bprime (y, x, QHtR_1y, normaln, betan)

  subroutine to calculate nudging term and correlated random errors efficiently

5.15.1 Function/Subroutine Documentation

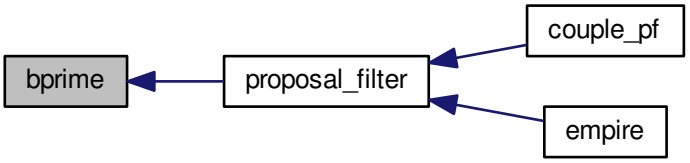
5.15.1.1 subroutine bprime (real(kind=rk), dimension(obs_dim,pf%count), intent(in) *y,* real(kind=rk), dimension(state_dim,pf%count), intent(out) *x,* real(kind=rk), dimension(state_dim,pf%count), intent(out) *QHtR_1y,* real(kind=rk), dimension(state_dim,pf%count), intent(in) *normaln,* real(kind=rk), dimension(state_dim,pf%count), intent(out) *betan*)

subroutine to calculate nudging term and correlated random errors efficiently

Parameters

in	*y*	(obs_dim,pf%count) vectors of innovations $y - H(x^{n-1})$
out	*x*	(state_dim,pf%count) vectors of $\rho Q^{\frac{1}{2}} H^T R^{-1}[y - H(x^{n-1})]$
out	*QHtR_1y*	(state_dim,pf%count) vectors of $\rho QH^T R^{-1}[y - H(x^{n-1})]$
in	*normaln*	(state_dim,pf%count) uncorrelated random vectors such that normaln(:,i) $\sim \mathcal{N}(0, I)$
out	*betan*	(state_dim,pf%count) correlated random vectors such that betan(:,i) $\sim \mathcal{N}(0, Q)$

Here is the caller graph for this function:



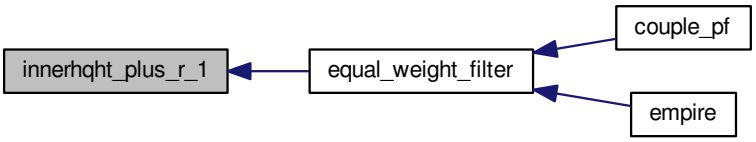
5.15.1.2 subroutine innerhqht_plus_r_1 (real(kind=rk), dimension(obs_dim), intent(in) *y*, real(kind=rk), intent(out) *w*)

subroutine to compute the inner product with $(HQH^T + R)^{-1}$

Parameters

in	*y*	vector in observation space
out	*w*	scalar with value $y^T R^{-1} y$

Here is the caller graph for this function:



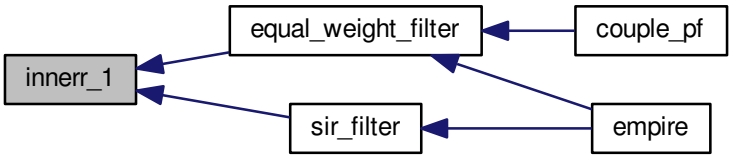
5.15.1.3 subroutine innerr_1 (real(kind=rk), dimension(obs_dim,pf%count), intent(in) *y*, real(kind=rk), dimension(pf%count), intent(out) *w*)

subroutine to compute the inner product with R^{-1}

Parameters

in	*y*	multiple vectors in observation space (pf%count of them)
out	*w*	multiple scalars (pf%count) where w(i) has the value $y(:,i)^T R^{-1} y(:,i)$

Here is the caller graph for this function:



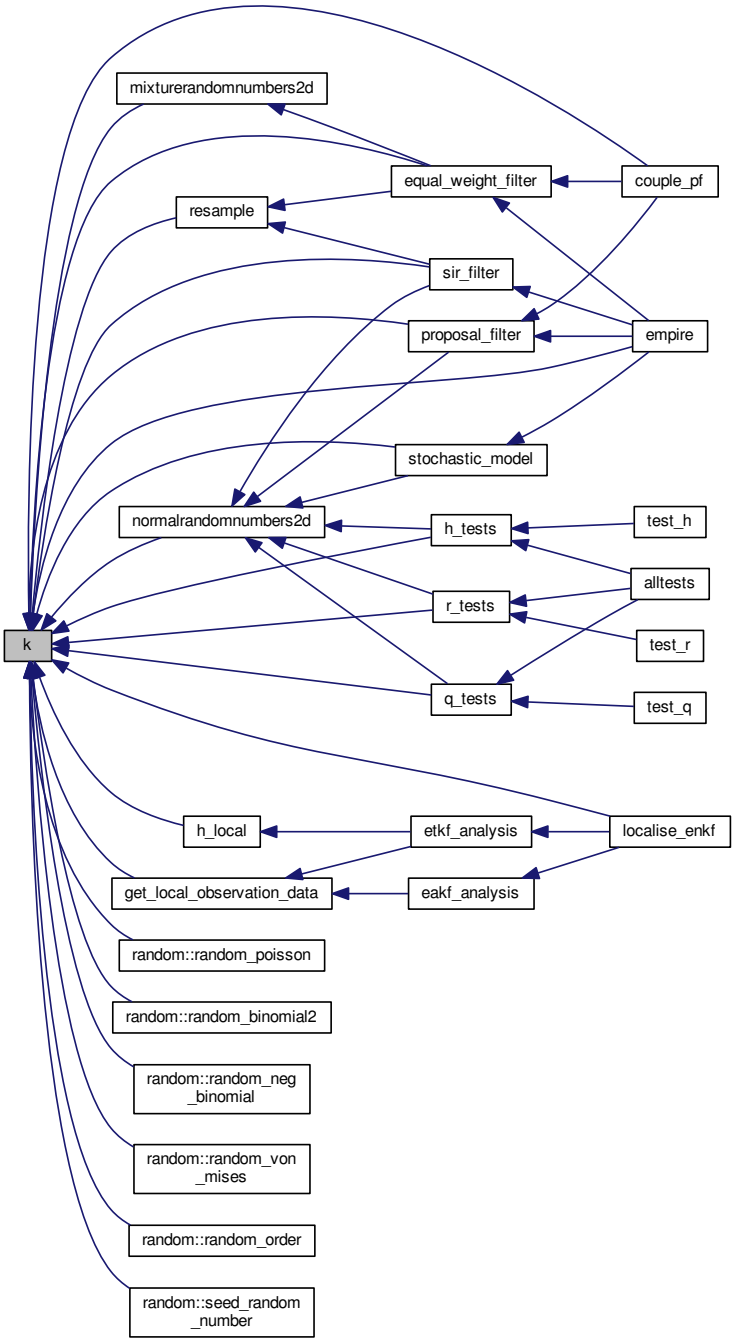
5.15.1.4 subroutine k (real(kind=rk), dimension(obs_dim,pf%count), intent(in) *y*, real(kind=rk), dimension(state_dim,pf%count), intent(out) *x*)

Subroutine to apply K to a vector y in observation space where $K := QH^T(HQH^T + R)^{-1}$.

Parameters

in	*y*	vector in observation space
out	*x*	vector in state space

Here is the caller graph for this function:



5.16 src/operations/perturb_particle.f90 File Reference

Functions/Subroutines

- subroutine perturb_particle (x)

  Subroutine to perturb state vector with normal random vector drawn from $\mathcal{N}(0, Q)$.

- subroutine update_state (state, fpsi, kgain, betan)

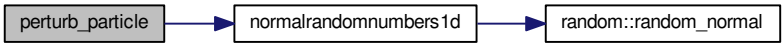
  Subroutine to update the state.

5.16.1 Function/Subroutine Documentation

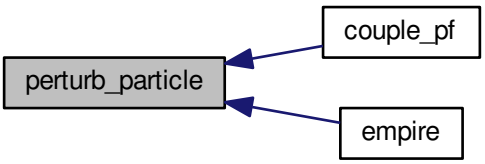
5.16.1.1 subroutine perturb_particle (real(kind=rk), dimension(state_dim), intent(inout) *x*)

Subroutine to perturb state vector with normal random vector drawn from $\mathcal{N}(0,Q)$.

Here is the call graph for this function:



Here is the caller graph for this function:



5.16.1.2 subroutine update_state (real(kind=rk), dimension(state_dim), intent(out) *state,* real(kind=rk), dimension(state_dim), intent(in) *fpsi,* real(kind=rk), dimension(state_dim), intent(in) *kgain,* real(kind=rk), dimension(state_dim), intent(inout) *betan*)

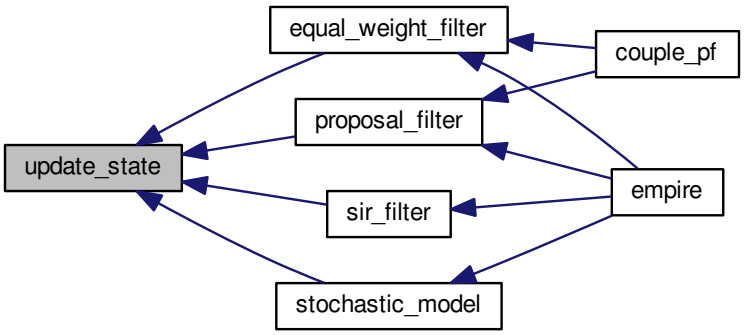
Subroutine to update the state.

This can be changed for the specific model if it needs to be

Parameters

in	*fpsi*	deterministic model update $f(x^{n-1})$
in	*kgain*	nudging term
in,out	*betan*	Stochastic term
out	*state*	The updated state vector

Here is the caller graph for this function:



5.17 src/operations/resample.f90 File Reference

Functions/Subroutines

- subroutine resample

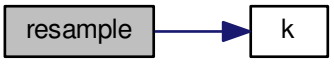
  Subroutine to perform Universal Importance Resampling.

5.17.1 Function/Subroutine Documentation

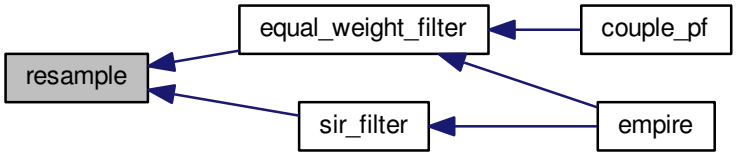
5.17.1.1 subroutine resample ( )

Subroutine to perform Universal Importance Resampling.

Here is the call graph for this function:



Here is the caller graph for this function:



5.18 src/tests/alltests.f90 File Reference

Functions/Subroutines

- program alltests

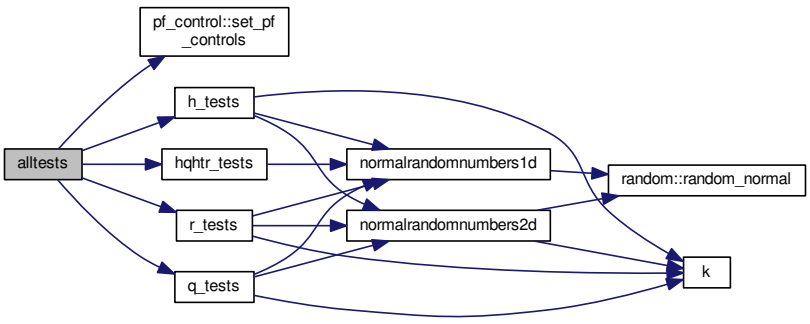
  program to run all tests of user specific functions

5.18.1 Function/Subroutine Documentation

5.18.1.1 program alltests ( )

program to run all tests of user specific functions

Here is the call graph for this function:



5.19 src/tests/test_h.f90 File Reference

Functions/Subroutines

- program test_h

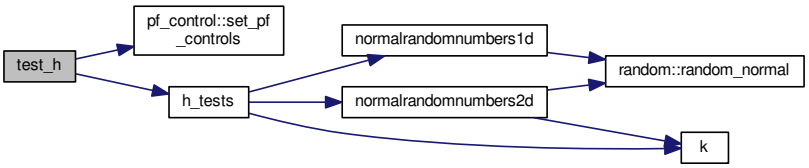
  program to run tests of user supplied observation operator

5.19.1 Function/Subroutine Documentation

5.19.1.1 program test_h ( )

program to run tests of user supplied observation operator

Here is the call graph for this function:



5.20 src/tests/test_hqhtr.f90 File Reference

Functions/Subroutines

- program test_hqhtr

  program to run tests of user supplied linear solve

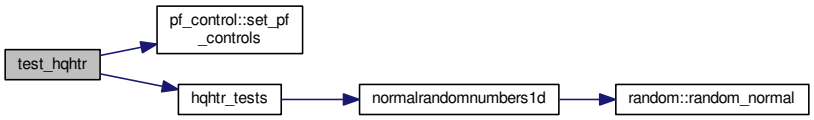
5.20.1 Function/Subroutine Documentation

5.20.1.1 program test_hqhtr ( )

program to run tests of user supplied linear solve

$(HQH^T + R)^{-1}$

Here is the call graph for this function:



5.21 src/tests/test_q.f90 File Reference

Functions/Subroutines

- program test_q

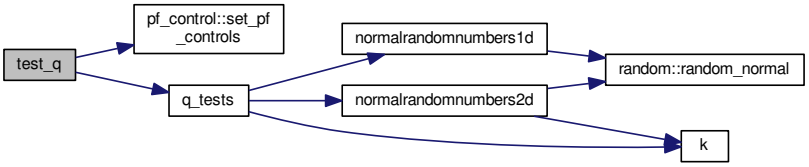
  program to run tests of user supplied model error covariance matrix

5.21.1 Function/Subroutine Documentation

5.21.1.1 program test_q ( )

program to run tests of user supplied model error covariance matrix

Here is the call graph for this function:



5.22 src/tests/test_r.f90 File Reference

Functions/Subroutines

- program test_r

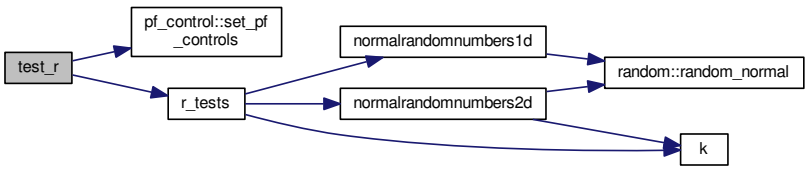
  program to run all tests of user supplied observation error covariance matrix/

5.22.1 Function/Subroutine Documentation

5.22.1.1 program test_r ( )

program to run all tests of user supplied observation error covariance matrix/

Here is the call graph for this function:



5.23 src/tests/tests.f90 File Reference

Functions/Subroutines

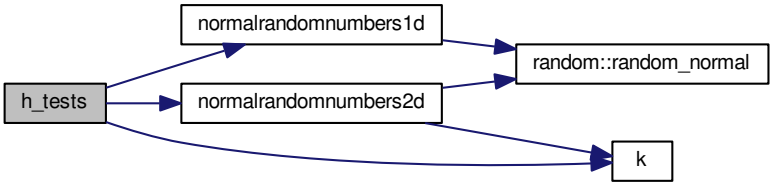
- subroutine h_tests ()
- subroutine r_tests ()
- subroutine q_tests ()
- subroutine hqhtr_tests ()

5.23.1 Function/Subroutine Documentation

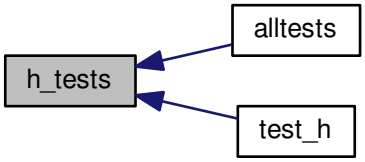
5.23.1.1 subroutine h_tests ( )

These are some tests to check that the observation operator is implemented correctly

Here is the call graph for this function:



Here is the caller graph for this function:

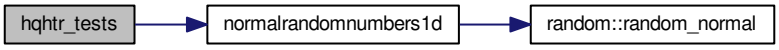


5.23.1.2 subroutine hqhtr_tests ( )

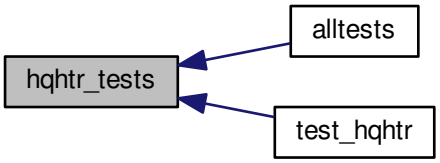
These are some tests to check that the linear solve operator is implemented correctly

This should check the operation $(HQH^T + R)^{-1}$ is working

Here is the call graph for this function:



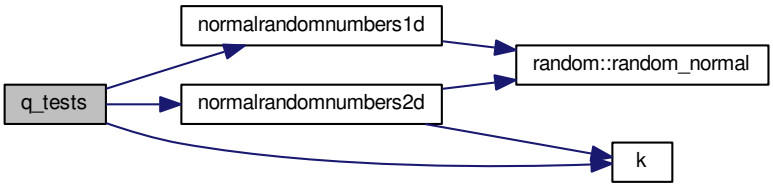
Here is the caller graph for this function:



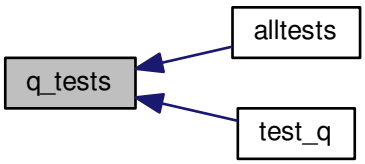
5.23.1.3 subroutine q_tests ( )

These are some tests to check that the model error covariance matrix is implemented correctly

Here is the call graph for this function:



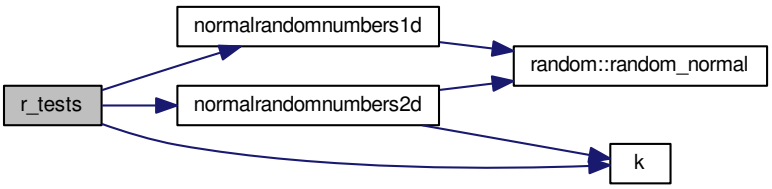
Here is the caller graph for this function:



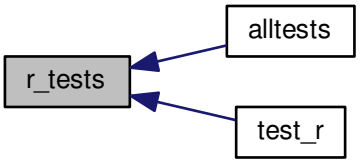
5.23.1.4 subroutine r_tests ( )

These are some tests to check that the observation error covariance matrix is implemented correctly

Here is the call graph for this function:



Here is the caller graph for this function:



5.24 src/utils/comms.f90 File Reference

Data Types

- module comms

  Module containing EMPIRE coupling data.

5.25 src/utils/data_io.f90 File Reference

Functions/Subroutines

- subroutine get_observation_data (y)

  Subroutine to read observation from a file
  Uses pftimestep to determine which observation to read.
- subroutine save_observation_data (y)

  Subroutine to save observation to a file
  Uses pftimestep to determine which observation to save.
- subroutine save_truth (x)

  Subroutine to save truth to a file
  .
- subroutine output_from_pf

  subroutine to ouput data from the filter

5.25.1 Function/Subroutine Documentation

5.25.1.1 subroutine get_observation_data (real(kind=rk), dimension(obs_dim), intent(out) *y*)

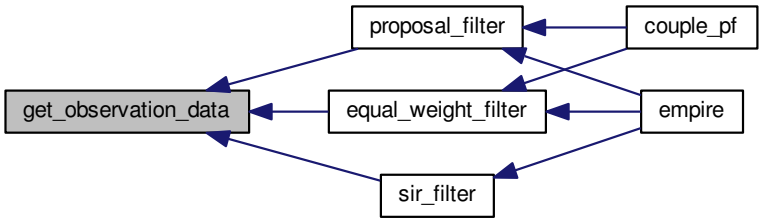
Subroutine to read observation from a file

Uses pftimestep to determine which observation to read.

Parameters

out	*y*	The observation

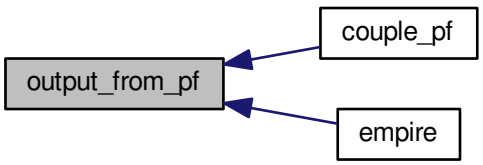
Here is the caller graph for this function:



5.25.1.2 subroutine output_from_pf ( )

subroutine to ouput data from the filter

Here is the caller graph for this function:



5.25.1.3 subroutine save_observation_data (real(kind=rk), dimension(obs_dim), intent(in) *y*)

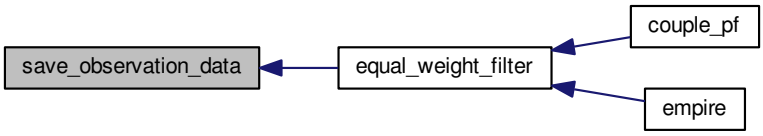
Subroutine to save observation to a file

Uses pftimestep to determine which observation to save.

Parameters

in	*y*	The observation

Here is the caller graph for this function:



5.25.1.4 subroutine save_truth (real(kind=rk), dimension(state_dim), intent(in) *x*)

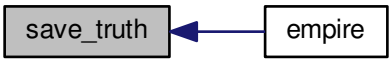
Subroutine to save truth to a file

.

Parameters

in	*x*	The state vector

Here is the caller graph for this function:



5.26 src/utils/diagnostics.f90 File Reference

Functions/Subroutines

- subroutine diagnostics

  Subroutine to give output diagnositics such as rank histograms and trajectories.
- subroutine trajectories

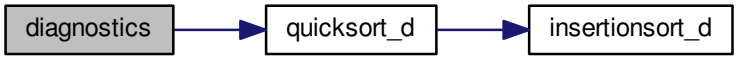
  subroutine to output trajectories

5.26.1 Function/Subroutine Documentation

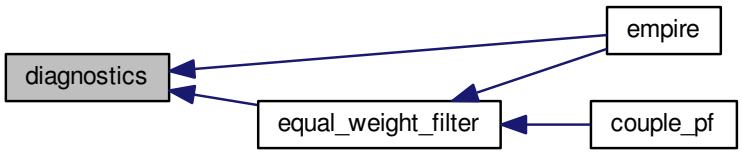
5.26.1.1 subroutine diagnostics ( )

Subroutine to give output diagnositics such as rank histograms and trajectories.

Here is the call graph for this function:



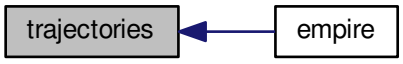
Here is the caller graph for this function:



5.26.1.2 subroutine trajectories ( )

subroutine to output trajectories

Here is the caller graph for this function:



5.27 src/utils/genQ.f90 File Reference

Functions/Subroutines

- subroutine genq

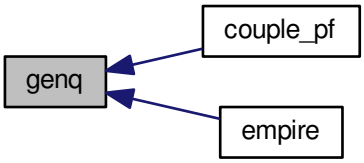
  Subroutine to estimate Q from a long model run.

5.27.1 Function/Subroutine Documentation

5.27.1.1 subroutine genq ( )

Subroutine to estimate Q from a long model run.

Here is the caller graph for this function:



5.28 src/utils/histogram.f90 File Reference

Data Types

- module histogram_data

  Module to control what variables are used to generate rank histograms.

5.29 src/utils/quicksort.f90 File Reference

Functions/Subroutines

- recursive subroutine quicksort_d (a, na)

  subroutine to sort using the quicksort algorithm

- subroutine insertionsort_d (A, nA)

  subroutine to sort using the insertionsort algorithm

5.29.1 Function/Subroutine Documentation

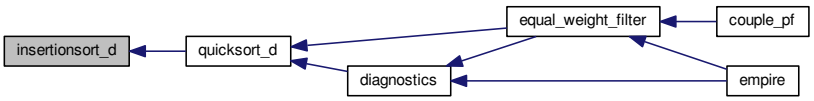
5.29.1.1 subroutine insertionsort_d (real(kind=kind(1.0d0)), dimension(na), intent(inout) *A*, integer, intent(in) *nA*)

subroutine to sort using the insertionsort algorithm

Parameters

in,out	*a*	array of doubles to be sorted
in	*na*	dimension of array a

Here is the caller graph for this function:



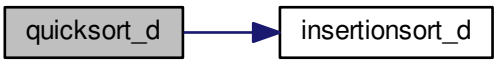
5.29.1.2 recursive subroutine quicksort_d (real(kind=kind(1.0d0)), dimension(na), intent(inout) *a*, integer, intent(in) *na*)

subroutine to sort using the quicksort algorithm

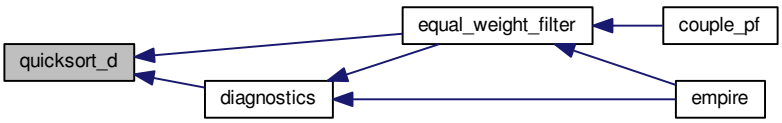
Parameters

in,out	*a*	array of doubles to be sorted
in	*na*	dimension of array a

Here is the call graph for this function:



Here is the caller graph for this function:



5.30 src/utils/random_d.f90 File Reference

Data Types

- module random

  A module for random number generation from the following distributions:

Index