ASH3D.F90

Call Parse_Command_Line
Call Set_OS_Env
Call Read_Control_File
  input_data_OPTMOD
Call ReadAirports
Call alloc_arrays
Call calc_mesh_params
Call Allocate_Source_Umbrella
Call Calc_Normalized_SourceCol
Call NC_RestartFile_LoadConcen
Call Allocate_Atmosphere_Met
Call Allocate_Tephra_Met
Call Allocate_Output_UserVars
Call MesoInterpolater
  MesoInterpolater_OPTMOD
Call output_results
Call Allocate_Ntime
Call Allocate_Profile
Call EruptivePulse_MassFluxRate

Loop over time:
  Call MesoInterpolater
  Call CheckEruptivePulses
  Call TephraSourceNodes
    Source_OPTMOD
  Call Set_BC
  Call AdvectHorz
  Call advect_z
  Call Set_BC
  Call DiffuseVert
  Call DiffuseHorz
  Call Gen_Output_Vars
    output_OPTMOD
  Call FirstAsh
  Call Calc_vprofile
  Call vprofilewriter
  Call Gen_Output_Vars
  Call output_results
  Call Gen_Output_Vars
  Call TimeStepTotals
  Call Gen_Output_Vars
  Call Prune_GS
End loop over time

Call Gen_Output_Vars
Call output_results
Call TimeStepTotals
Call dealloc_arrays
  dealloc_OPTMOD

Setup / Initialization

Input_Data.f90
MODULE Ash3d_Program_Control
Parse_Command_line
  Call NC_RestartFile_ReadTimes
  Call help_general
  Call help_make
  Call help_run
  Call help_input
Set_OS_Env
  Call check_endian
  Call getlog
  Call hostnm
  Call getcwd
check_endian
Read_Control_File
  Call input_data_ResetParams
  Call get_ESP
  Call PJ_Set_Proj
  Call LatLonChecker
  Call xyChecker
  Call Allocate_Source_eruption
  Call MR_Allocate_FullMetFileList
  Call MR_Set_Gen_Index_GRIB
  Call MR_Read_Met_DimVars
  Call Allocate_Tephra
  Call Calculate_Tephra_Shape
  Call Sort_Tephra_Size
  Call vprofchecker
LatLonChecker
xyChecker
Vprofchecker
Read_PostProc_Control_File

Ash3d_VariableModules.f90
MODULE precis_param
MODULE io_units
MODULE global_param
MODULE io_data
  Deallocate_io_data
MODULE mesh
  Allocate_mesh
  Deallocate_mesh
MODULE solution
  Allocate_solution
  Deallocate_solution
MODULE time_data
MODULE wind_grid
  Allocate_wind_grid
  Deallocate_wind_grid

Calc_Mesh.f90
calc_mesh_params
  Call MR_Set_CompProjection
  Call MR_Initialize_Met_Grids
  Call MR_Set_Met_Times
get_minmax_lonlat
  Call PJ_proj_inv
get_minmax_index

Tephra.f90
MODULE Tephra
Allocate_Tephra
Allocate_Tephra_Met
Deallocate_Tephra
Deallocate_Tephra_Met
Set_Vf_Meso
  Call Regrid_MetP_to_CompH
Calculate_Tephra_Shape
Sort_Tephra_Size
  Call partition_gsbins
partition_gsbins
Prune_GS
vset_WH
vset_WH_slip
vset_WH_PCM
vset_Gans
vset_Gans_slip
vset_Stokes_slip

Alloc_Arrays.f90
alloc_arrays
  Call Allocate_mesh
  Call Allocate_solution
  Call Allocate_wind_grid
  Call Allocate_Output_Vars
  Call Allocate_Source_grid
  Call Allocate_Diff
dealloc_arrays
  Call Deallocate_io_data
  Call Deallocate_mesh
  Call Deallocate_solution
  Call Deallocate_wind_grid
  Call Deallocate_Tephra
  Call Deallocate_Tephra_Met
  Call Deallocate_Source
  Call Deallocate_Source_Umbrella
  Call Deallocate_Diff
  Call Deallocate_Output_Vars
  Call Deallocate_Ntime
  Call Deallocate_Profile
  Call Deallocate_Output_UserVars
  Call Deallocate_Airports
  Call Deallocate_Atmosphere_Met

Atmosphere.f90
MODULE Atmosphere
Allocate_Atmosphere_Met
Deallocate_Atmosphere_Met
Set_Atmosphere_Meso
  Call MR_Read_3d_MetP_Variable
Dens_IdealGasLaw
Visc_Sutherland
lambda_MeanFreePath

Help.f90
MODULE Help
help_general
  Call help_run
help_make
help_run
help_input
  Call help_inputfile
help_inputfile
help_postproc

ResetParams.f90
input_data_ResetParams

VotW.f90
MODULE VotW_ESP
get_ESP
  Call VotW_v12
VotW_v12

Airports.f90
MODULE Airports
Allocate_Airports
Deallocate_Airports
ReadAirports
  Call Read_GlobalAirports
  Call ReadExtAirports
  Call PJ_proj_for
  Call Allocate_Airports
  Call PJ_proj_for
bilinear_thickness
ReadExtApirports
Read_GlobalAirports

/opt/USGS/Ash3d/share/GlobalAirports_ewert.txt

/opt/USGS/Ash3d/share/VotW_ESP_v12_csv.txt

Set Met. Values / Calc. dt

MesoInterpolater.f90
MesoInterpolater
  Call Read_NextMesoStep
  Call Adjust_DT
  Call umbrella_winds
Read_NextMesoStep
  Call MR_Read_HGT_arrays
  Call MR_Read_3d_Met_Variable_to_CompH
  Call MR_Rotate_UV_ER2GR_Comp
  Call MR_Rotate_UV_GR2ER_Met
  Call Set_Atmosphere_Meso
  Call MR_Read_3d_MetP_Variable
  Call MR_Regrid_MetP_to_CompH
  Call Set_Vf_Meso

Adjust_DT.f90
Adjust_DT

Source

Source.f90
MODULE Source
Allocate_Source_eruption
Allocate_Source_grid
Deallocate_Source
Calc_Normalized_SourceCol
EruptivePulse_MassFluxRate
CheckEruptivePulses
TephraSourceNodes
SourceVolInc

Source_Umbrella.f90
MODULE Source_Umbrella
Allocate_Source_Umbrella
Deallocate_Source_Umbrella
umbrella_winds
TephraSourceNodes_Umbrella
SourceVolInc_Umbrella
AbgCon_Umbrella

Set_BC.f90
Set_BC

Advection

AdvectionHorz.f90
MODULE AdvectionHorz
AdvectHorz
  Call get_minmax_index
  Call advect_x
  Call advect_y

AdvectionHorz_DCU.f90
MODULE AdvectionHorz_DCU
advect_x
advect_y

AdvectionVert_DCU.f90
MODULE AdvectionVert_DCU
advect_z

Diffusion

Diffusion.f90
MODULE Diffusion
Allocate_Diff
Deallocate_Diff
DiffuseHorz
  Call diffCN_x
  Call diffCN_y
  Call diff_x
  Call diff_y
DiffuseVert
  Call diffCN_z
  Call diff_z
diff_x
diff_y
diff_z
diffCN_x
  Call sptsv / dptsv
diffCN_y
  Call sptsv / dptsv
diffCN_z
  Call sptsv / dptsv

Test Output Criteria

Output_Vars.f90
MODULE Output_Vars
Allocate_Output_Vars
Allocate_Ntime
Allocate_Profile
Allocate_Output_UserVars
Deallocate_Output_Vars
Deallocate_Ntime
Deallocate_Profile
Deallocate_Output_UserVars
Set_OutVar_ContourLevel
AshThicknessCalculator
AshTotalCalculator
DbZCalculator
  Call AshLoadCalculator
ConcentrationCalculator
CloudAreaCalculator
Get_Output_Vars
  Call AshThicknessCalculator
  Call ConcentrationCalculator
  Call CloudAreaCalculator
Calc_AshVol_Aloft
Calc_vprofile
Calc_AshVol_Deposit
Calc_AshVol_Outflow
FirstAsh
  Call ConcentrationCalculator
  Call AshThicknessCalculator

TimeStepTotals.f90
TimeStepsTotals
  Call Calc_AshVol_Aloft
  Call Calc_AshVol_Deposit
  Call Calc_AshVol_Outflow
  HS_yyyymmddhhmm_since

Output

Output_Results.f90
output_results
  Call vprofileopener
  Call Set_OutVar_Specs
  Call OpenFile_KML
  Call NC_create_netcdf_file
  Call write_2D_ASCII
  Call write_2D_KML
  Call write_3D_ASCII
  Call write_3D_Binary
  Call write_2D_Binary
  Call NC_append_to_netcdf
  Call vprofileclose
  Call OpenFile_KML
  Call Write_2D_KML
  Call Close_KML
  Call write_2D_ASCII
  Call Write_PointData_Airports_KML
  Call Write_PointData_Airports_ASCII

write_ASCII.f90
MODULE Ash3d_ASCII_IO
Vprofileopener
Vprofilewriter
Vprofilecloser
write_2D_ASCII
read_2D_ASCII
write_3D_ASCII
write_PointData_Airports_ASCII

write_BINARY.f90
MODULE Ash3d_Binary_IO
write_2D_Binary
read_2D_Binary
write_2D_Binary
read_3D_Binary

write_KML.f90
MODULE Ash3d_KML_IO
Set_OutVar_Specs
OpenFile_KML
  Call PlotModelBoundary
  Call PJ_proj_inv
Write_2D_KML
  Call PJ_proj_inv
Write_PointData_Airports_KML
  Call PJ_proj_inv
Close_KML
PlotModelBoundary
  Call PJ_proj_inv

write_NETCDF.f90
MODULE Ash3d_Netcdf_IO
NC_create_netcdf_file
NC_append_to_netcdf
NC_RestartFile_ReadTimes
NC_Restart_LoadConcen
NC_check_status
NC_Read_Output_Products
  Call Allocate_Ntime
  Call Allocate_Airports
  Call Allocate_Profile
  Call Set_OutVar_ContourLevel