ASH3D.F90

Call Parse Command Line

Call Set_OS_Env Call Read Control File Call input data ResetParams 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 Call output results Call Allocate Ntime Call Allocate Profile Call EruptivePulse MassFluxRate

Loop over time: Call MesoInterpolater

Call CheckEruptivePulses Call TephraSourceNodes Call Set BC

Call AdvectHorz Call advect_z Call Set BC

Call DiffuseVert Call DiffuseHorz Call Gen Output_Vars 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

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 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 profchecker

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

Help.f90

Call help_inputfile

Adjust_DT

help_inputfile

help_postproc

help_run

help_input

Allocate_solution Deallocate_solution MODULE time_data Atmosphere.f90 MODULE Atmosphere Allocate_Atmosphere_Met MODULE wind_grid Allocate_wind_grid Deallocate wind grid Deallocate_Atmosphere_Me Set Atmosphere Meso

MODULE Help lambda_MeanFreePath help_general Call help_run help_make

Allocate_Tephra Allocate_Tephra_Met Deallocate_Tephra Deallocate_Tephra_Met Set_Vf_Meso

Calculate_Tephra_Shape Sort_Tephra_Size Call partition_gsbins partition_gsbins

vset_Gans vset_Stokes Call MR_Read_3d_MetP_Variable vset_Stokesslip Dens IdealGasLaw

ResetParams.f90 input_data_ResetParams VotW_v12

Calc Mesh.f90

Call MR Set CompProjection

Call MR Initialize Met Grids

Call MR Set Met Times

calc_mesh_params

get_minmax_lonlat

Call PJ_proj_inv

get_minmax_index

Visc Sutherland

Tephra.f90

MODULE Tephra

Call Regrid_MetP_to_CompH

Prune_GS vset_WH vset_WH_slip vset_WH_PCM

VotW.f90 MODULE VotW_ESP get_ESP Call VotW_v12

Airports.f90 MODULE Airports Allocate_Airports

Deallocate_Airports

Alloc_Arrays.f90

alloc_arrays

Call Allocate mesh

Call Allocate Diff

dealloc arrays

Call Allocate solution

Call Allocate wind grid

Call Deallocate io data

Call Deallocate mesh

Call Deallocate solution

Call Deallocate Tephra

Call Deallocate Source

Call Deallocate Diff

Call Deallocate Ntime

Call Deallocate Profile

Call Deallocate Airports

Call Deallocate wind grid

Call Deallocate Tephra Met

Call Deallocate Output Vars

Call Deallocate Source Umbrella

Call Deallocate Output UserVars

Call Deallocate_Atmosphere_Met

Call Allocate Output Vars

Call Allocate Source grid

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

Deallocate_Source Calc Normalized SourceCol EruptivePulse_MassFluxRate CheckEruptivePulses TephraSourceNodes 4 6 1 ourceVolInc

Set_BC.f90

Source

Source.f90 MODULE Source Allocate_Source_eruption Allocate_Source_grid

MODULE Source_Umbrella Allocate_Source_Umbrella Deallocate_Source_Umbrella umbrella winds TephraSourceNodes_Umbrella SourceVolInc_Umbrella AbgCon_Umbrella

Source Umbrella.f90

Set_BC

Advection

AdvectionHorz.f90

MODULE AdvectionHorz AdvectHorz 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

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 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 AshThicknessCalculato

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 Set_OutVar_Specs

Call OpenFile_KML Call create netcdf file Call write 2D ASCII

Call write 2D KML Call write 3D ASCII

Call write 3D Binary Call 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

Vprofilewriter Vprofilecloser read 2D ASCII write 3D ASCII

write_PointData_Airports_ASCII

write BINARY.f90 MODULE Ash3d_Binary_IO write_3D_Binary write 2D 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