pyrad library reference for developers

Release 0.0.1

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Dec 09, 2016

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ONE

PYRAD.FLOW.FLOW_CONTROL

functions to control the Pyrad data processing flow

main(cfgfile, starttime, endtime[, infostr, ...])	main flow control. Processes data over a given period of time
_create_cfg_dict(cfgfile)	creates a configuration dictionary
_create_datacfg_dict(cfg)	creates a data configuration dictionary from a config dictionary
_create_dscfg_dict(cfg, dataset[, voltime])	creates a dataset configuration dictionary
_create_prdcfg_dict(cfg, dataset, product, ...)	creates a product configuration dictionary
_get_datatype_list(cfg[, radarnr])	get list of unique input data types
_get_datasets_list(cfg)	get list of dataset at each processing level
_get_masterfile_list(datatypesdescr, ...[, ...])	get master file list
_add_dataset(new_dataset, radar_list, ind_rad)	adds a new field to an existing radar object
_process_dataset(cfg, dscfg[, proc_status, ...])	processes a dataset
_warning_format(message, category, filename, ...)	

pyrad.flow.flow_control.**_add_dataset**(*new_dataset*, *radar_list*, *ind_rad*, *make_global=True*)

adds a new field to an existing radar object

Parameters **new_dataset** : radar object

the radar object containing the new fields

radar : radar object

the radar object containing the global data

make_global : boolean

if true a new field is added to the global data

Returns 0 if successful. None otherwise

pyrad.flow.flow_control.**_create_cfg_dict**(*cfgfile*)

creates a configuration dictionary

Parameters **cfgfile** : str

path of the main config file

Returns **cfg** : dict

dictionary containing the configuration data

pyrad.flow.flow_control.**_create_datacfg_dict**(*cfg*)

creates a data configuration dictionary from a config dictionary

Parameters **cfg** : dict

config dictionary

Returns **datacfg** : dict

data config dictionary

pyrad.flow.flow_control.**_create_dscfg_dict**(*cfg*, *dataset*, *voltime=None*)
creates a dataset configuration dictionary

Parameters **cfg** : dict

config dictionary

dataset : str

name of the dataset

voltime : datetime object

time of the dataset

Returns **dscfg** : dict

dataset config dictionary

pyrad.flow.flow_control.**_create_prdcfg_dict**(*cfg*, *dataset*, *product*, *voltime*, *runinfo=None*)
creates a product configuration dictionary

Parameters **cfg** : dict

config dictionary

dataset : str

name of the dataset used to create the product

product : str

name of the product

voltime : datetime object

time of the dataset

Returns **prdcfg** : dict

product config dictionary

pyrad.flow.flow_control.**_get_datasets_list**(*cfg*)
get list of dataset at each processing level

Parameters **cfg** : dict

config dictionary

Returns **dataset_levels** : dict

a dictionary containing the list of datasets at each processing level

pyrad.flow.flow_control.**_get_datatype_list**(*cfg*, *radarnr='RADAR001'*)
get list of unique input data types

Parameters **cfg** : dict

config dictionary

radarnr : str

radar number identifier

Returns **datatypesdescr** : list

list of data type descriptors

pyrad.flow.flow_control.**_get_masterfile_list**(*datatypesdescr*, *starttime*, *endtime*, *datacfg*, *scan_list=None*)

get master file list

Parameters **datatypesdescr** : list

list of unique data type descriptors

starttime, endtime : datetime object

start and end of processing period

datacfg : dict

data configuration dictionary

scan_list : list

list of scans

Returns **masterfilelist** : list

the list of master files

masterdatatypedescr : str

the master data type descriptor

pyrad.flow.flow_control.**_process_dataset**(*cfg*, *dscfg*, *proc_status=0*, *radar_list=None*, *voltime=None*, *trajectory=None*, *runinfo=None*)

processes a dataset

Parameters **cfg** : dict

configuration dictionary

dscfg : dict

dataset specific configuration dictionary

proc_status : int

status of the processing 0: Initialization 1: process of radar volume 2: Final processing

radar : radar object

radar object containing the data to be processed

voltime : datetime object

reference time of the radar

trajectory : Trajectory object

containing trajectory samples

Returns 0 if a new dataset has been created. None otherwise

pyrad.flow.flow_control.**_warning_format**(*message*, *category*, *filename*, *lineno*, *file=None*, *line=None*)

pyrad.flow.flow_control.**main**(*cfgfile*, *starttime*, *endtime*, *infostr=''*, *trajfile=''*)

main flow control. Processes data over a given period of time

Parameters **cfgfile** : str

path of the main config file

starttime, endtime : datetime object

start and end time of the data to be processed

trajfile : str

path to file describing the trajectory

infostr : Information string about the actual data processing

(e.g. 'RUN57'). This sting is added to product files.

CHAPTER

TWO

PYRAD.PROC.PROCESS_AUX

Auxiliary functions. Functions to determine the process type, pass raw data to the product generation functions, save radar data and extract data at determined points or regions of interest.

get_process_func(dataset_type, dsname)	maps the dataset type into its processing function and data set format
process_raw(procstatus, dscfg[, radar_list])	dummy function that returns the initial input data set
process_save_radar(procstatus, dscfg[, ...])	dummy function that allows to save the entire radar object
process_point_measurement(procstatus, dscfg)	Obtains the radar data at a point measurement
process_trajectory(procstatus, dscfg[, ...])	Return trajectory
process_traj_atplane(procstatus, dscfg[, ...])	Return time series according to trajectory

pyrad.proc.process_aux.**get_process_func**(*dataset_type*, *dsname*)

maps the dataset type into its processing function and data set format

Parameters **dataset_type** : str

data set type, i.e. 'RAW', 'SAN', etc.

dsname : str

Name of dataset

Returns **func_name** : str or function

pyrad function used to process the data set type

dsformat : str

data set format, i.e.: 'VOL', etc.

pyrad.proc.process_aux.**process_point_measurement**(*procstatus*, *dscfg*, *radar_list=None*)

Obtains the radar data at a point measurement

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [string. Dataset keyword] The data type where we want to extract the point measurement

latlon [boolean. Dataset keyword] if True position is obtained from latitude, longitude information, otherwise position is obtained from antenna coordinates (range, azimuth, elevation).

truealt [boolean. Dataset keyword] if True the user input altitude is used to determine the point of interest. if False use the altitude at a given radar elevation ele over the point of interest.

lon [float. Dataset keyword] the longitude [deg]. Use when latlon is True.

lat [float. Dataset keyword] the latitude [deg]. Use when latlon is True.

alt [float. Dataset keyword] altitude [m MSL]. Use when latlon is True.

ele [float. Dataset keyword] radar elevation [deg]. Use when latlon is False or when latlon is True and truealt is False

azi [float. Dataset keyword] radar azimuth [deg]. Use when latlon is False

rng [float. Dataset keyword] range from radar [m]. Use when latlon is False

AziTol [float. Dataset keyword] azimuthal tolerance to determine which radar azimuth to use [deg]

EleTol [float. Dataset keyword] elevation tolerance to determine which radar elevation to use [deg]

RngTol [float. Dataset keyword] range tolerance to determine which radar bin to use [m]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : dict

dictionary containing the data and metadata of the point of interest

ind_rad : int

radar index

pyrad.proc.process_aux.**process_raw**(*procstatus*, *dscfg*, *radar_list=None*)

dummy function that returns the initial input data set

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_aux.**process_save_radar**(*procstatus*, *dscfg*, *radar_list=None*)

dummy function that allows to save the entire radar object

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_aux.**process_traj_atplane**(*procstatus*, *dscfg*, *radar_list=None*, *trajectory=None*)

Return time series according to trajectory

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration

radar_list : list of Radar objects

Optional. list of radar objects

trajectory : Trajectory object

containing trajectory samples

Returns **new_dataset** : Trajectory object

radar object

ind_rad : int

None

pyrad.proc.process_aux.**process_trajectory**(*procstatus*, *dscfg*, *radar_list=None*, *trajectory=None*)

Return trajectory

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration

radar_list : list of Radar objects

Optional. list of radar objects

trajectory : Trajectory object

containing trajectory samples

Returns **new_dataset** : Trajectory object

radar object

ind_rad : int

None

CHAPTER

THREE

PYRAD.PROC.PROCESS_ECHOCLASS

Functions for echo classification and filtering

process_echo_id(procstatus, dscfg[, radar_list])	identifies echoes as 0: No data, 1: Noise, 2: Clutter,
process_echo_filter(procstatus, dscfg[, ...])	Masks all echo types that are not of the class specified in
process_filter_snr(procstatus, dscfg[, ...])	filters out low SNR echoes
process_filter_visibility(procstatus, dscfg)	filters out rays gates with low visibility and corrects the reflectivity
process_hydroclass(procstatus, dscfg[, ...])	Classifies precipitation echoes

pyrad.proc.process_echoclass.**process_echo_filter**(*procstatus*, *dscfg*, *radar_list=None*)

Masks all echo types that are not of the class specified in keyword echo_type

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

echo_type [int] The type of echo to keep: 1 noise, 2 clutter, 3 precipitation. Default 3

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_echoclass.**process_echo_id**(*procstatus*, *dscfg*, *radar_list=None*)

identifies echoes as 0: No data, 1: Noise, 2: Clutter, 3: Precipitation

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_echoclass.**process_filter_snr**(*procstatus*, *dscfg*, *radar_list=None*)

filters out low SNR echoes

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

SNRmin [float. Dataset keyword] The minimum SNR to keep the data.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_echoclass.**process_filter_visibility**(*procstatus*, *dscfg*, *radar_list=None*)

filters out rays gates with low visibility and corrects the reflectivity

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

VISmin [float. Dataset keyword] The minimum visibility to keep the data.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_echoclass.**process_hydroclass**(*procstatus*, *dscfg*, *radar_list=None*)

Classifies precipitation echoes

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

HYDRO_METHOD [string. Dataset keyword] The hydrometeor classification method. One of the following: SEMISUPERVISED

RADARCENTROIDS [string. Datset keyword] Used with HYDRO_METHOD SEMISUPERVISED. The name of the radar of which the derived centroids will be used. One of the following: A Albis, L Lema, P Plaine Morte, DX50

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

CHAPTER

FOUR

PYRAD.PROC.PROCESS_PHASE

Functions for PhiDP and KDP processing and attenuation correction

process_correct_phidp0(procstatus, dscfg[, ...])	corrects phidp of the system phase
process_smooth_phidp_single_window(...[, ...])	corrects phidp of the system phase and smoothes it using one window
process_smooth_phidp_double_window(...[, ...])	corrects phidp of the system phase and smoothes it using one window
process_kdp_leastsquare_single_window(...[, ...])	Computes specific differential phase using a piecewise least square method
process_kdp_leastsquare_double_window(...[, ...])	Computes specific differential phase using a piecewise least square method
process_phidp_kdp_Maesaka(procstatus, dscfg)	Estimates PhiDP and KDP using the method by Maesaka
process_phidp_kdp_lp(procstatus, dscfg[, ...])	Estimates PhiDP and KDP using a linear programming algorithm
process_selfconsistency_kdp_phidp	
process_selfconsistency_bias	
process_attenuation(procstatus, dscfg[, ...])	Computes specific attenuation and specific differential attenuation using

pyrad.proc.process_phase.**process_attenuation**(*procstatus*, *dscfg*, *radar_list=None*)

Computes specific attenuation and specific differential attenuation using the Z-Phi method and corrects reflectivity and differential reflectivity

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

ATT_METHOD [float. Dataset keyword] The attenuation estimation method used. One of the following: ZPhi, Philin

fzl [float. Dataset keyword] The default freezing level height. It will be used if no temperature field name is specified or the temperature field is not in the radar object. Default 2000.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_correct_phidp0**(*procstatus*, *dscfg*, *radar_list=None*)

corrects phidp of the system phase

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] The minimum range where to look for valid data [m]

rmax [float. Dataset keyword] The maximum range where to look for valid data [m]

rcell [float. Dataset keyword] The length of a continuous cell to consider it valid precip [m]

Zmin [float. Dataset keyword] The minimum reflectivity [dBZ]

Zmax [float. Dataset keyword] The maximum reflectivity [dBZ]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_kdp_leastsquare_double_window**(*procstatus*, *dscfg*, *radar_list=None*)

Computes specific differential phase using a piecewise least square method

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rwinds [float. Dataset keyword] The length of the short segment for the least square method [m]

rwindl [float. Dataset keyword] The length of the long segment for the least square method [m]

Zthr [float. Dataset keyword] The threshold defining which estimated data to use [dBZ]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_kdp_leastsquare_single_window**(*procstatus*, *dscfg*, *radar_list=None*)

Computes specific differential phase using a piecewise least square method

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rwind [float. Dataset keyword] The length of the segment for the least square method [m]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_phidp_kdp_Maesaka**(*procstatus*, *dscfg*, *radar_list=None*)

Estimates PhiDP and KDP using the method by Maesaka

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] The minimum range where to look for valid data [m]

rmax [float. Dataset keyword] The maximum range where to look for valid data [m]

rcell [float. Dataset keyword] The length of a continuous cell to consider it valid precip [m]

Zmin [float. Dataset keyword] The minimum reflectivity [dBZ]

Zmax [float. Dataset keyword] The maximum reflectivity [dBZ]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_phidp_kdp_lp**(*procstatus*, *dscfg*, *radar_list=None*)

Estimates PhiDP and KDP using a linear programming algorithm

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_smooth_phidp_double_window**(*procstatus*, *dscfg*, *radar_list=None*)

corrects phidp of the system phase and smoothes it using one window

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] The minimum range where to look for valid data [m]

rmax [float. Dataset keyword] The maximum range where to look for valid data [m]

rcell [float. Dataset keyword] The length of a continuous cell to consider it valid precip [m]

rwinds [float. Dataset keyword] The length of the short smoothing window [m]

rwindl [float. Dataset keyword] The length of the long smoothing window [m]

Zmin [float. Dataset keyword] The minimum reflectivity [dBZ]

Zmax [float. Dataset keyword] The maximum reflectivity [dBZ]

Zthr [float. Dataset keyword] The threshold defining wich smoothed data to used [dBZ]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_phase.**process_smooth_phidp_single_window**(*procstatus*, *dscfg*, *radar_list=None*)

corrects phidp of the system phase and smoothes it using one window

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] The minimum range where to look for valid data [m]

rmax [float. Dataset keyword] The maximum range where to look for valid data [m]

rcell [float. Dataset keyword] The length of a continuous cell to consider it valid precip [m]

rwind [float. Dataset keyword] The length of the smoothing window [m]

Zmin [float. Dataset keyword] The minimum reflectivity [dBZ]

Zmax [float. Dataset keyword] The maximum reflectivity [dBZ]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

CHAPTER

FIVE

PYRAD.PROC.PROCESS_RETRIEVE

Functions for retrieving new moments and products

process_signal_power(procstatus, dscfg[, ...])	Computes the signal power in dBm
process_snr(procstatus, dscfg[, radar_list])	Computes SNR
process_l(procstatus, dscfg[, radar_list])	Computes L parameter
process_cdr(procstatus, dscfg[, radar_list])	Computes Circular Depolarization Ratio
process_rainrate(procstatus, dscfg[, radar_list])	Estimates rainfall rate from polarimetric moments

pyrad.proc.process_retrieve.**process_cdr**(*procstatus*, *dscfg*, *radar_list=None*)

Computes Circular Depolarization Ratio

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [string. Dataset keyword] The input data type

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_retrieve.**process_l**(*procstatus*, *dscfg*, *radar_list=None*)

Computes L parameter

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [string. Dataset keyword] The input data type

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_retrieve.**process_rainrate**(*procstatus*, *dscfg*, *radar_list=None*)

Estimates rainfall rate from polarimetric moments

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [string. Dataset keyword] The input data type

RR_METHOD [string. Dataset keyword] The rainfall rate estimation method. One of the following: Z, ZPoly, KDP, A, ZKDP, ZA, hydro

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_retrieve.**process_signal_power**(*procstatus*, *dscfg*, *radar_list=None*)

Computes the signal power in dBm

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

mflossv [float. Global keyword] The matching filter losses of the vertical channel. Used if input is vertical reflectivity

radconstv [float. Global keyword] The vertical channel radar constant. Used if input is vertical reflectivity

mflossh [float. Global keyword] The matching filter losses of the vertical channel. Used if input is horizontal reflectivity

radconsth [float. Global keyword] The horizontal channel radar constant. Used if input is horizontal reflectivity

attg [float. Dataset keyword] The gas attenuation

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_retrieve.**process_snr**(*procstatus*, *dscfg*, *radar_list=None*)

Computes SNR

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [string. Dataset keyword] The input data type

output_type [string. Dataset keyword] The output data type. Either SNRh or SNRv

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

CHAPTER

SIX

PYRAD.PROC.PROCESS_CALIB

Functions for monitoring data quality and correct bias and noise effects

process_correct_bias(procstatus, dscfg[, ...])	Corrects a bias on the data
process_correct_noise_rhohv(procstatus, dscfg)	identifies echoes as 0: No data, 1: Noise, 2: Clutter,
process_selfconsistency_kdp_phidp(...[, ...])	Computes specific differential phase and differential phase in rain using
process_selfconsistency_bias(procstatus, dscfg)	Estimates the reflectivity bias by means of the selfconsistency
process_estimate_phidp0(procstatus, dscfg[, ...])	estimates the system differential phase offset at each ray
process_rhohv_rain(procstatus, dscfg[, ...])	Keeps only suitable data to evaluate the 80 percentile of RhoHV in rain
process_zdr_rain(procstatus, dscfg[, radar_list])	Keeps only suitable data to evaluate the differential reflectivity in
process_monitoring(procstatus, dscfg[, ...])	computes monitoring statistics
process_time_avg(procstatus, dscfg[, radar_list])	computes the temporal mean of a field
process_weighted_time_avg(procstatus, dscfg)	computes the temporal mean of a field weighted by the reflectivity
process_time_avg_flag(procstatus, dscfg[, ...])	computes a flag field describing the conditions of the data used while
process_colocated_gates(procstatus, dscfg[, ...])	Find colocated gates within two radars
process_intercomp(procstatus, dscfg[, ...])	intercomparison between two radars
process_sun_hits(procstatus, dscfg[, radar_list])	monitoring of the radar using sun hits

pyrad.proc.process_calib.**process_colocated_gates**(*procstatus*, *dscfg*, *radar_list=None*)

Find colocated gates within two radars

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

h_tol [float. Dataset keyword] Tolerance in altitude difference between radar gates [m]. Default 100.

latlon_tol [float. Dataset keyword] Tolerance in latitude and longitude position between radar gates [deg]. Default 0.0005

vol_d_tol [float. Dataset keyword] Tolerance in pulse volume diameter [m]. Default 100.

vismin [float. Dataset keyword] Minimum visibility [percent]. Default None.

hmin [float. Dataset keyword] Minimum altitude [m MSL]. Default None.

hmax [float. Dataset keyword] Maximum altitude [m MSL]. Default None.

rmin [float. Dataset keyword] Minimum range [m]. Default None.

rmax [float. Dataset keyword] Maximum range [m]. Default None.

elmin [float. Dataset keyword] Minimum elevation angle [deg]. Default None.

elmax [float. Dataset keyword] Maximum elevation angle [deg]. Default None.

azmin [float. Dataset keyword] Minimum azimuth angle [deg]. Default None.

azmax [float. Dataset keyword] Maximum azimuth angle [deg]. Default None.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : radar object

radar object containing the flag field

ind_rad : int

radar index

pyrad.proc.process_calib.**process_correct_bias**(*procstatus*, *dscfg*, *radar_list=None*)

Corrects a bias on the data

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [string. Dataset keyword] The data type to correct for bias

bias [float. Dataset keyword] The bias to be corrected [dB]. Default 0

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_correct_noise_rhohv**(*procstatus*, *dscfg*, *radar_list=None*)

identifies echoes as 0: No data, 1: Noise, 2: Clutter, 3: Precipitation

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The data types used in the correction

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_estimate_phidp0**(*procstatus*, *dscfg*, *radar_list=None*)

estimates the system differential phase offset at each ray

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] The minimum range where to look for valid data [m]

rmax [float. Dataset keyword] The maximum range where to look for valid data [m]

rcell [float. Dataset keyword] The length of a continuous cell to consider it valid precip [m]

Zmin [float. Dataset keyword] The minimum reflectivity [dBZ]

Zmax [float. Dataset keyword] The maximum reflectivity [dBZ]

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_intercomp**(*procstatus*, *dscfg*, *radar_list=None*)

intercomparison between two radars

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

radar_list : list of Radar objects

Optional. list of radar objects

Returns **sun_hits_dict** : dict

dictionary containing a radar object, a sun_hits dict and a sun_retrieval dictionary

ind_rad : int

radar index

pyrad.proc.process_calib.**process_monitoring**(*procstatus*, *dscfg*, *radar_list=None*)
computes monitoring statistics

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

step [float. Dataset keyword] The width of the histogram bin. Default is None. In that case the default step in function get_histogram_bins is used

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object containing histogram data

ind_rad : int

radar index

pyrad.proc.process_calib.**process_rhohv_rain**(*procstatus*, *dscfg*, *radar_list=None*)
Keeps only suitable data to evaluate the 80 percentile of RhoHV in rain

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] minimum range where to look for rain [m]. Default 1000.

rmax [float. Dataset keyword] maximum range where to look for rain [m]. Default 50000.

Zmin [float. Dataset keyword] minimum reflectivity to consider the bin as precipitation [dBZ]. Default 20.

Zmax [float. Dataset keyword] maximum reflectivity to consider the bin as precipitation [dBZ] Default 40.

ml_thickness [float. Dataset keyword] assumed thickness of the melting layer. Default 700.

fzl [float. Dataset keyword] The default freezing level height. It will be used if no temperature field name is specified or the temperature field is not in the radar object. Default 2000.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_selfconsistency_bias**(*procstatus*, *dscfg*, *radar_list=None*)

Estimates the reflectivity bias by means of the selfconsistency algorithm by Gourley

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rsmooth [float. Dataset keyword] length of the smoothing window [m]. Default 1000.

min_rhohv [float. Dataset keyword] minimum valid RhoHV. Default 0.92

max_phidp [float. Dataset keyword] maximum valid PhiDP [deg]. Default 20.

rcell [float. Dataset keyword] length of continuous precipitation to consider the precipitation cell a valid phidp segment [m]. Default 1000.

dphidp_min [float. Dataset keyword] minimum phase shift [deg]. Default 2.

dphidp_max [float. Dataset keyword] maximum phase shift [deg]. Default 16.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_selfconsistency_kdp_phidp**(*procstatus*, *dscfg*, *radar_list=None*)

Computes specific differential phase and differential phase in rain using the selfconsistency between Zdr, Zh and KDP

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of strings. Dataset keyword] The input data types

rsmooth [float. Dataset keyword] length of the smoothing window [m]. Default 1000.

min_rhohv [float. Dataset keyword] minimum valid RhoHV. Default 0.92

max_phidp [float. Dataset keyword] maximum valid PhiDP [deg]. Default 20.

ml_thickness [float. Dataset keyword] assumed melting layer thickness [m]. Default 700.

fzl [float. Dataset keyword] The default freezing level height. It will be used if no temperature field name is specified or the temperature field is not in the radar object. Default 2000.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_sun_hits**(*procstatus*, *dscfg*, *radar_list=None*)

monitoring of the radar using sun hits

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] minimum range where to look for a sun hit signal [m]. Default 20

delev_max [float. Dataset keyword] maximum elevation distance from nominal radar elevation where to look for a sun hit signal [deg]. Default 1.5

dazim_max [float. Dataset keyword] maximum azimuth distance from nominal radar elevation where to look for a sun hit signal [deg]. Default 1.5

elmin [float. Dataset keyword] minimum radar elevation where to look for sun hits [deg]. Default 1.

percent_bins [float. Dataset keyword.] minimum percentage of range bins that have to contain signal to consider the ray a potential sun hit. Default 10.

attg [float. Dataset keyword] gaseous attenuation. Default None

max_std [float. Dataset keyword] maximum standard deviation to consider the data noise. Default 1.

az_width_co [float. Dataset keyword] co-polar antenna azimuth width (convoluted with sun width) [deg]. Default None

el_width_co [float. Dataset keyword] co-polar antenna elevation width (convoluted with sun width) [deg]. Default None

az_width_cross [float. Dataset keyword] cross-polar antenna azimuth width (convoluted with sun width) [deg]. Default None

el_width_cross [float. Dataset keyword] cross-polar antenna elevation width (convoluted with sun width) [deg]. Default None

ndays [int. Dataset keyword] number of days used in sun retrieval. Default 1

radar_list : list of Radar objects

Optional. list of radar objects

Returns **sun_hits_dict** : dict

dictionary containing a radar object, a sun_hits dict and a sun_retrieval dictionary

ind_rad : int

radar index

pyrad.proc.process_calib.**process_time_avg**(*procstatus*, *dscfg*, *radar_list=None*)
computes the temporal mean of a field

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

period [float. Dataset keyword] the period to average [s]. Default 3600.

start_average [float. Dataset keyword] when to start the average [s from midnight UTC]. Default 0.

lin_trans: int. Dataset keyword If 1 apply linear transformation before averaging

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_time_avg_flag**(*procstatus*, *dscfg*, *radar_list=None*)
computes a flag field describing the conditions of the data used while averaging

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

period [float. Dataset keyword] the period to average [s]. Default 3600.

start_average [float. Dataset keyword] when to start the average [s from midnight UTC]. Default 0.

phidpmax: float. Dataset keyword maximum PhiDP

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_weighted_time_avg**(*procstatus*, *dscfg*, *radar_list=None*)

computes the temporal mean of a field weighted by the reflectivity

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

period [float. Dataset keyword] the period to average [s]. Default 3600.

start_average [float. Dataset keyword] when to start the average [s from midnight UTC]. Default 0.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

pyrad.proc.process_calib.**process_zdr_rain**(*procstatus*, *dscfg*, *radar_list=None*)

Keeps only suitable data to evaluate the differential reflectivity in moderate rain

Parameters **procstatus** : int

Processing status: 0 initializing, 1 processing volume, 2 post-processing

dscfg : dictionary of dictionaries

data set configuration. Accepted Configuration Keywords:

datatype [list of string. Dataset keyword] The input data types

rmin [float. Dataset keyword] minimum range where to look for rain [m]. Default 1000.

rmax [float. Dataset keyword] maximum range where to look for rain [m]. Default 50000.

Zmin [float. Dataset keyword] minimum reflectivity to consider the bin as precipitation [dBZ]. Default 20.

Zmax [float. Dataset keyword] maximum reflectivity to consider the bin as precipitation [dBZ] Default 40.

rhohvmin [float. Dataset keyword] minimum RhoHV to consider the bin as precipitation Default 0.97

phidpmax [float. Dataset keyword] maximum PhiDP to consider the bin as precipitation [deg] Default 10.

elmax [float. Dataset keyword] maximum elevation angle where to look for precipitation [deg] Default 20.

ml_thickness [float. Dataset keyword] assumed thickness of the melting layer. Default 700.

fzl [float. Dataset keyword] The default freezing level height. It will be used if no temperature field name is specified or the temperature field is not in the radar object. Default 2000.

radar_list : list of Radar objects

Optional. list of radar objects

Returns **new_dataset** : Radar

radar object

ind_rad : int

radar index

CHAPTER

SEVEN

PYRAD.PROD.PRODUCT_AUX

Auxiliary functions to generate products

get_prodgen_func(dsformat, dsname, dstype)	maps the dataset format into its processing function

pyrad.prod.product_aux.**get_prodgen_func**(*dsformat*, *dsname*, *dstype*)
maps the dataset format into its processing function

Parameters **dsformat** : str

dataset group, i.e. 'VOL', etc.

Returns **func** : function

pyrad function used to generate the products

CHAPTER

EIGHT

PYRAD.PROD.PROCESS_PRODUCT

Functions for obtaining Pyrad products from the datasets

generate_sun_hits_products(dataset, prdcfg)	generates sun hits products
generate_intercomp_products(dataset, prdcfg)	generates radar intercomparison products
generate_colocated_gates_products(dataset, ...)	generates colocated gates products
generate_time_avg_products(dataset, prdcfg)	generates time average products
generate_vol_products(dataset, prdcfg)	generates radar volume products
generate_timeseries_products(dataset, prdcfg)	generates time series products
generate_monitoring_products(dataset, prdcfg)	

pyrad.prod.process_product.**generate_colocated_gates_products**(*dataset*, *prdcfg*)
generates colocated gates products

Parameters **dataset** : tuple

radar objects and colocated gates dictionary

prdcfg : dictionary of dictionaries

product configuration dictionary of dictionaries

Returns **filename** : str

the name of the file created. None otherwise

pyrad.prod.process_product.**generate_intercomp_products**(*dataset*, *prdcfg*)
generates radar intercomparison products

Parameters **dataset** : tuple

values of colocated gates dictionary

prdcfg : dictionary of dictionaries

product configuration dictionary of dictionaries

Returns **filename** : str

the name of the file created. None otherwise

pyrad.prod.process_product.**generate_monitoring_products**(*dataset*, *prdcfg*)

pyrad.prod.process_product.**generate_sun_hits_products**(*dataset*, *prdcfg*)
generates sun hits products

Parameters **dataset** : tuple

radar object and sun hits dictionary

prdcfg : dictionary of dictionaries

product configuration dictionary of dictionaries

Returns **filename** : str

the name of the file created. None otherwise

pyrad.prod.process_product.**generate_time_avg_products**(*dataset*, *prdcfg*)
generates time average products

Parameters **dataset** : tuple

radar objects and colocated gates dictionary

prdcfg : dictionary of dictionaries

product configuration dictionary of dictionaries

Returns **filename** : str

the name of the file created. None otherwise

pyrad.prod.process_product.**generate_timeseries_products**(*dataset*, *prdcfg*)
generates time series products

Parameters **dataset** : dictionary

radar object

prdcfg : dictionary of dictionaries

product configuration dictionary of dictionaries

Returns no return

pyrad.prod.process_product.**generate_vol_products**(*dataset*, *prdcfg*)
generates radar volume products

Parameters **dataset** : Radar

radar object

prdcfg : dictionary of dictionaries

product configuration dictionary of dictionaries

Returns no return

CHAPTER

NINE

PYRAD.IO.READ_DATA_RADAR

Functions for reading radar data files

get_data(voltime, datatypesdescr, cfg)	Reads pyrad input data.
merge_scans_rainbow(basepath, scan_list, ...)	merge rainbow scans
merge_scans_dem(basepath, scan_list, ...[, ...])	merge rainbow scans
merge_scans_rad4alp(basepath, scan_list, ...)	merge rad4alp data.
merge_scans_cosmo(voltime, datatype_list, cfg)	merge rainbow scans
merge_scans_cosmo_rad4alp(voltime, datatype, cfg)	merge cosmo rad4alp scans. If data for all the scans cannot be retrieved
merge_scans_dem_rad4alp(voltime, datatype, cfg)	merge cosmo rad4alp scans. If data for all the scans cannot be retrieved
merge_fields_rainbow(basepath, scan_name, ...)	merge Rainbow fields into a single radar object.
merge_fields_cosmo(filename_list)	merge COSMO fields in Rainbow file format
merge_fields_dem(basepath, scan_name, ...)	merge DEM fields into a single radar object.
get_data_rainbow(filename, datatype)	gets rainbow radar data
get_data_rad4alp(filename, datatype_list, ...)	gets rad4alp radar data
add_field(radar_dest, radar_orig)	adds the fields from orig radar into dest radar. If they are not in the
interpol_field(radar_dest, radar_orig, ...)	interpolates field field_name contained in radar_orig to the grid in

pyrad.io.read_data_radar.**add_field**(*radar_dest*, *radar_orig*)

adds the fields from orig radar into dest radar. If they are not in the same grid, interpolates them to dest grid

Parameters **radar_dest** : radar object

the destination radar

radar_orig : radar object

the radar object containing the original field

Returns **field_dest** : dict

interpolated field and metadata

pyrad.io.read_data_radar.**get_data**(*voltime*, *datatypesdescr*, *cfg*)

Reads pyrad input data.

Parameters **voltime** : datetime object

volume scan time

datatypesdescr : list

list of radar field types to read. Format : [radar file type]:[datatype]

cfg: dictionary of dictionaries

configuration info to figure out where the data is

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**get_data_rad4alp**(*filename*, *datatype_list*, *scan_name*, *cfg*, *ind_rad=0*)

gets rad4alp radar data

Parameters **filename** : str

name of file containing rainbow data

datatype_list : list of strings

list of data fields to get

scan_name : str

name of the elevation (001 to 020)

cfg : dict

configuration dictionary

ind_rad : int

radar index

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**get_data_rainbow**(*filename*, *datatype*)

gets rainbow radar data

Parameters **filename** : str

name of file containing rainbow data

datatype : str

field name

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**interpol_field**(*radar_dest*, *radar_orig*, *field_name*, *fill_value=None*)

interpolates field field_name contained in radar_orig to the grid in radar_dest

Parameters **radar_dest** : radar object

the destination radar

radar_orig : radar object

the radar object containing the original field

field_name: str

name of the field to interpolate

Returns **field_dest** : dict

interpolated field and metadata

pyrad.io.read_data_radar.**merge_fields_cfradial**(*basepath*, *loadname*, *voltime*, *datatype_list*, *dataset_list*, *product_list*)

merge CF/Radial fields into a single radar object.

Parameters **basepath** : str

name of the base path where to find the data

loadname: str

name of the saving directory

voltime : datetime object

reference time of the scan

datatype_list : list

list of data types to get

dataset_list : list

list of datasets that produced the data type to get. Used to get path.

product_list : list

list of products. Used to get path

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**merge_fields_cosmo**(*filename_list*)

merge COSMO fields in Rainbow file format

Parameters **filename_list** : str

list of file paths where to find the data

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**merge_fields_dem**(*basepath*, *scan_name*, *datatype_list*)

merge DEM fields into a single radar object.

Parameters **basepath** : str

name of the base path where to find the data

scan_name: str

name of the scan

datatype_list : list

lists of data types to get

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**merge_fields_rainbow**(*basepath*, *scan_name*, *voltime*, *datatype_list*)

merge Rainbow fields into a single radar object.

Parameters **basepath** : str

name of the base path where to find the data

scan_name: str

name of the scan

voltime : datetime object

reference time of the scan

datatype_list : list

lists of data types to get

Returns radar : Radar

radar object

pyrad.io.read_data_radar.**merge_scans_cosmo**(*voltime*, *datatype_list*, *cfg*, *ind_rad=0*)

merge rainbow scans

Parameters voltime: datetime object

reference time of the scan

datatype_list : list

lists of data types to get

cfg : dict

configuration dictionary

ind_rad : int

radar index

Returns radar : Radar

radar object

pyrad.io.read_data_radar.**merge_scans_cosmo_rad4alp**(*voltime*, *datatype*, *cfg*, *ind_rad=0*)

merge cosmo rad4alp scans. If data for all the scans cannot be retrieved returns None

Parameters voltime: datetime object

reference time of the scan

datatype : str

name of the data type to read

cfg : dict

configuration dictionary

ind_rad : int

radar index

Returns radar : Radar

radar object

pyrad.io.read_data_radar.**merge_scans_dem**(*basepath*, *scan_list*, *datatype_list*, *radarnr='RADAR001'*)

merge rainbow scans

Parameters basepath : str

base path of rad4alp radar data

scan_list : list

list of scans

datatype_list : list

lists of data types to get

radarnr : str

radar identifier number

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**merge_scans_dem_rad4alp**(*voltime*, *datatype*, *cfg*, *ind_rad=0*)

merge cosmo rad4alp scans. If data for all the scans cannot be retrieved returns None

Parameters **voltime: datetime object**

reference time of the scan

datatype : str

name of the data type to read

cfg : dict

configuration dictionary

ind_rad : int

radar index

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**merge_scans_rad4alp**(*basepath*, *scan_list*, *radar_name*, *radar_res*, *voltime*, *datatype_list*, *cfg*, *ind_rad=0*)

merge rad4alp data.

Parameters **basepath** : str

base path of rad4alp radar data

scan_list : list

list of scans (001 to 020)

radar_name : str

radar_name (A, D, L, ...)

radar_res : str

radar resolution (H or L)

voltime: datetime object

reference time of the scan

datatype_list : list

lists of data types to get

cfg : dict

configuration dictionary

ind_rad : int

radar index

Returns **radar** : Radar

radar object

pyrad.io.read_data_radar.**merge_scans_rainbow**(*basepath*, *scan_list*, *voltime*, *scan_period*, *datatype_list*, *cfg*, *radarnr='RADAR001'*)

merge rainbow scans

Parameters **basepath** : str

base path of rad4alp radar data

scan_list : list

list of scans

voltime: datetime object

reference time of the scan

scan_period : float

time from reference time where to look for other scans data

datatype_list : list

lists of data types to get

cfg : dict

configuration dictionary

radarnr : str

radar identifier number

Returns **radar** : Radar

radar object

CHAPTER

TEN

PYRAD.IO.READ_DATA_OTHER

Functions for reading auxiliary data

read_status(voltime, cfg[, ind_rad])	Reads rad4alp xml status file.
read_rad4alp_cosmo(fname, datatype)	Reads rad4alp COSMO data binary file.
read_rad4alp_vis(fname, datatype)	Reads rad4alp visibility data binary file.
read_colocated_gates(fname)	Reads a csv files containing the posistion of colocated gates
read_colocated_data(fname)	Reads a csv files containing colocated data
read_timeseries(fname)	Reads a time series contained in a csv file
read_monitoring_ts(fname)	Reads a monitoring time series contained in a csv file
read_sun_hits_multiple_days(cfg, time_ref[, ...])	Reads sun hits data from multiple file sources
read_sun_hits(fname)	Reads sun hits data contained in a csv file
read_sun_retrieval(fname)	Reads sun retrieval data contained in a csv file
read_solar_flux(fname)	Reads solar flux data from the DRAO observatory in Canada
get_sensor_data(date, datatype, cfg)	Gets data from a point measurement sensor (rain gauge or disdrometer)
read_smn(fname)	Reads SwissMetNet data contained in a csv file
read_disdro_scattering(fname)	Reads scattering parameters computed from disdrometer data contained in a
read_selfconsistency(fname)	Reads a self-consistency table with Zdr, Kdp/Zh columns

pyrad.io.read_data_other.**get_sensor_data**(*date*, *datatype*, *cfg*)

Gets data from a point measurement sensor (rain gauge or disdrometer)

Parameters **date** : datetime object

measurement date

datatype : str

name of the data type to read

cfg : dictionary

dictionary containing sensor information

Returns **sensordate , sensorvalue, label, period** : tupple

date, value, type of sensor and measurement period

pyrad.io.read_data_other.**read_colocated_data**(*fname*)

Reads a csv files containing colocated data

Parameters **fname** : str

path of time series file

Returns rad1_ele , rad1_azi, rad1_rng, rad1_val, rad2_ele, rad2_azi, rad2_rng,

rad2_val : tupple

A tupple with the data read. None otherwise

pyrad.io.read_data_other.**read_colocated_gates**(*fname*)

Reads a csv files containing the posistion of colocated gates

Parameters **fname** : str

path of time series file

Returns **rad1_ele , rad1_azi, rad1_rng, rad2_ele, rad2_azi, rad2_rng** : tupple

A tupple with the data read. None otherwise

pyrad.io.read_data_other.**read_disdro_scattering**(*fname*)

Reads scattering parameters computed from disdrometer data contained in a text file

Parameters **fname** : str

path of time series file

Returns **id, date , pressure, temp, rh, precip, wspeed, wdir** : arrays

The read values

pyrad.io.read_data_other.**read_monitoring_ts**(*fname*)

Reads a monitoring time series contained in a csv file

Parameters **fname** : str

path of time series file

Returns **date , np_t, central_quantile, low_quantile, high_quantile** : tupple

The read data. None otherwise

pyrad.io.read_data_other.**read_rad4alp_cosmo**(*fname*, *datatype*)

Reads rad4alp COSMO data binary file.

Parameters **fname** : str

name of the file to read

datatype : str

name of the data type

Returns **field** : dictionary

The data field

pyrad.io.read_data_other.**read_rad4alp_vis**(*fname*, *datatype*)

Reads rad4alp visibility data binary file.

Parameters **fname** : str

name of the file to read

datatype : str

name of the data type

Returns **field_list** : list of dictionaries

A data field. Each element of the list corresponds to one elevation

pyrad.io.read_data_other.**read_selfconsistency**(*fname*)
Reads a self-consistency table with Zdr, Kdp/Zh columns

Parameters **fname** : str

path of time series file

Returns **zdr, kdpzh** : arrays

The read values

pyrad.io.read_data_other.**read_smn**(*fname*)
Reads SwissMetNet data contained in a csv file

Parameters **fname** : str

path of time series file

Returns **id, date , pressure, temp, rh, precip, wspeed, wdir** : tupple

The read values

pyrad.io.read_data_other.**read_solar_flux**(*fname*)
Reads solar flux data from the DRAO observatory in Canada

Parameters **fname** : str

path of time series file

Returns **flux_datetime** : datetime array

the date and time of the solar flux retrievals

flux_value : array

the observed solar flux

pyrad.io.read_data_other.**read_status**(*voltime*, *cfg*, *ind_rad=0*)
Reads rad4alp xml status file.

Parameters **voltime** : datetime object

volume scan time

cfg: dictionary of dictionaries

configuration info to figure out where the data is

ind_rad: int

radar index

Returns **root** : root element object

The information contained in the status file

pyrad.io.read_data_other.**read_sun_hits**(*fname*)
Reads sun hits data contained in a csv file

Parameters **fname** : str

path of time series file

Returns date, ray, nrng, rad_el, rad_az, sun_el, sun_az, ph, ph_std, nph, nvalh,

pv, pv_std, npv, nvalv, zdr, zdr_std, nzdr, nvalzdr : tupple

Each parameter is an array containing a time series of information on a variable

pyrad.io.read_data_other.**read_sun_hits_multiple_days**(*cfg*, *time_ref*, *nfiles=1*)

Reads sun hits data from multiple file sources

Parameters **cfg** : dict

dictionary with configuration data to find out the right file

time_ref : datetime object

reference time

nfiles : int

number of files to read

Returns date, ray, nrng, rad_el, rad_az, sun_el, sun_az, ph, ph_std, nph, nvalh,

pv, pv_std, npv, nvalv, zdr, zdr_std, nzdr, nvalzdr : tupple

Each parameter is an array containing a time series of information on a variable

pyrad.io.read_data_other.**read_sun_retrieval**(*fname*)

Reads sun retrieval data contained in a csv file

Parameters **fname** : str

path of time series file

Returns first_hit_time, last_hit_time, nhits_h, el_width_h, az_width_h, el_bias_h,

az_bias_h, dBm_sun_est, std_dBm_sun_est, nhits_v, el_width_v, az_width_v,

el_bias_v, az_bias_v, dBmv_sun_est, std_dBmv_sun_est, nhits_zdr,

zdr_sun_est, std_zdr_sun_est, dBm_sun_ref, ref_time : tupple

Each parameter is an array containing a time series of information on a variable

pyrad.io.read_data_other.**read_timeseries**(*fname*)

Reads a time series contained in a csv file

Parameters **fname** : str

path of time series file

Returns **date , value** : tupple

A datetime object array containing the time and a numpy masked array containing the value. None otherwise

CHAPTER

ELEVEN

PYRAD.IO.WRITE_DATA

Functions for writing pyrad output data

write_ts_polar_data(dataset, fname)	writes time series of data
write_monitoring_ts(start_time, np_t, ...)	writes time series of data
write_colocated_gates(coloc_gates, fname)	Writes the position of gates colocated with two radars
write_colocated_data(coloc_data, fname)	Writes the position of gates colocated with two radars
write_sun_hits(sun_hits, fname)	Writes sun hits data.
write_sun_retrieval(sun_retrieval, fname)	Writes sun retrieval data.
generate_field_name_str(datatype)	Generates a field name in a nice to read format.

pyrad.io.write_data.**write_colocated_data**(*coloc_data*, *fname*)

Writes the position of gates colocated with two radars

Parameters **coloc_data** : dict

dictionary containing the colocated data parameters

fname : str

file name where to store the data

Returns **fname** : str

the name of the file where data has written

pyrad.io.write_data.**write_colocated_gates**(*coloc_gates*, *fname*)

Writes the position of gates colocated with two radars

Parameters **coloc_gates** : dict

dictionary containing the colocated gates parameters

fname : str

file name where to store the data

Returns **fname** : str

the name of the file where data has written

pyrad.io.write_data.**write_monitoring_ts**(*start_time*, *np_t*, *values*, *quantiles*, *datatype*, *fname*)

writes time series of data

Parameters **start_time** : datetime object

the time of the monitoring

np_t : int

the total number of points

values: float array

the values at certain quantiles

quantiles: float array

the quantiles computed

fname : str

file name where to store the data

Returns **fname** : str

the name of the file where data has written

pyrad.io.write_data.**write_sun_hits**(*sun_hits*, *fname*)

Writes sun hits data.

Parameters **sun_hits** : dict

dictionary containing the sun hits parameters

fname : str

file name where to store the data

Returns **fname** : str

the name of the file where data has written

pyrad.io.write_data.**write_sun_retrieval**(*sun_retrieval*, *fname*)

Writes sun retrieval data.

Parameters **sun_retrieval** : dict

dictionary containing the sun retrieval parameters

fname : str

file name where to store the data

Returns **fname** : str

the name of the file where data has written

pyrad.io.write_data.**write_ts_polar_data**(*dataset*, *fname*)

writes time series of data

Parameters **dataset** : dict

dictionary containing the time series parameters

fname : str

file name where to store the data

Returns **fname** : str

the name of the file where data has written

CHAPTER

TWELVE

PYRAD.IO.IO_AUX

Auxiliary functions for reading/writing files

get_save_dir(basepath, procname, dsname, prdname)	obtains the path to a product directory and eventually creates it
make_filename(prdtype, dstype, dsname, ext)	creates a product file name
generate_field_name_str(datatype)	Generates a field name in a nice to read format.
get_datatype_metranet(datatype)	maps de config file radar data type name into the corresponding metranet
get_fieldname_pyart(datatype)	maps de config file radar data type name into the corresponding rainbow
get_file_list(datadescriptor, starttime, ...)	gets the list of files with a time period
get_scan_list(scandescriptor_list)	determine which is the scan list for each radar
get_datatype_fields(datadescriptor)	splits the data type descriptor and provides each individual member
get_dataset_fields(datasetdescr)	splits the dataset type descriptor and provides each individual member
get_datetime(fname, datadescriptor)	gets date and time from file name
find_cosmo_file(voltime, datatype, cfg, scanid)	Search a COSMO file
find_rad4alpcosmo_file(voltime, datatype, ...)	Search a COSMO file

pyrad.io.io_aux.**find_cosmo_file**(*voltime*, *datatype*, *cfg*, *scanid*, *ind_rad=0*)

Search a COSMO file

Parameters **voltime** : datetime object

volume scan time

datatype : str

type of COSMO data to look for

cfg : dictionary of dictionaries

configuration info to figure out where the data is

scanid : str

name of the scan

ind_rad : int

radar index

Returns **fname** : str

Name of COSMO file if it exists. None otherwise

pyrad.io.io_aux.**find_rad4alpcosmo_file**(*voltime*, *datatype*, *cfg*, *scanid*, *ind_rad=0*)
Search a COSMO file

Parameters **voltime** : datetime object

volume scan time

datatype : str

type of COSMO data to look for

cfg: dictionary of dictionaries

configuration info to figure out where the data is

ind_rad: int

radar index

Returns **fname** : str

Name of COSMO file if it exists. None otherwise

scanid: str

name of the scan

pyrad.io.io_aux.**generate_field_name_str**(*datatype*)
Generates a field name in a nice to read format.

Parameters **datatype** : str

The data type

Returns **field_str** : str

The field name

pyrad.io.io_aux.**get_dataset_fields**(*datasetdescr*)
splits the dataset type descriptor and provides each individual member

Parameters **datasetdescr** : str

dataset type. Format : [processing level]:[dataset type]

Returns **proclevel** : str

dataset processing level

dataset : str

dataset type, i.e. dBZ, ZDR, ISO0, ...

pyrad.io.io_aux.**get_datatype_fields**(*datadescriptor*)
splits the data type descriptor and provides each individual member

Parameters **datadescriptor** : str

radar field type. Format : [radar file type]:[datatype]

Returns **radarnr** : str

radar number, i.e. RADAR1, RADAR2, ...

datagroup : str

data type group, i.e. RAINBOW, RAD4ALP, CFRADIAL, COSMO, ...

datatype : str

data type, i.e. dBZ, ZDR, ISO0, ...

dataset : str

dataset type (for saved data only)

product : str

product type (for saved data only)

pyrad.io.io_aux.**get_datatype_metranet**(*datatype*)

maps de config file radar data type name into the corresponding metranet data type name and Py-ART field name

Parameters **datatype** : str

config file radar data type name

Returns **metranet type** : dict

dictionary containing the metranet data type name and its corresponding Py-ART field name

pyrad.io.io_aux.**get_datetime**(*fname*, *datadescriptor*)

gets date and time from file name

Parameters **fname** : file name

datadescriptor : str

radar field type. Format : [radar file type]:[datatype]

Returns **fdatetime** : datetime object

date and time in file name

pyrad.io.io_aux.**get_fieldname_pyart**(*datatype*)

maps de config file radar data type name into the corresponding rainbow Py-ART field name

Parameters **datatype** : str

config file radar data type name

Returns **field_name** : str

Py-ART field name

pyrad.io.io_aux.**get_file_list**(*datadescriptor*, *starttime*, *endtime*, *cfg*, *scan=None*)

gets the list of files with a time period

Parameters **datadescriptor** : str

radar field type. Format : [radar file type]:[datatype]

startime : datetime object

start of time period

endtime : datetime object

end of time period

cfg: dictionary of dictionaries

configuration info to figure out where the data is

scan : str

scan name

Returns **radar** : Radar

radar object

pyrad.io.io_aux.**get_save_dir**(*basepath*, *procname*, *dsname*, *prdname*, *timeinfo=None*, *timeformat='%Y-%m-%d'*, *create_dir=True*)

obtains the path to a product directory and eventually creates it

Parameters **basepath** : str

product base path

procname : str

name of processing space

dsname : str

data set name

prdname : str

product name

timeinfo : datetime

time info to generate the date directory. If None there is no time format in the path

timeformat : str

Optional. The time format.

create_dir : boolean

If True creates the directory

Returns **savedir** : str

path to product

pyrad.io.io_aux.**get_scan_list**(*scandescriptor_list*)

determine which is the scan list for each radar

Parameters **scandescriptor** : list of string

the list of all scans for all radars

Returns **scan_list** : list of lists

the list of scans corresponding to each radar

pyrad.io.io_aux.**make_filename**(*prdtype*, *dstype*, *dsname*, *ext*, *prdcfginfo=None*, *timeinfo=None*, *timeformat='%Y%m%d%H%M%S'*, *runinfo=None*)

creates a product file name

Parameters **timeinfo** : datetime

time info to generate the date directory

prdtype : str

product type, i.e. 'ppi', etc.

dstype : str

data set type, i.e. 'raw', etc.

dsname : str

data set name

ext : array of str

file name extensions, i.e. 'png'

prdcfginfo : str

Optional. string to add product configuration information, i.e. 'el0.4'

timeformat : str

Optional. The time format

runinfo : str

Optional. Additional information about the test (e.g. 'RUN01', 'TS011')

Returns **fname_list** : list of str

list of file names (as many as extensions)

CHAPTER

THIRTEEN

PYRAD.GRAPH.PLOTS

Functions to plot Pyrad datasets

plot_ppi(radar, field_name, ind_el, prdcfg, ...)	plots a PPI
plot_rhi(radar, field_name, ind_az, prdcfg, ...)	plots an RHI
plot_bscope(radar, field_name, ind_sweep, ...)	plots a B-Scope (angle-range representation)
plot_cappi(radar, field_name, altitude, ...)	plots a Constant Altitude Plan Position Indicator CAPPI
plot_density(hist_obj, hist_type, ...[, ...])	density plot (angle-values representation)
plot_scatter(bins1, bins2, hist_2d, ...[, ...])	2D histogram
plot_quantiles(quant, value, fname_list[, ...])	plots quantiles
plot_histogram(bins, values, fname_list[, ...])	computes and plots histogram
plot_histogram2(bins, hist, fname_list[, ...])	plots histogram
plot_timeseries(date, value, fname_list[, ...])	plots a time series
plot_timeseries_comp(date1, value1, date2, ...)	plots 2 time series in the same graph
plot_monitoring_ts(date, np_t, cquant, ...)	plots a time series of monitoring data
plot_sun_hits(field, field_name, fname_list, ...)	plots the sun hits
plot_sun_retrieval_ts(sun_retrieval, ...)	plots a time series
get_colobar_label(field_dict, field_name)	creates the colorbar label using field metadata
get_field_name(field_dict, field)	Return a nice field name for a particular field

pyrad.graph.plots.**get_colobar_label**(*field_dict*, *field_name*)

creates the colorbar label using field metadata

Parameters **field_dict** : dict

dictionary containing field metadata

field_name : str

name of the field

Returns **label** : str

colorbar label

pyrad.graph.plots.**get_field_name**(*field_dict*, *field*)

Return a nice field name for a particular field

Parameters **field_dict** : dict

dictionary containing field metadata

field : str

name of the field

Returns **field_name** : str

the field name

pyrad.graph.plots.**plot_bscope**(*radar*, *field_name*, *ind_sweep*, *prdcfg*, *fname_list*)
plots a B-Scope (angle-range representation)

Parameters **radar** : Radar object

object containing the radar data to plot

field_name : str

name of the radar field to plot

ind_sweep : int

sweep index to plot

prdcfg : dict

dictionary containing the product configuration

fname_list : list of str

list of names of the files where to store the plot

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_cappi**(*radar*, *field_name*, *altitude*, *prdcfg*, *fname_list*)
plots a Constant Altitude Plan Position Indicator CAPPI

Parameters **radar** : Radar object

object containing the radar data to plot

field_name : str

name of the radar field to plot

altitude : float

the altitude [m MSL] to be plotted

prdcfg : dict

dictionary containing the product configuration

fname_list : list of str

list of names of the files where to store the plot

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_density**(*hist_obj*, *hist_type*, *field_name*, *ind_sweep*, *prdcfg*, *fname_list*, *quantiles=[25.0, 50.0, 75.0]*, *ref_value=0.0*)
density plot (angle-values representation)

Parameters **hist_obj** : histogram object

object containing the histogram data to plot

hist_type : str

type of histogram (instantaneous data or cumulative)

field_name : str

name of the radar field to plot

ind_sweep : int

sweep index to plot

prdcfg : dict

dictionary containing the product configuration

fname_list : list of str

list of names of the files where to store the plot

quantiles : array

the quantile lines to plot

ref_value : float

the reference value

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_histogram**(*bins*, *values*, *fname_list*, *labelx='bins'*, *labely='Number of Samples'*, *titl='histogram'*)

computes and plots histogram

Parameters **bins** : array

histogram bins

values : array

data values

fname_list : list of str

list of names of the files where to store the plot

labelx : str

The label of the X axis

labely : str

The label of the Y axis

titl : str

The figure title

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_histogram2**(*bins*, *hist*, *fname_list*, *labelx='bins'*, *labely='Number of Samples'*, *titl='histogram'*)

plots histogram

Parameters **quant** : array

histogram bins

hist : array

values for each bin

fname_list : list of str

list of names of the files where to store the plot

labelx : str

The label of the X axis

labely : str

The label of the Y axis

titl : str

The figure title

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_monitoring_ts**(*date*, *np_t*, *cquant*, *lquant*, *hquant*, *field_name*, *fname_list*, *ref_value=None*, *labelx='Time [UTC]'*, *labely='Value'*, *titl='Time Series'*)

plots a time series of monitoring data

Parameters **date** : datetime object

time of the time series

cquant, lquant, hquant : float array

values of the central, low and high quantiles

field_name : str

name of the field

fname_list : list of str

list of names of the files where to store the plot

ref_value : float

the reference value

labelx : str

The label of the X axis

labely : str

The label of the Y axis

titl : str

The figure title

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_ppi**(*radar*, *field_name*, *ind_el*, *prdcfg*, *fname_list*, *plot_type='PPI'*, *step=None*, *quantiles=None*)

plots a PPI

Parameters **radar** : Radar object

object containing the radar data to plot

field_name : str

name of the radar field to plot

ind_el : int

sweep index to plot

prdcfg : dict

dictionary containing the product configuration

fname_list : list of str

list of names of the files where to store the plot

plot_type : str

type of plot (PPI, QUANTILES or HISTOGRAM)

step : float

step for histogram plotting

quantiles : float array

quantiles to plot

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_quantiles**(*quant*, *value*, *fname_list*, *labelx='quantile'*, *labely='value'*, *titl='quantile'*)

plots quantiles

Parameters **quant** : array

quantiles to be plotted

value : array

values of each quantile

fname_list : list of str

list of names of the files where to store the plot

labelx : str

The label of the X axis

labely : str

The label of the Y axis

titl : str

The figure title

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_rhi**(*radar*, *field_name*, *ind_az*, *prdcfg*, *fname_list*, *plot_type='PPI'*, *step=None*, *quantiles=None*)

plots an RHI

Parameters **radar** : Radar object

object containing the radar data to plot

field_name : str

name of the radar field to plot

ind_az : int

sweep index to plot

prdcfg : dict

dictionary containing the product configuration

fname_list : list of str

list of names of the files where to store the plot

plot_type : str

type of plot (PPI, QUANTILES or HISTOGRAM)

step : float

step for histogram plotting

quantiles : float array

quantiles to plot

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_scatter**(*bins1*, *bins2*, *hist_2d*, *field_name1*, *field_name2*, *fname_list*, *prdcfg*, *metadata=None*)

2D histogram

Parameters **bins1, bins2** : float array2

the bins of each field

hist_2d : ndarray 2D

the 2D histogram

field_name1, field_name2 : str

the names of each field

fname_list : list of str

list of names of the files where to store the plot

prdcfg : dict

product configuration dictionary

metadata : str

a string with metadata to write in the plot

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_sun_hits**(*field*, *field_name*, *fname_list*, *prdcfg*)

plots the sun hits

Parameters **radar** : Radar object

object containing the radar data to plot

field_name : str

name of the radar field to plot

altitude : float

the altitude [m MSL] to be plotted

prdcfg : dict

dictionary containing the product configuration

fname_list : list of str

list of names of the files where to store the plot

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_sun_retrieval_ts**(*sun_retrieval*, *data_type*, *fname_list*)

plots a time series

Parameters **date** : datetime object

time of the time series

value : float array

values of the time series

fname_list : list of str

list of names of the files where to store the plot

labelx : str

The label of the X axis

labely : str

The label of the Y axis

label1 : str

The label of the legend

titl : str

The figure title

period : float

measurement period in seconds used to compute accumulation. If 0 no accumulation is computed

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_timeseries**(*date*, *value*, *fname_list*, *labelx='Time [UTC]'*, *labely='Value'*, *label1='Sensor'*, *titl='Time Series'*, *period=0*, *timeformat=None*)

plots a time series

Parameters **date** : datetime object

time of the time series

value : float array

values of the time series

fname_list : list of str

list of names of the files where to store the plot

labelx : str

The label of the X axis

labely : str

The label of the Y axis

label1 : str

The label of the legend

titl : str

The figure title

period : float

measurement period in seconds used to compute accumulation. If 0 no accumulation is computed

timeformat : str

Specifies the date and time format on the x axis

Returns **fname_list** : list of str

list of names of the created plots

pyrad.graph.plots.**plot_timeseries_comp**(*date1*, *value1*, *date2*, *value2*, *fname_list*, *labelx='Time [UTC]'*, *labely='Value'*, *label1='Sensor 1'*, *label2='Sensor 2'*, *titl='Time Series Comparison'*, *period1=0*, *period2=0*)

plots 2 time series in the same graph

Parameters **date1** : datetime object

time of the first time series

value1 : float array

values of the first time series

date2 : datetime object

time of the second time series

value2 : float array

values of the second time series

fname_list : list of str

list of names of the files where to store the plot

labelx : str

The label of the X axis

labely : str

The label of the Y axis

label1, label2 : str

legend label for each time series

titl : str

The figure title

period1, period2 [float] measurement period in seconds used to compute accumulation. If 0 no accumulation is computed

Returns **fname_list** : list of str

list of names of the created plots

CHAPTER

FOURTEEN

PYRAD.UTIL.RADAR_UTILS

Miscellaneous functions dealing with radar data

get_range_bins_to_avg(rad1_rng, rad2_rng)	Compares the resolution of two radars and determines if and which radar
find_ray_index(ele_vec, azi_vec, ele, azi[, ...])	Find the ray index corresponding to a particular elevation and azimuth
find_rng_index(rng_vec, rng[, rng_tol])	Find the range index corresponding to a particular range
time_avg_range(timeinfo, avg_starttime, ...)	finds the new start and end time of an averaging
get_closest_solar_flux(hit_datetime_list, ...)	finds the solar flux measurement closest to the sun hit
create_sun_hits_field(rad_el, rad_az, ...)	creates a sun hits field from the position and power of the sun hits
create_sun_retrieval_field(par, imgcfg)	creates a sun retrieval field from the retrieval parameters
compute_quantiles(field[, quantiles])	computes quantiles
compute_quantiles_from_hist(bins, hist[, ...])	computes quantiles from histograms
compute_quantiles_sweep(field, ray_start, ...)	computes quantiles of a particular sweep
compute_histogram(field, field_name[, step])	computes histogram of the data
compute_histogram_sweep(field, ray_start, ...)	computes histogram of the data in a particular sweep
compute_2d_stats(field1, field2, ...[, ...])	computes histogram of the data
compute_2d_hist(field1, field2, field_name1, ...)	computes histogram of the data
quantize_field(field, field_name, step)	quantizes data

pyrad.util.radar_utils.**compute_2d_hist**(*field1*, *field2*, *field_name1*, *field_name2*, *step1=None*, *step2=None*)

computes histogram of the data

Parameters **field** : ndarray 2D

the radar field

field_name: str

name of the field

step : float

size of bin

Returns **bins** : float array

interval of each bin

values : float array

values at each bin

pyrad.util.radar_utils.**compute_2d_stats**(*field1*, *field2*, *field_name1*, *field_name2*, *step1=None*, *step2=None*)

computes histogram of the data

Parameters **field** : ndarray 2D

the radar field

field_name: str

name of the field

step : float

size of bin

Returns **bins** : float array

interval of each bin

values : float array

values at each bin

pyrad.util.radar_utils.**compute_histogram**(*field*, *field_name*, *step=None*)

computes histogram of the data

Parameters **field** : ndarray 2D

the radar field

field_name: str

name of the field

step : float

size of bin

Returns **bins** : float array

interval of each bin

values : float array

values at each bin

pyrad.util.radar_utils.**compute_histogram_sweep**(*field*, *ray_start*, *ray_end*, *field_name*, *step=None*)

computes histogram of the data in a particular sweep

Parameters **field** : ndarray 2D

the radar field

ray_start, ray_end : int

starting and ending ray indexes

field_name: str

name of the field

step : float

size of bin

Returns **bins** : float array

interval of each bin

values : float array

values at each bin

pyrad.util.radar_utils.**compute_quantiles**(*field*, *quantiles=None*)

computes quantiles

Parameters **field** : ndarray 2D

the radar field

ray_start, ray_end : int

starting and ending ray indexes

quantiles: float array

list of quantiles to compute

Returns **quantiles** : float array

list of quantiles

values : float array

values at each quantile

pyrad.util.radar_utils.**compute_quantiles_from_hist**(*bins*, *hist*, *quantiles=None*)

computes quantiles from histograms

Parameters **bins** : ndarray 1D

the bins

hist : ndarray 1D

the histogram

quantiles: float array

list of quantiles to compute

Returns **quantiles** : float array

list of quantiles

values : float array

values at each quantile

pyrad.util.radar_utils.**compute_quantiles_sweep**(*field*, *ray_start*, *ray_end*, *quantiles=None*)

computes quantiles of a particular sweep

Parameters **field** : ndarray 2D

the radar field

ray_start, ray_end : int

starting and ending ray indexes

quantiles: float array

list of quantiles to compute

Returns **quantiles** : float array

list of quantiles

values : float array

values at each quantile

pyrad.util.radar_utils.**create_sun_hits_field**(*rad_el*, *rad_az*, *sun_el*, *sun_az*, *data*, *imgcfg*)

creates a sun hits field from the position and power of the sun hits

Parameters **rad_el, rad_az, sun_el, sun_az** : ndarray 1D

azimuth and elevation of the radar and the sun respectively in degree

data : masked ndarray 1D

the sun hit data

imgcfg: dict

a dictionary specifying the ranges and resolution of the field to create

Returns **field** : masked ndarray 2D

the sun hit field

pyrad.util.radar_utils.**create_sun_retrieval_field**(*par*, *imgcfg*)

creates a sun retrieval field from the retrieval parameters

Parameters **par** : ndarray 1D

the 5 retrieval parameters

imgcfg: dict

a dictionary specifying the ranges and resolution of the field to create

Returns **field** : masked ndarray 2D

the sun retrieval field

pyrad.util.radar_utils.**find_ray_index**(*ele_vec*, *azi_vec*, *ele*, *azi*, *ele_tol=0.0*, *azi_tol=0.0*)

Find the ray index corresponding to a particular elevation and azimuth

Parameters **ele_vec, azi_vec** : float arrays

The elevation and azimuth data arrays where to look for

ele, azi : floats

The elevation and azimuth to search

ele_tol, azi_tol : floats

Tolerances [deg]

Returns **ind_ray** : int

The ray index

pyrad.util.radar_utils.**find_rng_index**(*rng_vec*, *rng*, *rng_tol=0.0*)

Find the range index corresponding to a particular range

Parameters **rng_vec** : float array

The range data array where to look for

rng : float

The range to search

rng_tol : float

Tolerance [m]

Returns **ind_rng** : int

The range index

pyrad.util.radar_utils.**get_closest_solar_flux**(*hit_datetime_list*, *flux_datetime_list*, *flux_value_list*)

finds the solar flux measurement closest to the sun hit

Parameters **hit_datetime_list** : datetime array

the date and time of the sun hit

flux_datetime_list : datetime array

the date and time of the solar flux measurement

flux_value_list: ndarray 1D

the solar flux values

Returns **flux_datetime_closest_list** : datetime array

the date and time of the solar flux measurement closest to sun hit

flux_value_closest_list : ndarray 1D

the solar flux values closest to the sun hit time

pyrad.util.radar_utils.**get_histogram_bins**(*field_name*, *step=None*)

gets the histogram bins using the range limits of the field as defined in the Py-ART config file.

Parameters **field_name: str**

name of the field

step : float

size of bin

Returns **bins** : float array

interval of each bin

pyrad.util.radar_utils.**get_range_bins_to_avg**(*rad1_rng*, *rad2_rng*)

Compares the resolution of two radars and determines if and which radar has to be averaged and the length of the averaging window

Parameters **rad1_rng** : array

the range of radar 1

rad2_rng : datetime

the range of radar 2

Returns **avg_rad1, avg_rad2** : Boolean

Booleans specifying if the radar data has to be average in range

avg_rad_lim : array with two elements

the limits to the average (centered on each range gate)

pyrad.util.radar_utils.**quantize_field**(*field*, *field_name*, *step*)

quantizes data

Parameters **field** : ndarray 2D

the radar field

field_name: str

name of the field

step : float

size of bin

Returns **fieldq** : ndarray 2D

The quantized field

values : float array

values at each bin

pyrad.util.radar_utils.**time_avg_range**(*timeinfo*, *avg_starttime*, *avg_endtime*, *period*)

finds the new start and end time of an averaging

Parameters **timeinfo** : datetime

the current volume time

avg_starttime : datetime

the current average start time

avg_endtime: datetime

the current average end time

period: float

the averaging period

Returns **new_starttime** : datetime

the new average start time

new_endtime : datetime

the new average end time

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