SIMBA Atmospheric Column File Format Overview – v1.6

Atmospheric column data files are generated by the SIMBA precipitation data fusion system. These files contain all available data from the SIMBA-supported platforms set into a user-defined 3D Cartesian grid. The user-specified grid is referred to as the "column grid" and the location of the column grid center point is referred to as the "column grid site", "column site", or "column location." This document briefly describes the structure of SIMBA column files; note that a more thorough description of the file can be found in the NetCDF header of any particular SIMBA column file.

Naming Convention: column_[main_platform]_[column_site]_[timestamp].nc

[main_platform]	Name of the main platform used for this column file. In the current SIMBA setup, this must be a ground-based scanning radar (typically NPOL, if available). The timestamp of the main platform's data file is used as the column file's timestamp, and all other available platforms' data timestamp information is recorded in the column file with an offset attribute (seconds relative to the main platform's timestamp).
[column_site]	Name of the column grid site location. Column locations are assigned in SIMBA as a named location, which is tied to lat/lon location.
[timestamp]	'YYYYMMDD_HHMM' format timestamp of the column file. This timestamp is taken directly from the main platform's timestamp.

Global Attributes: the most basic attributes in the column file

box_centered_on	Name of the column grid site location. Column locations are assigned in SIMBA as a named location, which is tied to lat/lon location. Will match [column_site] in filename.
box_center_lat	float, column location's latitude in decimal degrees
box_center_lon	float, column location's longitude in decimal degrees
grid_spacing_vert	short, column grid's vertical spacing in [m]
grid_spacing_horiz	short, column grid's horizontal spacing in [m]
grid_extent_vert	short, column grid's total vertical extent in [m]
grid_extend_horiz	short, column grid's total horizontal extent in [m]
grid_spacing_and_limits_units	string, "meters"
main_platform	string, name of the main platform. Will match [main_platform] in filename.
main_plat_timestamp	string, YYYYMMDD_HHMMSS timestamp of the main platform's data
main_plat_mode	string, main platform's scan mode, nominally "RHI" or "PPI"
SIMBA_version	string, indicates which version of SIMBA was used to generate this column file

Dimensions: give the dimension sizes used for each available data field variable

x	number of column grid points in the x-direction (west-east horizontal direction)
y	number of column grid points in the y-direction (north-south horizontal direction)
z	number of column grid points in the z-direction (vertical direction)
t	number of minutes included for some ground platforms – new to v1.6. SIMBA now allows users to set an integer number of before & after the main platform timestamp to include in the column file for data available from disdrometers, rain gauges, and MRR profiling radars.

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Variables: Variables available in a column file are entirely dependent on what platforms have data that exist within the bounds of the column grid near the main platform timestamp. Below is an overview list; for a more thorough list of possible fields, see the README_SIMBAv1.x_structs.txt and/or README_SIMBAv1.x_pros.txt documentation files provided within the SIMBA code package.

Character Variables: Have one availability character variable per SIMBA-supported platform

[platform]_avail — char, 'T' or 'F' for TRUE or FALSE based on whether or not data from the given platform is available. See below for currently supported [platform]s.

1-dimensional Variables: These variables define the locations of each column grid point.

- x — horizontal coordinate in meters for column grid points, east is positive, (0,0,0) is the column grid site center
- y — horizontal coordinate in meters for column grid points, north is positive, (0,0,0) is the column grid site center
- z — vertical coordinate in meters for column grid points, upward is positive, (0,0,0) is the column grid site center
- t — time coordinate, number of minutes before (negative)/after (positive) main platform time – only applies to disdrometer, gauge, and MRR platforms. Note: t=0 corresponds to the main platform timestamp.
- lat — latitude corresponding to each x grid point location, in decimal degrees
- lon — longitude corresponding to each y grid point location, in decimal degrees

3-dimensional Variables: These are data fields from each supported platform. Note that disdrometers, gauges, and MRRs are listed separately, below, as v1.6 now supports time intervals of those data. Platforms currently supported in SIMBA, and their data fields/variables, are:

NPOL data fields:

- ZZ – reflectivity
- CZ – corrected reflectivity (QC & calibration applied)
- DR – corrected differential reflectivity (QC & calibration applied)
- RH – correlation coefficient
- PH – differential phase
- KD – specific differential phase
- SQ – signal quality index
- SW – spectrum width
- VR – radial velocity
- RR – rain rate via DROPS 2.0 (Chen et al. 2017) algorithm
- RP – rain rate via Bringi et al. 2004 algorithm
- RC – rain rate via Cifelli et al. 2002 algorithm
- D0 – median drop diameter
- DM – mass weighted mean drop diameter
- NW – normalized DSD intercept parameter
- N2 – normalized intercept parameter via Tokay algorithm
- FH – categorical hydrometeor ID classification, as from Dolan et al. 2013

NEXRAD/88D data fields:

- ZZ – reflectivity
- CZ – corrected reflectivity (QC & calibration applied)
- DR – corrected differential reflectivity (QC & calibration applied)
- RH – correlation coefficient
- PH – differential phase
- KD – specific differential phase
- SQ – signal quality index

SW – spectrum width
VR – radial velocity
RR – rain rate via DROPS 2.0 (Chen et al. 2017) algorithm
RP – rain rate via Bringi et al. 2004 algorithm
RC – rain rate via Cifelli et al. 2002 algorithm
D0 – median drop diameter
DM – mass weighted mean drop diameter
NW – normalized DSD intercept parameter
N2 – normalized intercept parameter via Tokay algorithm
FH – categorical hydrometeor ID classification, as from Dolan et al. 2013

D3R data fields:

kaDZ – Ka-band reflectivity
kaVR – Ka-band radial velocity
kaSW – Ka-band spectrum width
kaDR – Ka-band differential reflectivity
kaPH – Ka-band differential phase
kaRH – Ka-band correlation coefficient
kuDZ – Ku-band reflectivity
kuVR – Ku-band radial velocity
kuSW – Ku-band spectrum width
kuDR – Ku-band differential reflectivity
kuPH – Ku-band differential phase
kuRH – Ku-band correlation coefficient
kuCZ – Ku-band attenuation corrected reflectivity
kuCR – Ku-band specific attenuation corrected differential reflectivity
kuKD – Ku-band specific differential phase

DOW data fields: available for OLYMPEX campaign

DBZHC – reflectivity, horizontal channel
DBZHC_F – clutter filtered reflectivity, horizontal channel
DBZVC – reflectivity, vertical channel
DBZVC_F – clutter filtered reflectivity, vertical channel
VR – radial velocity
VR_F – clutter filtered radial velocity
SW – spectrum width
SW_F – clutter filtered spectrum width
ZDRM – measured differential reflectivity
ZDRM_F – clutter filtered measured differential reflectivity
ZDRC – offset-corrected differential reflectivity
RHOHV – correlation coefficient
RHOHV_F – clutter filtered correlation coefficient
PHIDP – differential phase
PHIDP_F – clutter filtered differential phase
KDP – specific differential phase
KDP_F – clutter filtered specific differential phase

*Sonde (thermodynamic sounding) data fields: *thus far, have only tested sondes module w/ OLYMPEX data**

pressure

temperature
dew point temperature
wind speed
wind direction
Convective Available Potential Energy (CAPE)
Convective Inhibition (CIN)
Total Precipitable Water (TPW)
Lifting Condensation Level (LCL)
Level of Free Convection (LFC)
Equilibrium Level (EL)

GPM GMI L1C data fields: *Available for each GMI channel: 10.7, 18.7, 23.8, 36.5, 89.0, 166.0, 183.3 GHz*

Earth incidence angle
Sun glint angle
Calibrated brightness temperature

GPM GMI GPROF data fields: *depending on input 2AGPROF file version (04 vs. 05), other fields are available*

Total Precipitable Water (TPW)
Surface precipitation
Probability of precipitation
Rain water path
Cloud liquid water path
Ice water path

GPM DPR data fields: *Available for up to all 3 DPR swaths: NS, HS, MS**

Storm top height
Zero °C height
Brightband height and width
PIA due to precipitation particles
PIA due to cloud water
PIA due to cloud ice
PIA due to water vapor
PIA due to oxygen molecules
Attenuation corrected reflectivity
Near surface attenuation corrected reflectivity
Precipitation rate
Near surface precipitation rate
Integrated total precipitable liquid water (TPW)
Integrated total precipitation ice
Mass-weighted mean drop diameter (D_M)
Normalized DSD intercept parameter (N_W)
*MS swath does not contain: precipitation rate profile, D_M, N_W

L2BCMB GPM DPR + GMI data fields: *Available for up to both Combined Algorithm swaths: NS, MS*

Zero °C height
Precipitation type category and quality value
PIA total from DPR observations
Near surface precipitation rate and uncertainty
Liquid fraction of near surface precipitation rate

Simulated GMI brightness temperatures for each GMI channel
Integrated cloud IWC
Integrated cloud LWC
Attenuation corrected reflectivity
Integrated precipitation LWC and uncertainty
Precipitation rate and uncertainty
Mass-weighted mean drop diameter (D_M) – computed via algorithm
Normalized DSD intercept parameter (N_W) – prescribed by algorithm
Shape parameter (μ) – prescribed by algorithm
Mixed-phase region liquid precipitation mass fraction
Mixed-phase region liquate precipitation rate fraction

MRMS (Multi-Radar/Multi-Sensor QPE product) data fields:
Precipitation rate
Precipitation type
Radar Quality Index (RQI) value

4-dimensional Variables: New in SIMBA v1.6 is time intervals support for disdrometer, gauge, and MRR observations. User can now set the integer number of minutes before and after the main platform timestamp that will be included in the column file. The data fields from these platforms are then 4-D fields. The first 3 dimensions of these variables exactly match the above 3-dimensional fields, and the 4th dimension corresponds to time. Elements at the middle of the time dimension (ie, value of t=0) correspond to the main platform time; elements before (after) the main platform time correspond to negative (positive) values of t – see description of variable t, above.

APU (Parsivel disdrometer) data fields: *depending on pre-processing, may have other fields than on this list*
Total drop concentration
Liquid water content
Rain rate
Derived reflectivity assuming Rayleigh scattering
Mass-weighted mean drop diameter
Maximum drop diameter
32-bin drop size distribution

2DVD (2D-video disdrometer) data fields:
Total drop concentration
Liquid water content
Rain rate
Derived reflectivity assuming Rayleigh scattering
Mass-weighted mean drop diameter
Minimum drop diameter
Maximum drop diameter
50-bin drop size distribution

Gauge (tipping bucket rain gauge) data fields:
Rain rate

Pluvio (weighing rain gauge) data fields:
Rain rate

MRR (MicroRain Radar) data fields:

PIA – path integrated attenuation
ref – attenuation corrected reflectivity
RR – rain rate
LWC – liquid water content
WVEL – vertical velocity + particle fallseed (capital W)
disdro_Z – reflectivity computed from 64-bin drop density profile
disdro_Dm – mass-weighted mean drop diameter computed from 64-bin drop density profile
disdro_Nw – normalized DSD intercept parameter computed from 64-bin drop density profile

Platform-specific Variable Attributes: Column files contain platform-specific parameters recorded as attributes to the [platform]_avail character variables. These attributes are similar for similar types of sensors:

npol_avail, d3r_avail, and dow6_avail attributes:

latitude_degrees	radar location latitude degrees
latitude_minutes	radar location latitude minutes
latitude_seconds	radar location latitude seconds
longitude_degrees	radar location longitude degrees
longitude_minutes	radar location longitude minutes
longitude_seconds	radar location longitude seconds
elevation_MSL	radar location elevation MSL
operation_mode	radar operation mode
wavelength_m	radar operating wavelength in meters
frequency_GHz	radar operating frequency in GHz
beam_width_deg	radar beam width in degrees
gate_size_m	radar gate size in meters
timestamp	radar volume start timestamp, YYYYMMDD_HHMMSS
offset_vs_main	radar volume start time offset from main platform's timestamp in seconds

lev2_avail attributes: *NEXRAD/88D radars (interchangeably called NEXRAD/88D/lev2 platforms)*

[ID]:	radar ID, can have data from multiple NEXRAD radars in one SIMBA column file
[ID]_lat_degrees	radar location latitude degrees
[ID]_lat_minutes	radar location latitude minutes
[ID]_lat_seconds	radar location latitude seconds
[ID]_lon_degrees	radar location longitude degrees
[ID]_lon_minutes	radar location longitude minutes
[ID]_lon_seconds	radar location longitude seconds
[ID]_elevation_MSL	radar location elevation MSL
[ID]_operation_mode	radar operation mode
[ID]_wavelength_m	radar operating wavelength in meters
[ID]_frequency_GHz	radar operating frequency in GHz
[ID]_beam_width_deg	radar beam width in degrees
[ID]_gate_size_m	radar gate size in meters
[ID]_timestamp	radar volume start timestamp, YYYYMMDD_HHMMSS
[ID]_offset_vs_main	radar volume start time offset from main platform's timestamp in seconds

mrr_avail attributes: *MicroRain vertically profiling Radars*

[ID]:	radar ID, can have data from multiple MRR profiling radars in one SIMBA column file
[ID]_lat_degrees	radar location latitude degrees

[ID]_lat_minutes	radar location latitude minutes
[ID]_lat_seconds	radar location latitude seconds
[ID]_lon_degrees	radar location longitude degrees
[ID]_lon_minutes	radar location longitude minutes
[ID]_lon_seconds	radar location longitude seconds
[ID]_elevation_MSL	radar location elevation MSL
[ID]_operation_mode	radar operation mode
[ID]_wavelength_m	radar operating wavelength in meters
[ID]_frequency_GHz	radar operating frequency in GHz
[ID]_beam_width_deg	radar beam width in degrees
[ID]_gate_size_m	radar gate size in meters
[ID]_timestamp	radar volume start timestamp, YYYYMMDD_HHMMSS
[ID]_offset_vs_main	radar volume start time offset from main platform's timestamp in seconds
[ID]_time_interval_width	integer number of minutes before & after main platform time included in the column file for disdrometers, gauges, and MRRs

apu_avail attributes: *Parsivel disdrometers*
twoDVD_avail attributes: *2DVD disdrometers*
pluvio_avail attributes: *Pluvio weighting rain gauges*
gauges_avail attributes: *tipping bucket rain gauges*

[ID]_lat_deg	platform location latitude degrees
[ID]_lat_min	platform location latitude minutes
[ID]_lat_sec	platform location latitude seconds
[ID]_lon_deg	platform location longitude degrees
[ID]_lon_min	platform location longitude minutes
[ID]_lon_sec	platform location longitude seconds
[ID]_operation_mode	platform type (2DVD, Parsivel, pluvio, gauge)
[ID]_timestamp	'YYYYMMDD_HHMMSS' observation timestamp corresponding to the middle of the time interval – This is the timestamp for t=0, or the time nearest the main platform time.
[ID]_offset_vs_main	offset of timestamp (at middle of the time interval, or t=0) from main platform's timestamp in seconds
[ID]_time_interval_width	integer number of minutes before & after main platform time included in the column file for disdrometers, gauges, and MRRs

MRMS_avail attributes:

timestamp_requested	original time used to find a corresponding MRMS nearby time
timestamp	MRMS QPE product timestamp, YYYYMMDD_HHMMSS
offset_vs_main	MRMS QPE time offset from main platform's timestamp in seconds

soundings_avail attributes:

launch_site_latitude	sonde launch site latitude in decimal degrees
launch_site_longitude	sonde launch site longitude in decimal degrees
sonde_latitude	sonde sensor latitude at each original sounding vertical level
sonde_longitude	sonde sensor longitude at each original sounding vertical level
sonde_altitude	sonde sensor altitude at each original sounding vertical level
timestamp	sonde observation timestamp (sonde launch time), YYYYMMDD_HHMM
offset_vs_main	sonde timestamp offset from main platform's timestamp in seconds

SIMBA Atmospheric Column File Format Overview – v1.6

gmi_L1C_avail, gmi_gprof_avail, dpr_avail, and L2BCMB_avail attributes:

file_type	NASA PPS data product data level type
frequency	sensor operation frequency/frequencies in GHz
algorithm	NASA PPS data product algorithm name
orbit_number	NASA PPS data product orbit identification number
data_version	NASA PPS data product version number
timestamp	timestamp of sensor's field-of-view pixel containing the main platform location
offset_vs_main	offset of timestamp from main platform's timestamp in seconds
timestamp_cntr	timestamp of sensor's field-of-view pixel containing the column grid center point

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Most recent full release of the SIMBA framework: v1.6 (March 2018)

SIMBA References:

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