Description of MRMS Precipitation feature and convective features V1.0

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1. MRMS precipitation features (PFs) and convective features (CONVF)

This database is created with 2D MRMS products from 2017 to near current to identify precipitation and convective features. Precipitation features are defined by grouping contiguous area with ground radar derived precipitation rate > 0.1 mm/hr. Convective features are defined by grouping contiguous area with composite radar reflectivity > 40 dBZ and seamless height of radar echo < 2km. Because MRMS data available every 2 minutes, but most of volume scan of radar completes around 6 minute, we only calculate the PFs and ConvFs every 6 minutes instead to save time and space.

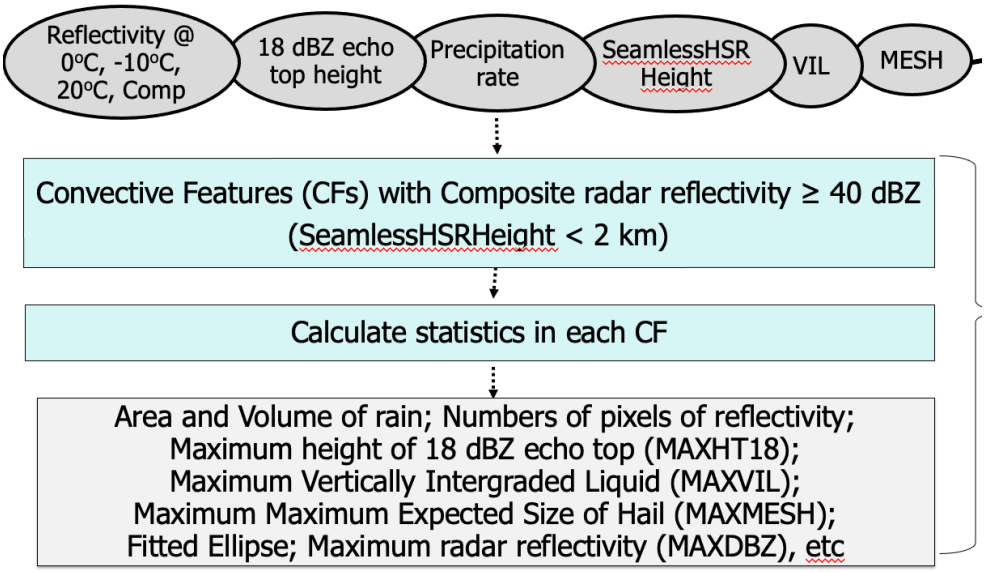

Figure 1. Schematic diagram of CONVF algorithm.

The properties of each precipitation and convective feature are summarized and listed below:

AREARAIN	DOUBLE	Array[1070344]	area of feature
AREARAIN_100MM	DOUBLE	Array[1070344]	area with > 100mm/hr
AREARAIN_10MM	DOUBLE	Array[1070344]	area with > 10 mm/hr
AREARAIN_1MM	DOUBLE	Array[1070344]	area with > 1 mm/hr
AREARAIN_20MM	DOUBLE	Array[1070344]	area with > 20 mm/hr
AREARAIN_50MM	DOUBLE	Array[1070344]	area with > 50 mm/hr
DAY	FLOAT	Array[1070344]	
HOUR	FLOAT	Array[1070344]	
LAT	DOUBLE	Array[1070344]	geo-center latitude
LON	DOUBLE	Array[1070344]	geo-center longitude
MAXDBZ_0C	DOUBLE	Array[1070344]	Max reflectivity at 0C in dBZ
MAXDBZ_10C	DOUBLE	Array[1070344]	Max reflectivity at -10C in dBZ
MAXDBZ_20C	DOUBLE	Array[1070344]	Max reflectivity at -20C
MAXHT18	DOUBLE	Array[1070344]	Maximum height of 18 dBZ in km
MAXRAINRATE	DOUBLE	Array[1070344]	Maximum rain rate in mm/hr
MONTH	FLOAT	Array[1070344]	
N0C_20DBZ	DOUBLE	Array[1070344]	Number of pixels with 20 dBZ at 0C

N0C_25DBZ	DOUBLE	Array[1070344]	Number of pixels with 25 dBZ at 0C
N0C_30DBZ	DOUBLE	Array[1070344]	Number of pixels with 30 dBZ at 0C
N0C_35DBZ	DOUBLE	Array[1070344]	Number of pixels with 35 dBZ at 0C
N0C_40DBZ	DOUBLE	Array[1070344]	Number of pixels with 40 dBZ at 0C
N0C_45DBZ	DOUBLE	Array[1070344]	Number of pixels with 45 dBZ at 0C
N0C_50DBZ	DOUBLE	Array[1070344]	Number of pixels with 50 dBZ at 0C
N10C_20DBZ	DOUBLE	Array[1070344]	Number of pixels with 20 dBZ at -10C
N10C_25DBZ	DOUBLE	Array[1070344]	Number of pixels with 25 dBZ at -10C
N10C_30DBZ	DOUBLE	Array[1070344]	Number of pixels with 30 dBZ at -10C
N10C_35DBZ	DOUBLE	Array[1070344]	Number of pixels with 35 dBZ at -10C
N10C_40DBZ	DOUBLE	Array[1070344]	Number of pixels with 40 dBZ at -10C
N10C_45DBZ	DOUBLE	Array[1070344]	Number of pixels with 45 dBZ at -10C
N10C_50DBZ	DOUBLE	Array[1070344]	Number of pixels with 50 dBZ at -10C
N20C_20DBZ	DOUBLE	Array[1070344]	Number of pixels with 20 dBZ at -20C
N20C_25DBZ	DOUBLE	Array[1070344]	Number of pixels with 25 dBZ at -20C
N20C_30DBZ	DOUBLE	Array[1070344]	Number of pixels with 30 dBZ at -20C
N20C_35DBZ	DOUBLE	Array[1070344]	Number of pixels with 35 dBZ at -20C
N20C_40DBZ	DOUBLE	Array[1070344]	Number of pixels with 40 dBZ at -20C
N20C_45DBZ	DOUBLE	Array[1070344]	Number of pixels with 45 dBZ at -20C
N20C_50DBZ	DOUBLE	Array[1070344]	Number of pixels with 50 dBZ at -20C
NLDN_MAX	DOUBLE	Array[525936]	Maximum NLDN lightning rate
NLDN_MEAN	DOUBLE	Array[1070344]	Mean NLDN lightning rate
NPIXELS_10	DOUBLE	Array[1070344]	Number of pixels with 18 dBZ top > 10 km
NPIXELS_12	DOUBLE	Array[1070344]	Number of pixels with 18 dBZ top > 12 km
NPIXELS_14	DOUBLE	Array[1070344]	Number of pixels with 18 dBZ top > 14 km
NPIXELS_NLDNG0	DOUBLE	Array[1070344]	Number of pixels with NLDN rate > 0

Following parameters starting with Q means only consider the pixels with Seamless Height < 2km:

QMAXDBZ	DOUBLE	Array[1070344]
QMAXDBZ_0C	DOUBLE	Array[1070344]
QMAXDBZ_10C	DOUBLE	Array[1070344]
QMAXDBZ_20C	DOUBLE	Array[1070344]
QMAXHT18	DOUBLE	Array[1070344]
QN0C_20DBZ	DOUBLE	Array[1070344]
QN0C_25DBZ	DOUBLE	Array[1070344]
QN0C_30DBZ	DOUBLE	Array[1070344]
QN0C_35DBZ	DOUBLE	Array[1070344]
QN0C_40DBZ	DOUBLE	Array[1070344]
QN0C_45DBZ	DOUBLE	Array[1070344]
QN0C_50DBZ	DOUBLE	Array[1070344]
QN10C_20DBZ	DOUBLE	Array[1070344]
QN10C_25DBZ	DOUBLE	Array[1070344]
QN10C_30DBZ	DOUBLE	Array[1070344]
QN10C_35DBZ	DOUBLE	Array[1070344]

QN10C_40DBZ DOUBLE Array[1070344]
QN10C_45DBZ DOUBLE Array[1070344]
QN10C_50DBZ DOUBLE Array[1070344]
QN20C_20DBZ DOUBLE Array[1070344]
QN20C_25DBZ DOUBLE Array[1070344]
QN20C_30DBZ DOUBLE Array[1070344]
QN20C_35DBZ DOUBLE Array[1070344]
QN20C_40DBZ DOUBLE Array[1070344]
QN20C_45DBZ DOUBLE Array[1070344]
QN20C_50DBZ DOUBLE Array[1070344]
QN_20DBZ DOUBLE Array[1070344]
QN_25DBZ DOUBLE Array[1070344]
QN_30DBZ DOUBLE Array[1070344]
QN_35DBZ DOUBLE Array[1070344]
QN_40DBZ DOUBLE Array[1070344]
QN_45DBZ DOUBLE Array[1070344]
QN_50DBZ DOUBLE Array[1070344]
QNPIXELS_10 DOUBLE Array[1070344]
QNPIXELS_12 DOUBLE Array[1070344]
QNPIXELS_14 DOUBLE Array[1070344]

R_LAT FLOAT Array[1070344]
R_LON FLOAT Array[1070344]
R_MAJOR FLOAT Array[1070344]
R_MAJOR_DEGREE FLOAT Array[1070344]
R_MINOR FLOAT Array[1070344]
R_MINOR_DEGREE FLOAT Array[1070344]
R_ORIENTATION FLOAT Array[1070344]
R_SOLID FLOAT Array[1070344]
RC_LAT FLOAT Array[1070344]
RC_LON FLOAT Array[1070344]
RC_MAJOR FLOAT Array[1070344]
RC_MAJOR_DEGREE FLOAT Array[1070344]
RC_MINOR FLOAT Array[1070344]
RC_MINOR_DEGREE FLOAT Array[1070344]
RC_ORIENTATION FLOAT Array[1070344]
RC_SOLID FLOAT Array[1070344]
VIL_MAX DOUBLE Array[1070344] Maximim VIL value
VOLRAIN DOUBLE Array[1070344] Volumetric rain
VOLRAIN_100MM DOUBLE Array[1070344] Volumetric rain from pixels > 100 mm/hr
VOLRAIN_10MM DOUBLE Array[1070344] Volumetric rain from pixels > 10 mm/hr
VOLRAIN_1MM DOUBLE Array[1070344] Volumetric rain from pixels > 1 mm/hr
VOLRAIN_20MM DOUBLE Array[1070344] Volumetric rain from pixels > 20 mm/hr
VOLRAIN_50MM DOUBLE Array[1070344] Volumetric rain from pixels > 50 mm/hr

YEAR DOUBLE Array[1070344]

Here each pixel is about 1x1 km. The morphology of the feature can be represented by major, minor axes, orientation angle of fitted ellipse. Here R_xxx are the parameters fitted for whole feature

2. Collocation of GLM Lightning dataset (testing)

Using the ellipse parameters, the GLM lightning data since 201802 are collocated to the MRMS data. The parameters include:

FLS5A	FLOAT	Number of lightning within 5 minutes after the feature
FLS5B	FLOAT	Number of lightning within 5 minutes after the feature
FLS10A	FLOAT	Number of lightning within 10 minutes after the feature
FLS10B	FLOAT	Number of lightning within 10 minutes after the feature

3. Tracking of CONVFs (experimental)

Tracking of CONVFs is completed only for data between 2017-near current for system with size greater than 4 km^2. The parameters calculated for each track include:

T	FLOAT	Array[3055518]	Julday time of each feature
T_IND	FLOAT	Array[1488]	Unique Time index
TRACKS	LONG	Array[3055518]	Track index of each IPF
TRACK_ID	LONG	Array[840942]	Track Index
TRACK_START_TIME	FLOAT	Array[840942]	Track start time
TRACK_START_LON	FLOAT	Array[840942]	Track start longitude
TRACK_START_LAT	FLOAT	Array[840942]	Track start latitude
TRACK_END_TIME	FLOAT	Array[840942]	Track end time
TRACK_END_LON	FLOAT	Array[840942]	Track end longitude
TRACK_END_LAT	FLOAT	Array[840942]	Track end latitude
TRACK_NTIMES	LONG	Array[840942]	Number of time stamps
TRACK_MAXRAINAREA	FLOAT	Array[840942]	Max rain area (km^2)
TRACK_MAXRAINAREA_TIME	FLOAT	Array[840942]	Time with maxrainarea
TRACK_MAXRAINAREA_5	FLOAT	Array[840942]	Max rain area > 5 mm/hr
TRACK_MAXVOLRAIN	FLOAT	Array[840942]	Max Volumetric rain
TRACK_MAXVOLRAIN_TIME	FLOAT	Array[840942]	Time with max Volrain
TRACK_MAXVOLRAIN_5	FLOAT	Array[840942]	Max Volrain from > 5 mm/hr
TRACK_MEANELONG	FLOAT	Array[840942]	Mean r_minor/r_major
TRACK_MAXELONG	FLOAT	Array[840942]	Max r_minor/r_major
TRACK_TOTFLASH	FLOAT	Array[840942]	Total lightning counts
TRACK_MAXFLASH	FLOAT	Array[840942]	Maximum lightning counts
TRACK_MAXFLASH_TIME	FLOAT	Array[840942]	Time with maximum lightning

All the calculated parameters for each one of PFs are saved in a Level-2 product file in “HDF format”. There is an IDL program “read_sds.pro” for accessing these level-2 files.

Read_sds.pro
This program reads all the science data from HDF-4 format file and save into a structure. This program can be used to access level-2 products with new definitions and all level-3 products.
Usage example:
IDL> read_sds,’example.HDF’,f ; f is a structure variable with all the parameters

Read_sds_one.pro
This program reads in one variable from HDF-4 format file Usage:
IDL> read_sds_one,’example.HDF’,’var1’,var

All these IDL programs can be downloaded at:

http://atmos.tamucc.edu/trmm/software/