

CACATOES_v1.02 Data Format

Update : 13/12/2019

version 1.02

[Filename]

CACATOES-REGION_YYYY0MM0DD0-YYYY1MM1DD1.ncdf

YYYY0 : yearStart
MM0 : monthStart
DD0 : dayStart
YYYY1 : yearEnd
MM1 : monthEnd
DD1 : dayEnd

ex : CACATOES-30S30N040W040E_20110801_20110831.ncdf

[Reference]

Fiolleau T. and Roca R. 2013 : An Algorithm for the Detection and Tracking of Tropical Mesoscale Convective Systems Using Infrared Images From Geostationary Satellite. IEEE Transactions on Geoscience and Remote Sensing, v. 99, p. 1-14

[Contact]

Thomas Fiolleau
OMP/LEGOS
14, av. Edouard Belin
31400 TOULOUSE
thomas.fiolleau@legos.obs-mip.fr

Rémy Roca
OMP/LEGOS
14, av. Edouard Belin
31400 TOULOUSE
FRANCE
Remy.roca@legos.obs-mip.fr

Parameters	Units	Description	Dimensions	Datatype
QCgeo_numgeo		ID of the geostationary platform	Time × lat × lon	short
QCgeo_GEOScan-Mode		Number of GEO images per day / in routine mode / in rapid scan mode	Time × GEO-mode × lat × lon	short
QCtoocan_Interruption		Indication of a tracking interruption	Time × lat × lon	short
QCtoocan_nbSegmentedImages		Number of segmented images created by TOOCAN per day	Time × GEO-mode × lat × lon	short
QCcaca-toes_nbpixels		number of GEO pixels within a 1°/1day CACATOES gridpoint	Time × lat × lon	int
QCcaca-toes_SurfGrid-Point		Cumultated GEO pixels surface into a CACATOES 1°/1day gridpoint	Time × lat × lon	float
DAYLYMCS_POP		population of MCSs which are included partially or totally (INT_Sfract) within a CACATOES 1°/1day gridpoint	Time × lat × lon	int
QCmcs_Label		ID of the MCS	Time × nmax-MCS × lat × lon	int
QCmcs_Flag		Confidence on the tracked MCS	Time × nmax-MCS × lat × lon	short
QCmcs_Class	<ul style="list-style-type: none"> - class 1 = MCS with a duration < 5hr - class 2a = MCS with a duration ≥ 5hr and described by a uniq maximum extent along their life cycles - class 2b = MCS with a duration ≥ 5hr and described by several maximums extent along their life cycles 	MCSs classification	Time × nmax-MCS × lat × lon	short
INT_Duration	hr	Life time duration	Time × nmax-MCS × lat × lon	float
INT_Smax	km ²	Maximum cold cloud surface reached by the MCS along its life cycle at 235K	Time × nmax-MCS × lat × lon	int
INT_Scum	km ²	Cumultaed cold cloud surface of the MCS along its life cycle at 235K	Time × nmax-MCS × lat × lon	int
INT_Tmax	%	Time of maximum extent	Time × nmax-MCS × lat × lon	float
INT_Distance	km	Propagated distance covered by the MCS	Time × nmax-MCS × lat × lon	float

INT_Tbmin	K	Minimum brightness temperature	Time × nmax-MCS × lat × lon	short
INT_Ecc220K		Eccentricity of the ellipse at a 220K threshold and at Tmax	Time × nmax-MCS × lat × lon	float
INT_Ecc235K		Eccentricity of the ellipse at a 235K threshold and at Tmax	Time × nmax-MCS × lat × lon	float
INIT_Time	integer part: number of days since the 1st January 1970 decimal part: fraction of the day	Local time of the MCS initiation	Time × nmax-MCS × lat × lon	double
INIT_Lon	°	Longitude of the MCS center of mass at its initiation	Time × nmax-MCS × lat × lon	float
INIT_Lat	°	Latitude of the MCS center of mass at its initiation	Time × nmax-MCS × lat × lon	float
END_Time	integer part: number of days since the 1st January 1970 decimal part: fraction of the day	Local time of the MCS dissipation	Time × nmax-MCS × lat × lon	double
END_Lon	°	Longitude of the MCS center of mass at its dissipation	Time × nmax-MCS × lat × lon	float
END_Lat	°	Latitude of the MCS center of mass at its dissipation	Time × nmax-MCS × lat × lon	Float
INT_Surfmcs	km ²	MCS Integrated Surface at a 235K threshold within a CACATOES 1°/1day gridpoint	Time × nmax-MCS × lat × lon	float
INT_Sfract	%	Fraction of the MCS within the CACATOES 1°/1day gridpoint	Time × nmax-MCS × lat × lon	Float
INT_GridFraction	%	Fraction of the CACATOES 1°/1day gridpoint occupied by an MCS	Time × nmax-MCS × lat × lon	float

Dimensions:

- Time: number of days within a month
- nmaxMCS: maximum number of MCS within a 1°/1day gridpoint, set at 25
- GEOMode: GEO scan mode used for a 1°/1day gridpoint (Routine mode / Rapid scan mode for the GOES platforms)
- lat: 60
- lon: 360

a gridpoint is set at -999 when a given region can't be monitored by a geostationary satellite at a 30-minute temporal frequency.

DAYLYMCS_POP

DAYLYMCS_POP variable indicates the population of MCSs which are included partially or totally within a CACATOES 1°/1day gridpoint.

The cold cloud shield of a given convective system can be partitioned into several neighboring 1°/1day gridpoints. The variable **INT_Sfract** indicates the Fraction of the MCS in each 1°/1day gridpoint where the system occurs.

For each gridpoint, where this system occurs, the **DAYLYMCS_POP** variable is incremented.

This variable has to be carefully used. As a same system can be counted several times for several gridpoints, the sum of the **DAYLYMCS_POP** variable over a given region does not correspond to the MCSs population over this region.

QCtoocan_nbSegmentedImages

QCtoocan_nbSegmentedImages[0]: total number of segmented images per day by TOOCAN.

QCtoocan_nbSegmentedImages[1]: number of segmented images per day by TOOCAN for geostationary images occurring in a routine/global mode.

QCtoocan_nbSegmentedImages[2]: number of segmented images per day by TOOCAN for geostationary images occurring in a Rapid Scan mode (GOES-13/GOES-15). In that case, the South part is not observed.

QCgeo_GEOScanMode

QCgeo_GEOScanMode [0]: total number of GEO images per day.

QCgeo_GEOScanMode[1]: number of GEO images per day occurring in a routine mode.

QCgeo_GEOScanMode[2]: number of GEO images per day occurring in a Rapid Scan mode (GOES-13/GOES-15).

QCtoocan_Interruption:

Indication of the interruption/restart of the tracking process during the day

1 → indication of the interruption/restart of tracking the tracking process for GEO images in a routine (global) mode

2 → indication of the interruption/restart of tracking the tracking process for GEO images in a Rapid Scan mode occurring for the GOES-13/GOES-15 platforms. In this case, the tracking process is stopped for the South scan of the AMERICAN and EASTERNPACIFIC region.

QCmcs_Flag

first digit = MCS Initiation error

- 1: OK
- 2: MCS initiation explained by a recovery of the tracking due to a minimum of 5 successive missing GEO images
- 3: MCS initiation explained by the transition from a GEO global mode to a rapid scan mode.

second digit = MCS Dissipation error

- 1: OK
- 2: MCS dissipation explained by a recovery of the tracking due to a minimum of 5 successive missing GEO images
- 3: MCS dissipation explained by the transition from a GEO global mode to a rapid scan mode.

third digit = MCS Edge error

- 1: OK
- 2: MCS impacted by the GEO image boundaries along its life cycle
- 3: MCS impacted by the GEO image boundaries in a rapid scan mode along its life cycle.
- 4: MCS impacted by missing/bad pixels

two last digits = number of images interpolated along the MCS life cycle

Example:

QCmcs_Flag = 11100

First digit = 1 → MCS initiation OK

Second digit = 1 → MCS dissipation OK

Third digit = 1 → MCS not impacted by the image boundaries

Two last digit = 00 → No interpolated GEO images during the MCS tracking

QCmcs_Flag = 11108

First digit = 1 → MCS initiation OK

Second digit = 1 → MCS dissipation OK

Third digit = 1 → MCS not impacted by the image boundaries

Two last digit = 08 → 8 interpolated GEO images during the MCS tracking

QCmcs_Flag = 11200

- First digit =1 → MCS initiation OK
- Second digit = 1 → MCS dissipation OK
- Third digit = 2 → MCS impacted by the image boundaries
- Two last digit = 00 → No interpolated GEO images during the MCS tracking

QCmcs_Flag = 11300

- First digit =1 → MCS initiation OK
- Second digit = 1 → MCS dissipation OK
- Third digit = 3 → MCS impacted by the image boundaries in a rapid scan mode (GOES-13 and GOES-15)
- Two last digit = 00 → No interpolated GEO images during the MCS tracking

QCmcs_Flag = 13100

- First digit =1 → MCS initiation OK
- Second digit = 3 → MCS dissipation due to the transition from a GEO global mode to a rapid scan mode
- Third digit = 1 → MCS not impacted by the image boundaries
- Two last digit = 00 → No interpolated GEO images during the MCS tracking

QCmcs_Flag = 21100

- First digit =2 → MCS initiation explained by a recovery of the tracking due to a minimum of 5 successive missing GEO images.
- Second digit = 1 → MCS dissipation OK
- Third digit = 1 → MCS not impacted by the image boundaries
- Two last digit = 00 → No interpolated GEO images during the MCS tracking

QCmcs_Class:

Classification of the MCSs

1 → MCS with a duration < 5hr

- 2→ MCS with a duration ≥ 5 hr and described by a unqi maximum of their cold surfaces along their life cycles
- 3→ MCS with a duration ≥ 5 hr and described by several maximums of their cold surfaces along their life cycles

INIT_Time / END_Time:

LTimeinit = 16256.3386

Local day = 16256 since the 1st January 1970

Local hour = 0.3386×24 hr = 8.1264 hr

dimensions:

```
lon = 360 ;  
lat = 60 ;  
time = UNLIMITED ; // (31 currently)  
nmaxMCS = 25 ;  
GEOmode = 3 ;
```

variables:

```
float lon(lon) ;  
lon:units = "degrees east" ;  
lon:long_name = "Longitude" ;
```

```
float lat(lat) ;  
lat:units = "degrees north" ;  
lat:long_name = "Latitude" ;
```

```
double time(time) ;  
time:units = "hours since 1970-01-01 00:00:00 UTC" ;  
time:long_name = "Time" ;  
time:calendar = "Standard" ;
```

```
short QCgeo_numgeo(lat, lon) ;  
QCgeo_numgeo:units = "nodimension" ;  
QCgeo_numgeo:long_name = "ID of the geostationary platform" ;  
QCgeo_numgeo:_FillValue = -999s ;  
QCgeo_numgeo:MissingValue = -999.f ;
```

```
short QCgeo_GEOScanMode(time, GEOmode, lat, lon) ;  
QCgeo_GEOScanMode:units = "nodimension" ;  
QCgeo_GEOScanMode:long_name = "total Number of geo images per day / in routine mode / in rapid scan  
mode " ;
```

```
QCgeo_GEOScanMode:_FillValue = -999s ;  
QCgeo_GEOScanMode:MissingValue = -999.f ;
```

```
short QCtoocan_Interruption(time, lat, lon) ;  
QCtoocan_Interruption:units = "nodimension" ;  
QCtoocan_Interruption:long_name = "Interruption of the TOOCAN tracking" ;  
QCtoocan_Interruption:_FillValue = -999s ;
```



```

QCtoocan_Interruption:MissingValue = -999.f ;

QCtoocan_Interruption:comment = "reasons for tracking interruption: more than 5 successives missing images
= 1 / a GEO Rapid Scan mode = 2" ;

short QCtoocan_nbSegmentedImages(time, GEOMode, lat, lon) ;

QCtoocan_nbSegmentedImages:units = "nodimension" ;

QCtoocan_nbSegmentedImages:long_name = "Number of segmented images created by TOOCAN" ;

QCtoocan_nbSegmentedImages:_FillValue = -999s ;

QCtoocan_nbSegmentedImages:MissingValue = -999.f ;

int QCcacatoes_nbpixels(time, lat, lon) ;

QCcacatoes_nbpixels:units = "nodimension" ;

QCcacatoes_nbpixels:long_name = "number of geo pixels within a gridpoint integrated on one day" ;

QCcacatoes_nbpixels:_FillValue = -999 ;

QCcacatoes_nbpixels:MissingValue = -999.f ;

float QCcacatoes_SurfGridPoint(time, lat, lon) ;

QCcacatoes_SurfGridPoint:units = "km2" ;

QCcacatoes_SurfGridPoint:long_name = "surface of a gridpoint integrated on one day" ;

QCcacatoes_SurfGridPoint:_FillValue = -999.f ;

QCcacatoes_SurfGridPoint:MissingValue = -999.f ;

int DAYLYmcs_Pop(time, lat, lon) ;

DAYLYmcs_Pop:units = "nodimension" ;

DAYLYmcs_Pop:long_name = "population of MCS included partially or totally within a 1-degree/1-day" ;

DAYLYmcs_Pop:_FillValue = -999 ;

DAYLYmcs_Pop:MissingValue = -999.f ;

int QCmcs_Label(time, nmaxMCS, lat, lon) ;

QCmcs_Label:units = "nodimension" ;

QCmcs_Label:long_name = "ID of the MCS in the tracking file" ;

QCmcs_Label:_FillValue = -999 ;

QCmcs_Label:MissingValue = -999.f ;

short QCmcs_Flag(time, nmaxMCS, lat, lon) ;

QCmcs_Flag:units = "nodimension" ;

QCmcs_Flag:long_name = "Confidence on the tracked MCS" ;

QCmcs_Flag:_FillValue = -999s ;

```

```
QCmcs_Flag:MissingValue = -999.f ;
```

```
QCmcs_Flag:comment = "combination of flag index /first digit = MCS Initiation error (1: OK; 2: Initiation following a tracking interruption; 3: initiation following rapid scan mode)\n",
```

```
"second digit = MCS Dissipation error (1: OK; 2: Dissipation due to a tracking interruption; 3: Dissipation due to rapid scan mode)\n",
```

```
"third digit = MCS Edge error (1: OK; 2: MCS affected by the boundaries ; 3: MCS affected by the boundaries of the rapid scan images; 4: MCS affected missing pixels )\n",
```

```
"two last digits = number of images interpolated along the MCS life cycle" ;
```

```
short QCmcs_Class(time, nmaxMCS, lat, lon) ;
```

```
QCmcs_Class:units = "nodimension" ;
```

```
QCmcs_Class:long_name = "MCS Classification" ;
```

```
QCmcs_Class:_FillValue = -999s ;
```

```
QCmcs_Class:MissingValue = -999.f ;
```

```
QCmcs_Class:comment = "Class_I = 1 / Class_Ia = 2 / Class_Ib = 3" ;
```

```
float INT_Duration(time, nmaxMCS, lat, lon) ;
```

```
INT_Duration:units = "h" ;
```

```
INT_Duration:long_name = "Duration of the MCS" ;
```

```
INT_Duration:_FillValue = -999.f ;
```

```
INT_Duration:MissingValue = -999.f ;
```

```
int INT_Smax(time, nmaxMCS, lat, lon) ;
```

```
INT_Smax:units = "km2" ;
```

```
INT_Smax:long_name = "Maximum size of the MCS" ;
```

```
INT_Smax:_FillValue = -999 ;
```

```
INT_Smax:MissingValue = -999.f ;
```

```
int INT_Scum(time, nmaxMCS, lat, lon) ;
```

```
INT_Scum:units = "km2" ;
```

```
INT_Scum:long_name = "Cumulated size of the MCS along their life cycle" ;
```

```
INT_Scum:_FillValue = -999 ;
```

```
INT_Scum:MissingValue = -999.f ;
```

```
float INT_Tmax(time, nmaxMCS, lat, lon) ;
```

```
INT_Tmax:units = "%" ;
```

```
INT_Tmax:long_name = "Time of Maximum size of the MCS" ;
```

```

INT_Tmax:_FillValue = -999.f ;
INT_Tmax:MissingValue = -999.f ;
float INT_Distance(time, nmaxMCS, lat, lon) ;
INT_Distance:units = "km" ;
INT_Distance:long_name = "Propagation of the MCS centroid from its initiation to its dissipation " ;
INT_Distance:_FillValue = -999.f ;
INT_Distance:MissingValue = -999.f ;
short INT_Tbmin(time, nmaxMCS, lat, lon) ;
INT_Tbmin:units = "K" ;
INT_Tbmin:long_name = "Minimum brightness temperature of the MCS along its lifecycle" ;
INT_Tbmin:_FillValue = -999s ;
INT_Tbmin:MissingValue = -999.f ;
float INT_Ecc220K(time, nmaxMCS, lat, lon) ;
INT_Ecc220K:units = "nodimension" ;
INT_Ecc220K:long_name = "eccentricity of the MCS at Tmax for a 220K threshold" ;
INT_Ecc220K:_FillValue = -999.f ;
INT_Ecc220K:MissingValue = -999.f ;
float INT_Ecc235K(time, nmaxMCS, lat, lon) ;
INT_Ecc235K:units = "nodimension" ;
INT_Ecc235K:long_name = "eccentricity of the MCS at Tmax for a 235K threshold" ;
INT_Ecc235K:_FillValue = -999.f ;
INT_Ecc235K:MissingValue = -999.f ;
double INIT_Time(time, nmaxMCS, lat, lon) ;
INIT_Time:units = "Julian Day / hour" ;
INIT_Time:long_name = "Day and Local hour of the initiation" ;
INIT_Time:_FillValue = -999. ;
INIT_Time:MissingValue = -999.f ;
float INIT_Lon(time, nmaxMCS, lat, lon) ;
INIT_Lon:units = "degrees" ;
INIT_Lon:long_name = "longitude of initiation" ;
INIT_Lon:_FillValue = -999.f ;
INIT_Lon:MissingValue = -999.f ;

```

```

float INIT_Lat(time, nmaxMCS, lat, lon) ;
    INIT_Lat:units = "degrees" ;
    INIT_Lat:long_name = "latitude of initiation" ;
    INIT_Lat:_FillValue = -999.f ;
    INIT_Lat:MissingValue = -999.f ;

double END_Time(time, nmaxMCS, lat, lon) ;
    END_Time:units = "Julian Day / hour" ;
    END_Time:long_name = "Day and Local hour of the dissipation" ;
    END_Time:_FillValue = -999. ;
    END_Time:MissingValue = -999.f ;

float END_Lon(time, nmaxMCS, lat, lon) ;
    END_Lon:units = "degrees" ;
    END_Lon:long_name = "longitude of dissipation" ;
    END_Lon:_FillValue = -999.f ;
    END_Lon:MissingValue = -999.f ;

float END_Lat(time, nmaxMCS, lat, lon) ;
    END_Lat:units = "degrees" ;
    END_Lat:long_name = "latitude of dissipation" ;
    END_Lat:_FillValue = -999.f ;
    END_Lat:MissingValue = -999.f ;

float INT_Surfmcs(time, nmaxMCS, lat, lon) ;
    INT_Surfmcs:units = "km2" ;
    INT_Surfmcs:long_name = "MCS Integrated Surface within a gridpoint and integrated on one day" ;
    INT_Surfmcs:_FillValue = -999.f ;
    INT_Surfmcs:MissingValue = -999.f ;

float INT_Sfract(time, nmaxMCS, lat, lon) ;
    INT_Sfract:units = "%" ;
    INT_Sfract:long_name = "Fraction of the MCS within the Grid point" ;
    INT_Sfract:_FillValue = -999.f ;
    INT_Sfract:MissingValue = -999.f ;

float INT_GridFraction(time, nmaxMCS, lat, lon) ;
    INT_GridFraction:units = "%" ;

```

```
INT_GridFraction:long_name = "Fraction of the gridpoint occupied by an MCS" ;  
INT_GridFraction:_FillValue = -999.f ;  
INT_GridFraction:MissingValue = -999.f ;
```

```
// global attributes:
```

```
:title = "CACATOES - Gridded data 1.00 degree" ;  
:conventions = "CF-1.6, ACDD-1.3" ;  
:institution = "CNRS/LEGOS/IPSL" ;  
:creator_name = "Thomas Fiolleau" ;  
:creator_email = "none" ;  
:creator_url = "none" ;  
:contributor_name = "Remy Roca" ;  
:time_coverage_resolution = "day" ;  
:time_coverage_start = "20160101" ;  
:time_coverage_end = "20160131" ;  
:Region = "GLOBAL" ;  
:Geostationary_platform = "MSG-1/2/3 - MET-7 - HIMAWARI-8 - GOES-13 - GOES-15" ;  
:product\ TOOCAN\ version = "1.06" ;  
:product\ CACATOES\ version = "v1.02" ;
```