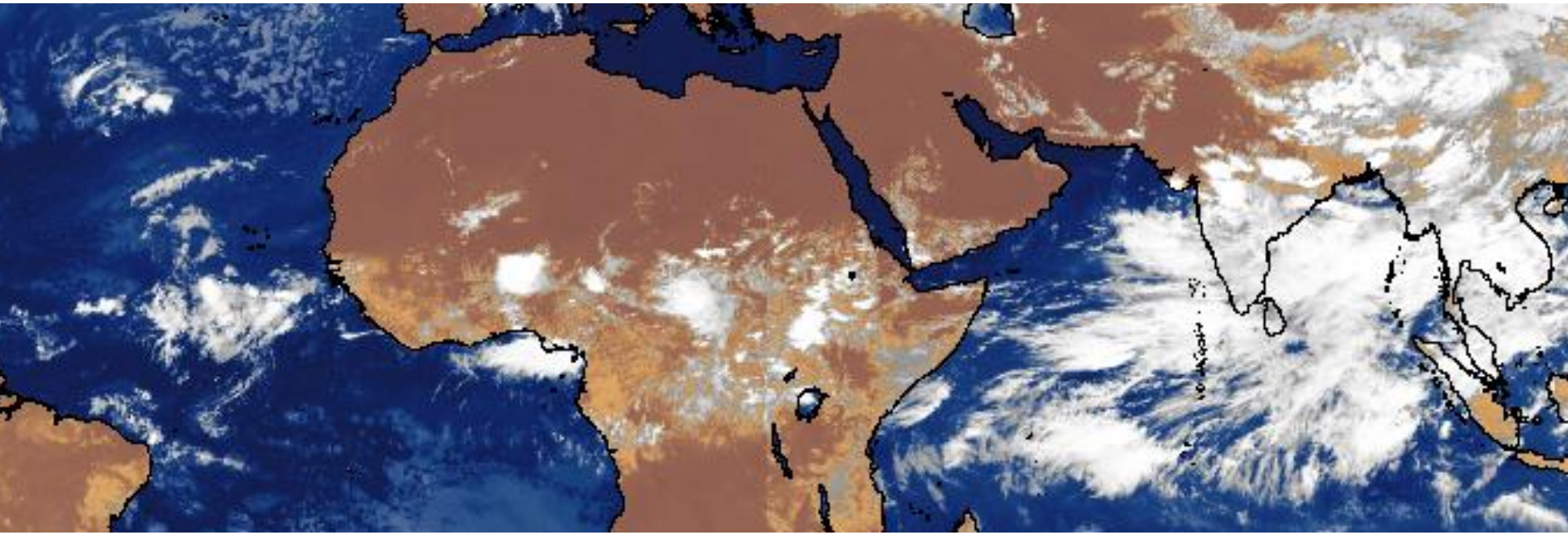
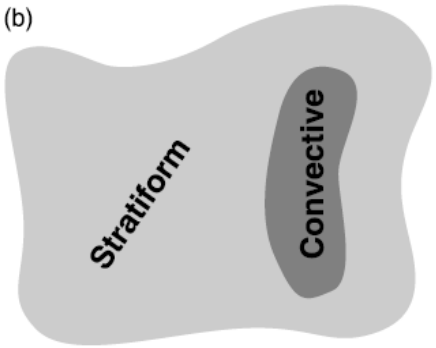
The life cycle of mesoscale convective systems in the WAM: a satellite perspective



Le 1 Juillet 2012 12Z Courtesy SATMOS

Rémy Roca, Thomas Fiolleau and Nicolas Viltard

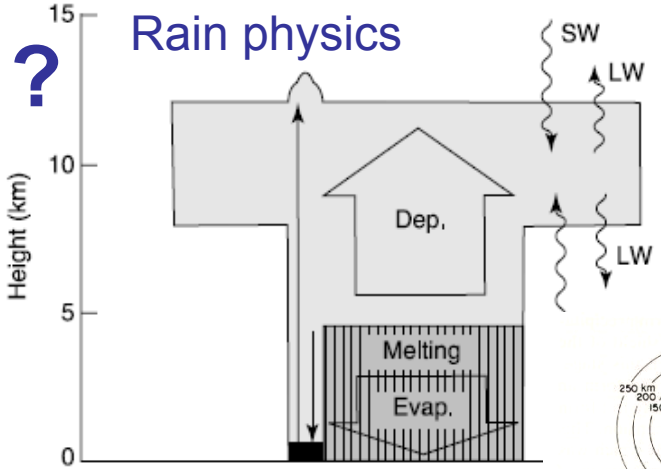
What is an MCS ?



Houze, 2004 ~100 km

Continuous cold cloud shield

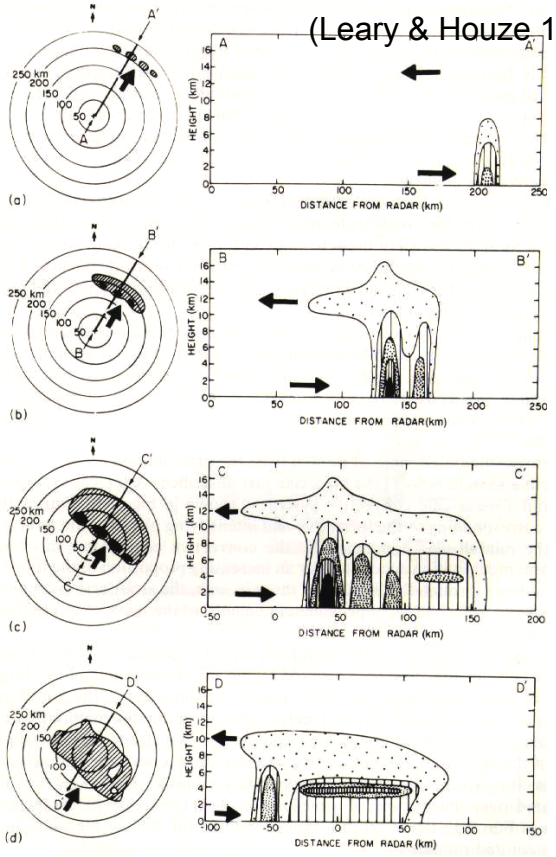
Rain physics

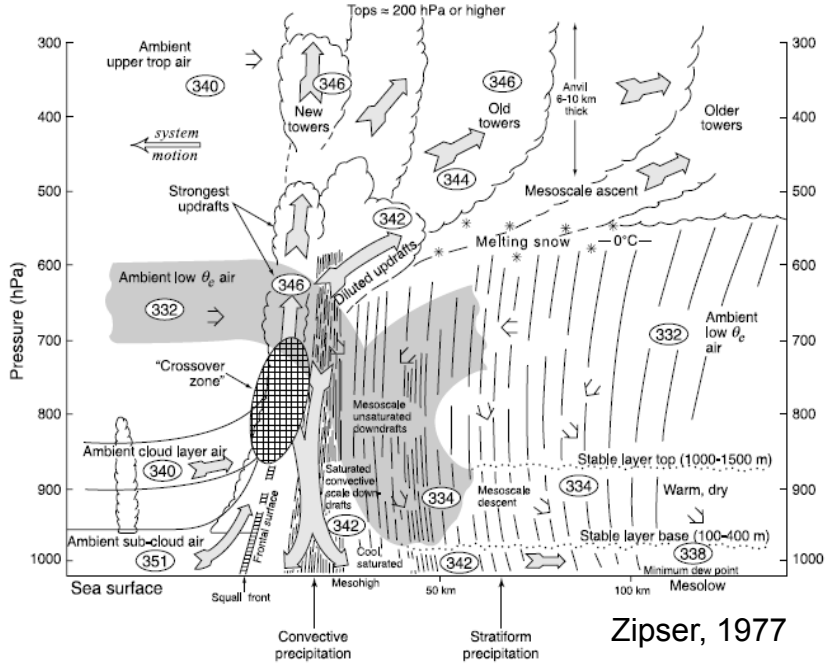


Houze, 2004

Life cycle

(Leary & Houze 1979)



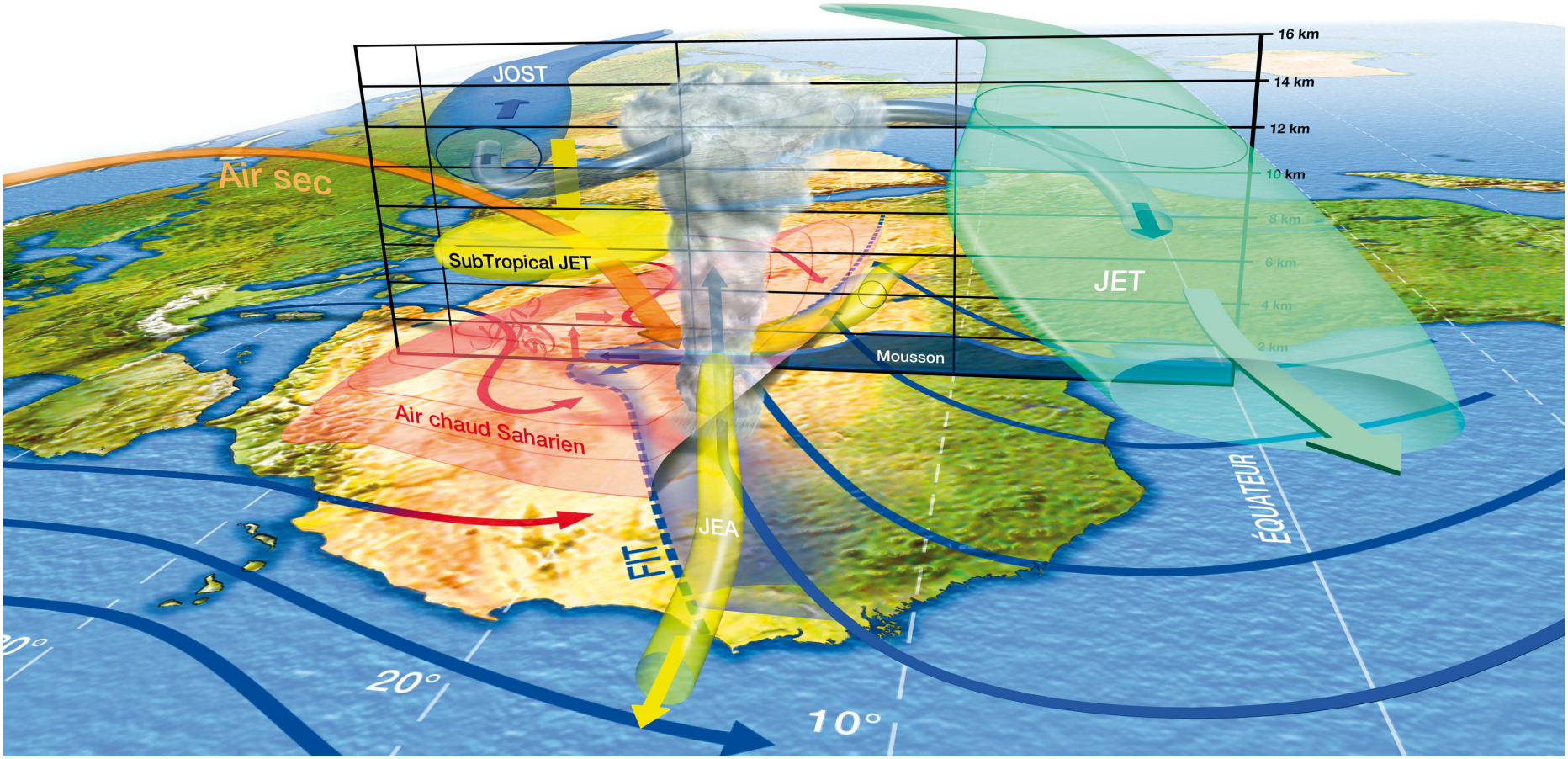


Zipser, 1977

Internal mesoscale dynamics

Large scale environment
(Upper level Wind shear)

The MCS and the WAM
At the heart of the monsoon !

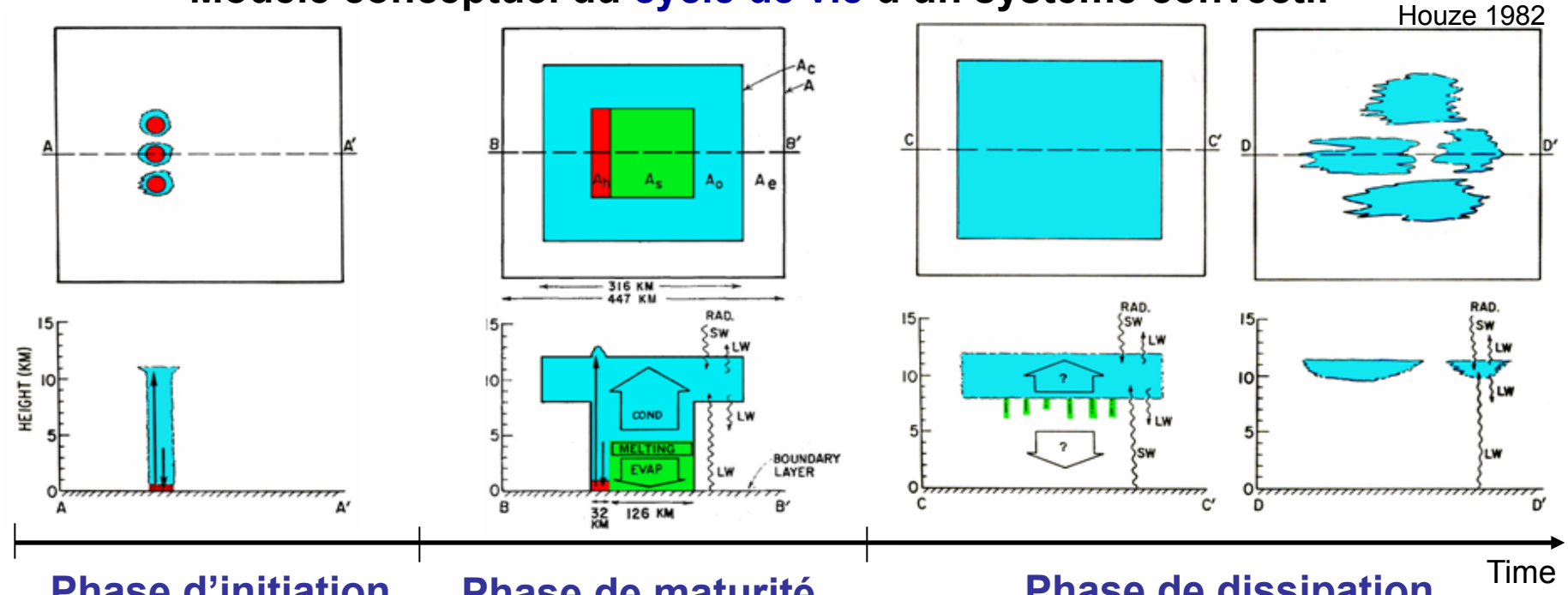


From Lafore et al., 2010

What is an MCS ?
The life cycle of the mesoscale convective system

Modèle conceptuel du cycle de vie d'un système convectif

Houze 1982



Evolution du bouclier nuageux

→ Importance pour le **bilan radiatif**

Evolution des précipitations convectives et stratiformes dans un système convectif

→Importance pour le **bilan de chaleur etc…**

Propagating MCS over WAM

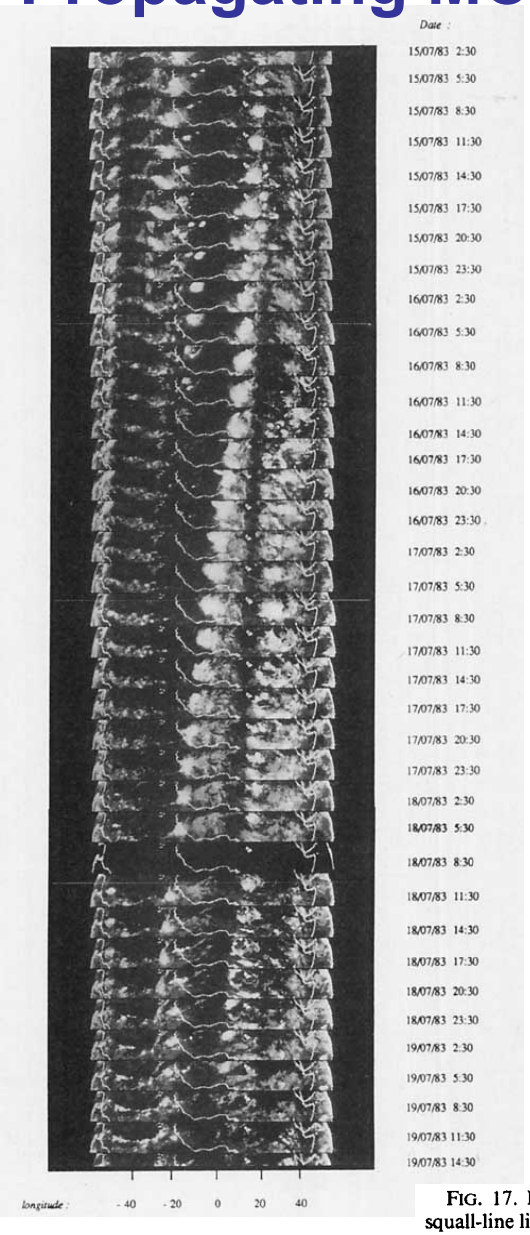


FIG. 17. Example of a time series image used for the study of squall-line life cycle (from 0230 UTC 15 July 1983 to 1730 UTC 18 July). Each band represents the latitude band 0–20°N at a particular time. Time interval is 3 h.

Manual tracking

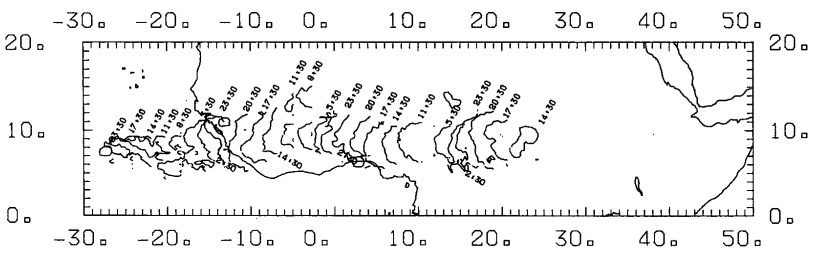


FIGURE 18 - A

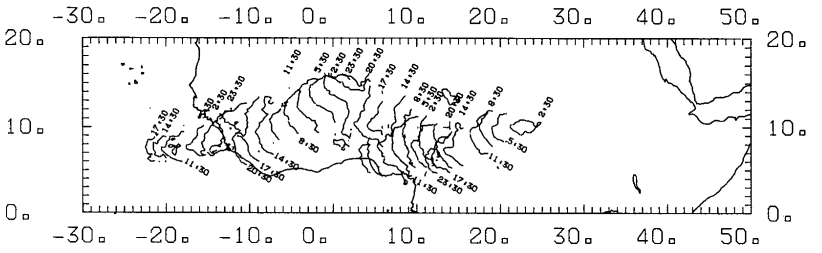


FIGURE 18 - B

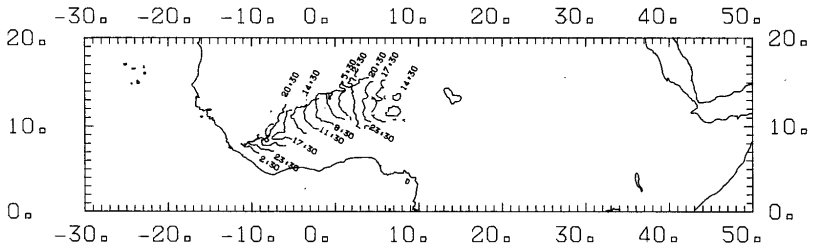


FIGURE 18 - C

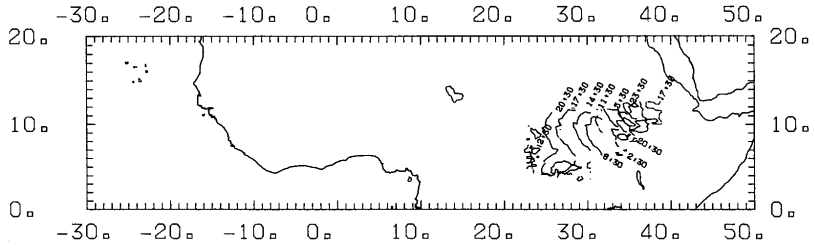
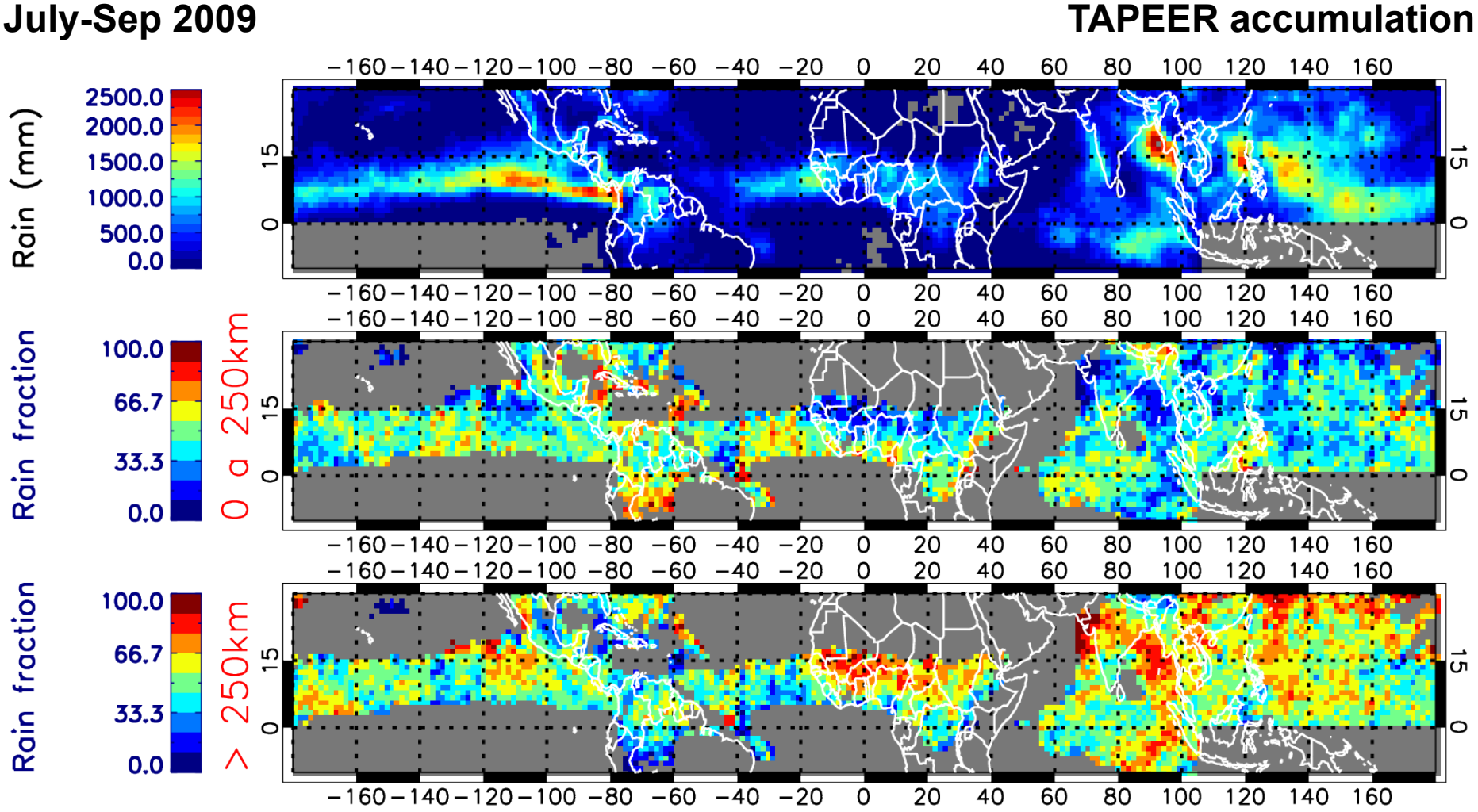


FIGURE 18 - D

FIG. 18. Examples of characteristic squall-line trackings: (a) 12 July to 15 July 1983; (b) 15 July to 18 July 1983; (c) 19 July to 21 July 1985; and (d) 26 July to 28 July 1985.

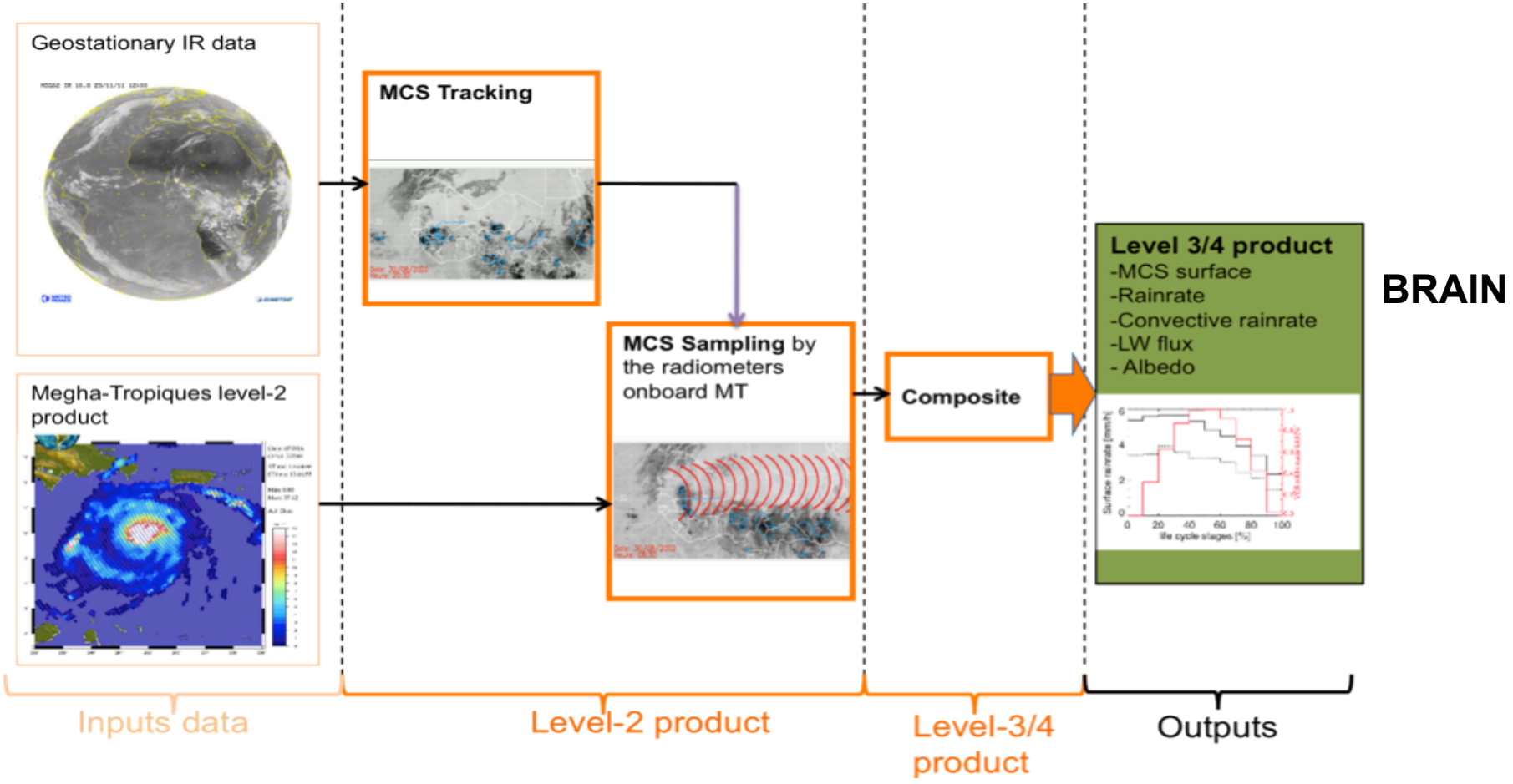
Desbois et al., 1988

The life cycle of MCS
Link to the water budget

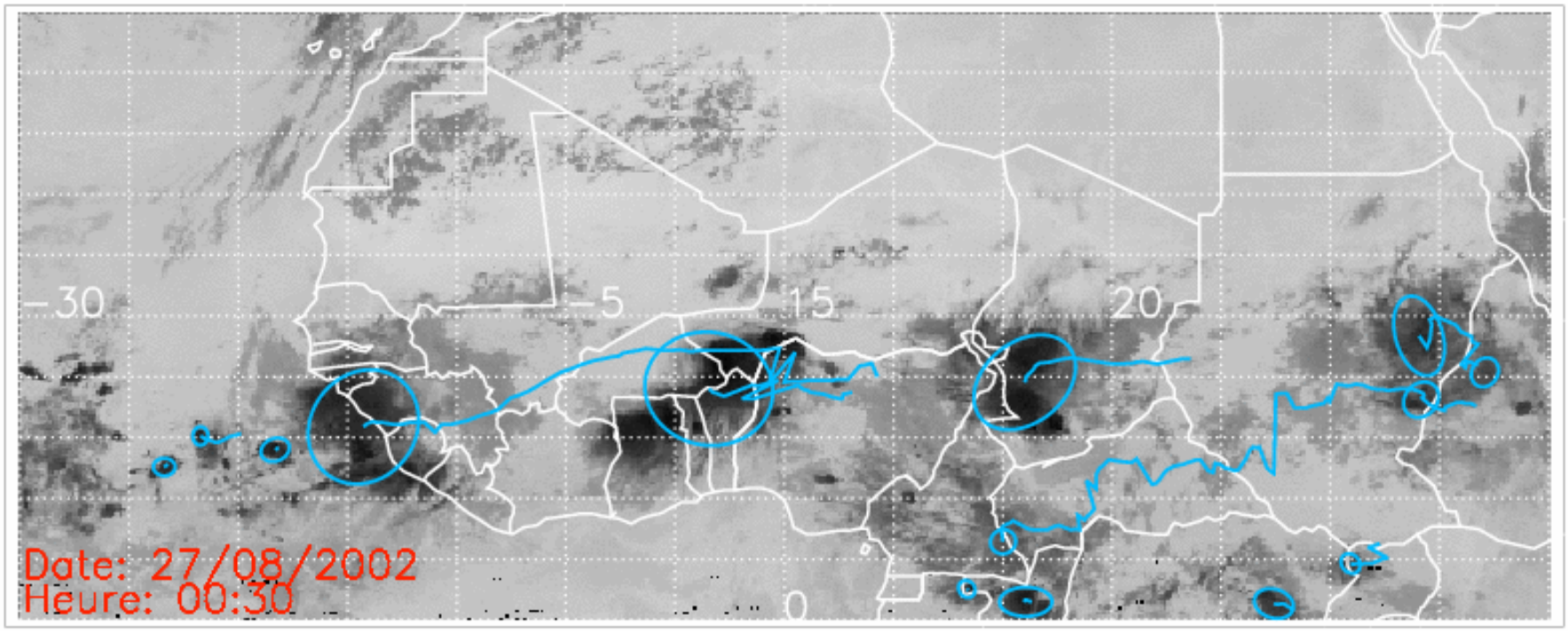


Courtesy P. Chambon

Composite of the life cycle of the MCS
Inputs & Algorithms

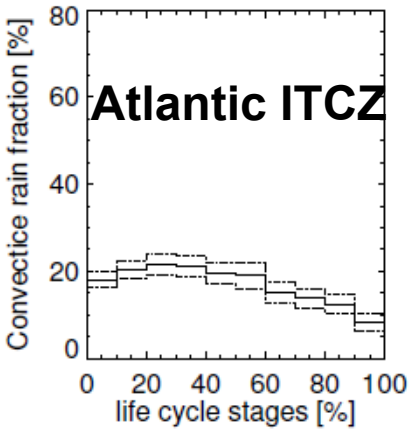


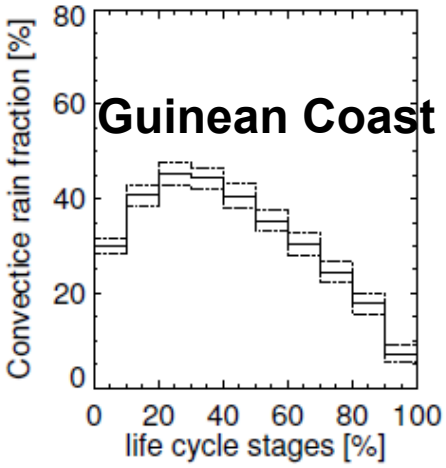
Composite of the life cycle of the MCS
Sampling using the upcoming MADRAS on board MT

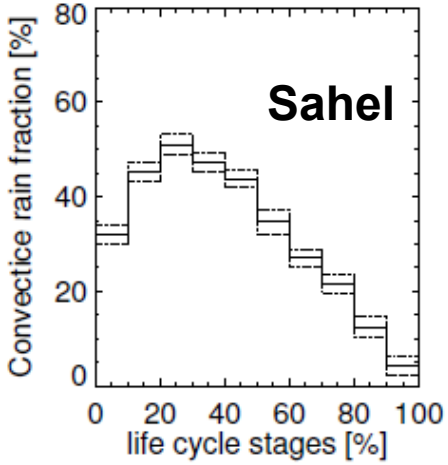


Qu'est ce qu'un MCS ?

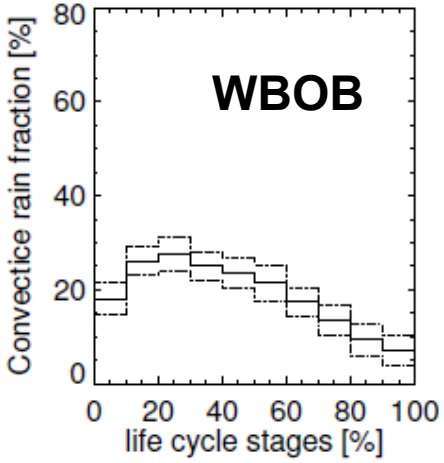
Le cycle de vie: revisité pour les moussons

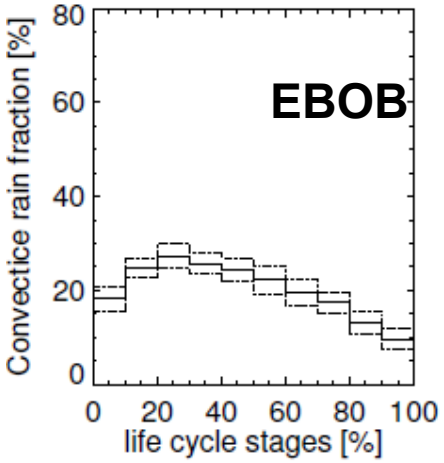


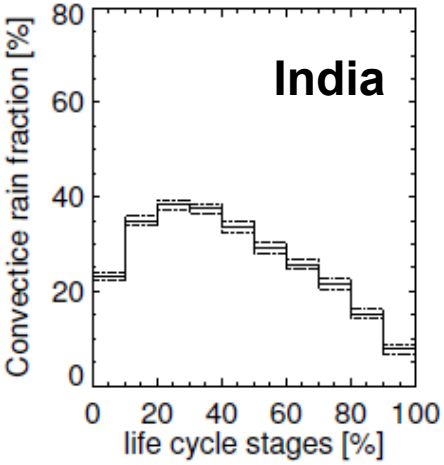


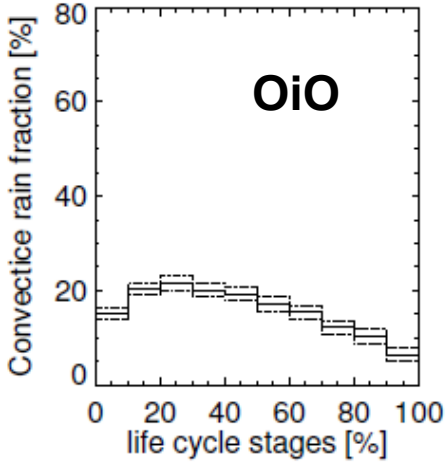


Données:
M-5 & 7
BRAIN TMI
JJAS 02,03,04









The life cycle of MCS: revisited for the monsoons

A 3 stages cycle

Données:
M-5 & 7
BRAIN TMI
JJAS 02,03,04,05

1) Evolution du bouclier du bouclier nuage haut

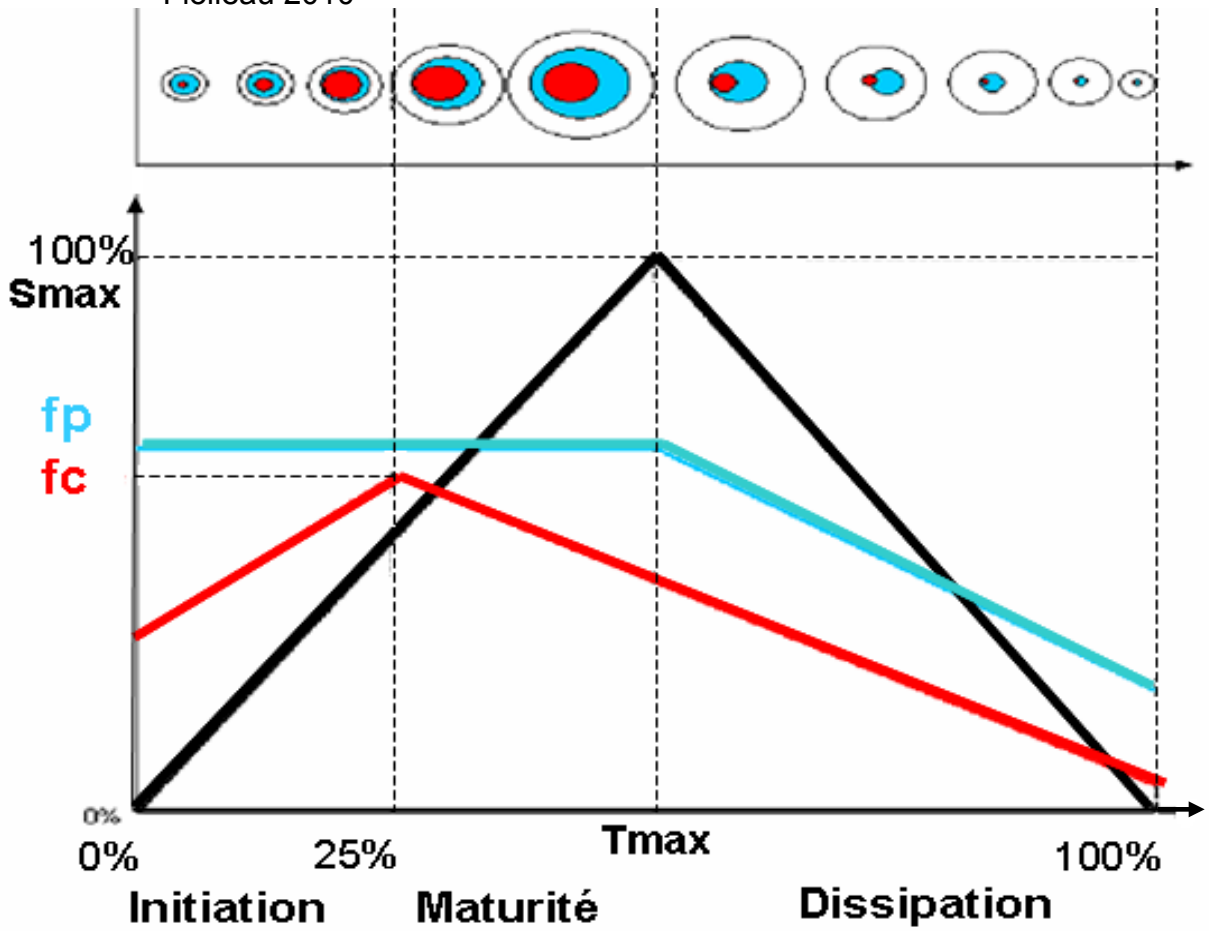
- **Tmax** constant ~ 50%

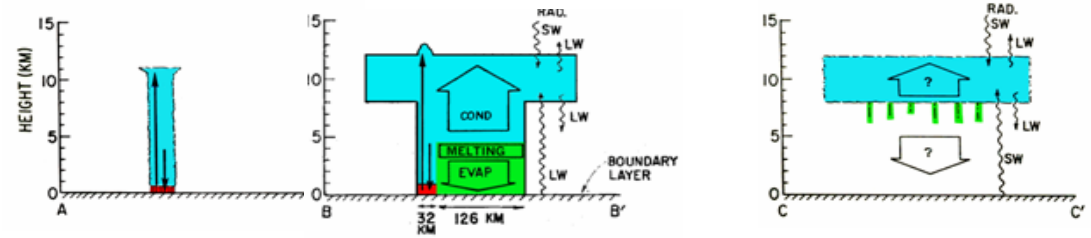
-**Durée de vie** et **Smax** corrélés

2) Evolution des processus humides au sein des MCS:
-fp: fraction précipitante
-fc: fraction de pluie convective

3) Les facteurs d'échelle révèlent une forte dépendance géographique

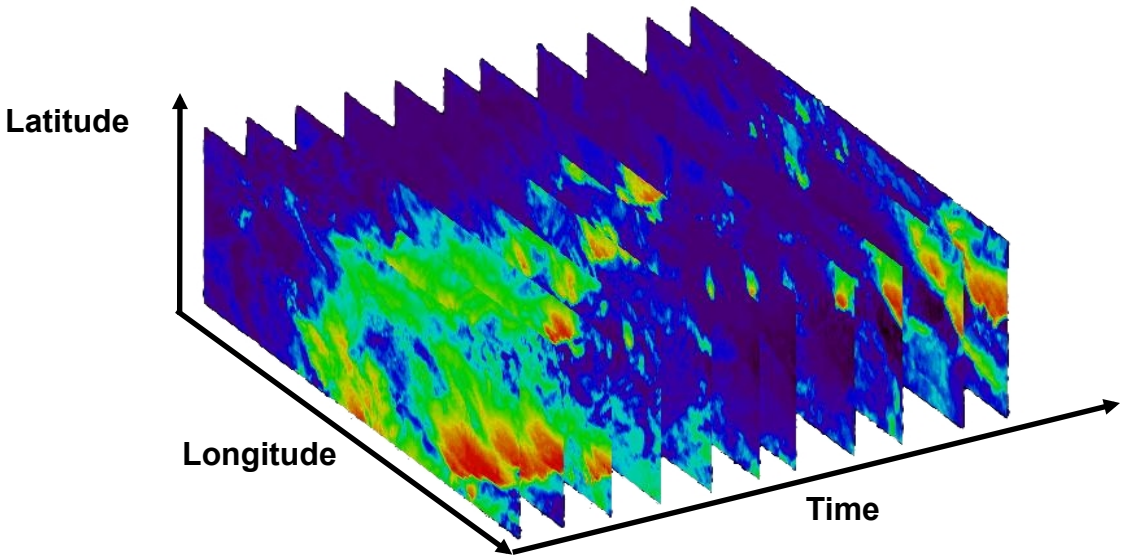
Fiolleau 2010





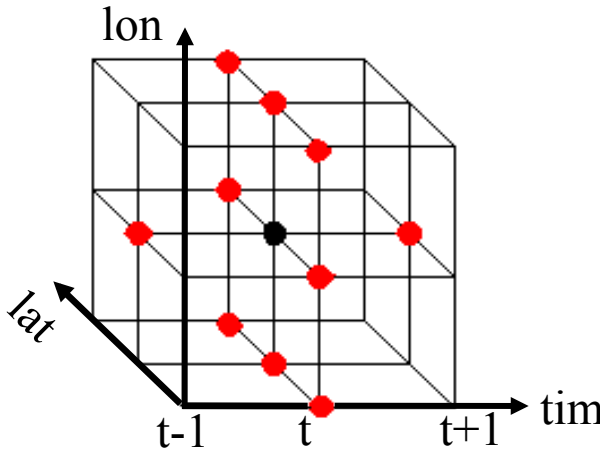
Tracking Of Organized Convection Algorithm through 3D segmentatioN

TOOCAN : a new approach to the detection of MCS



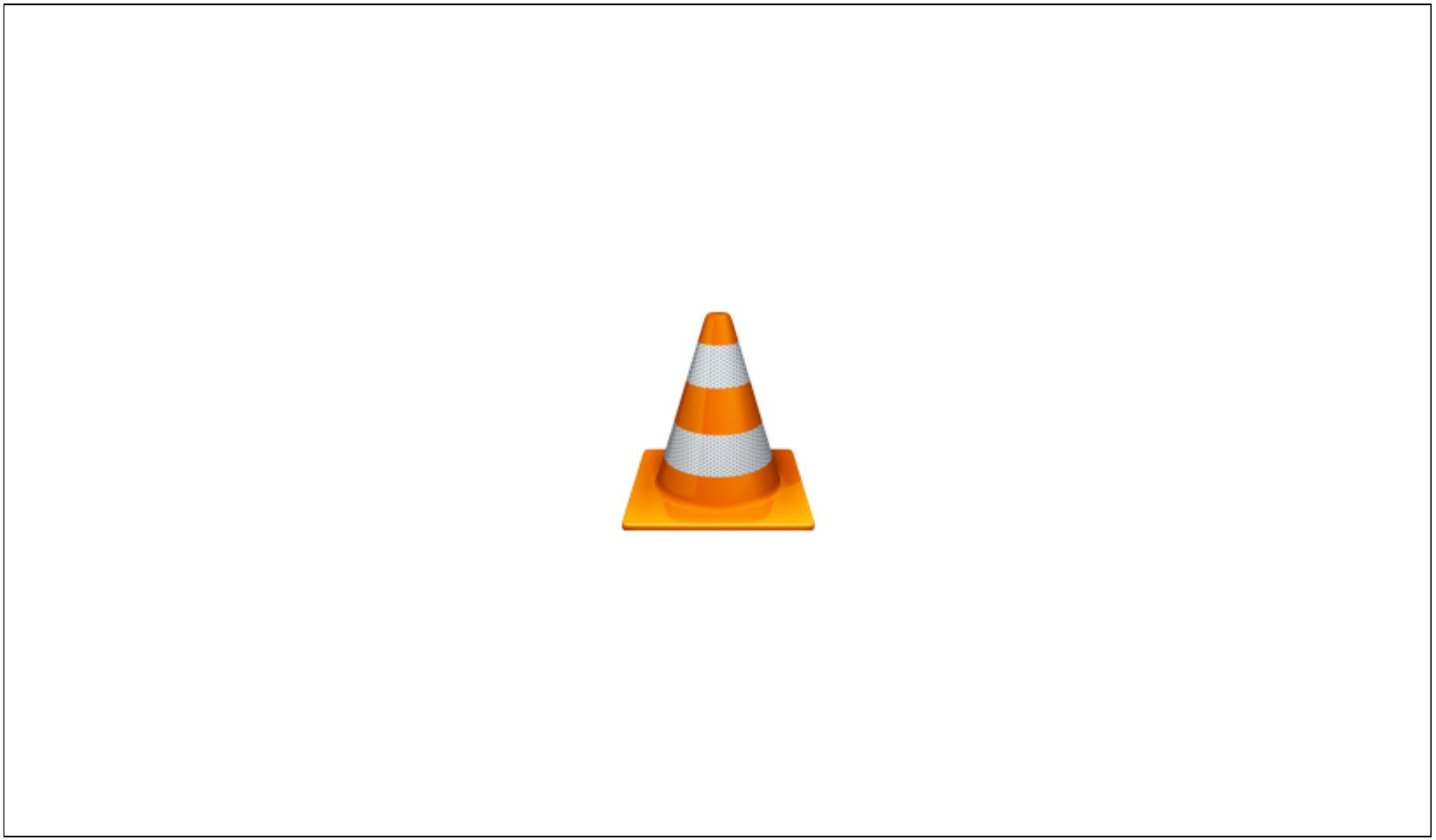
- Works on 3D volume of imagery
- 3D extension of the Detect And Spread technique (multiple steps, multiple threshold)
- BT<235K

- Region growing is performed by using to a **10-connected spatiotemporal neighbourhood :**
  - 8-connected spatial neighbourhood
  - 2-connected temporal neighbourhood (past and future)



Tracking Of Organized Convection with 3D segmentAtioN

TOOCAN : a new approach to the detection of MCS

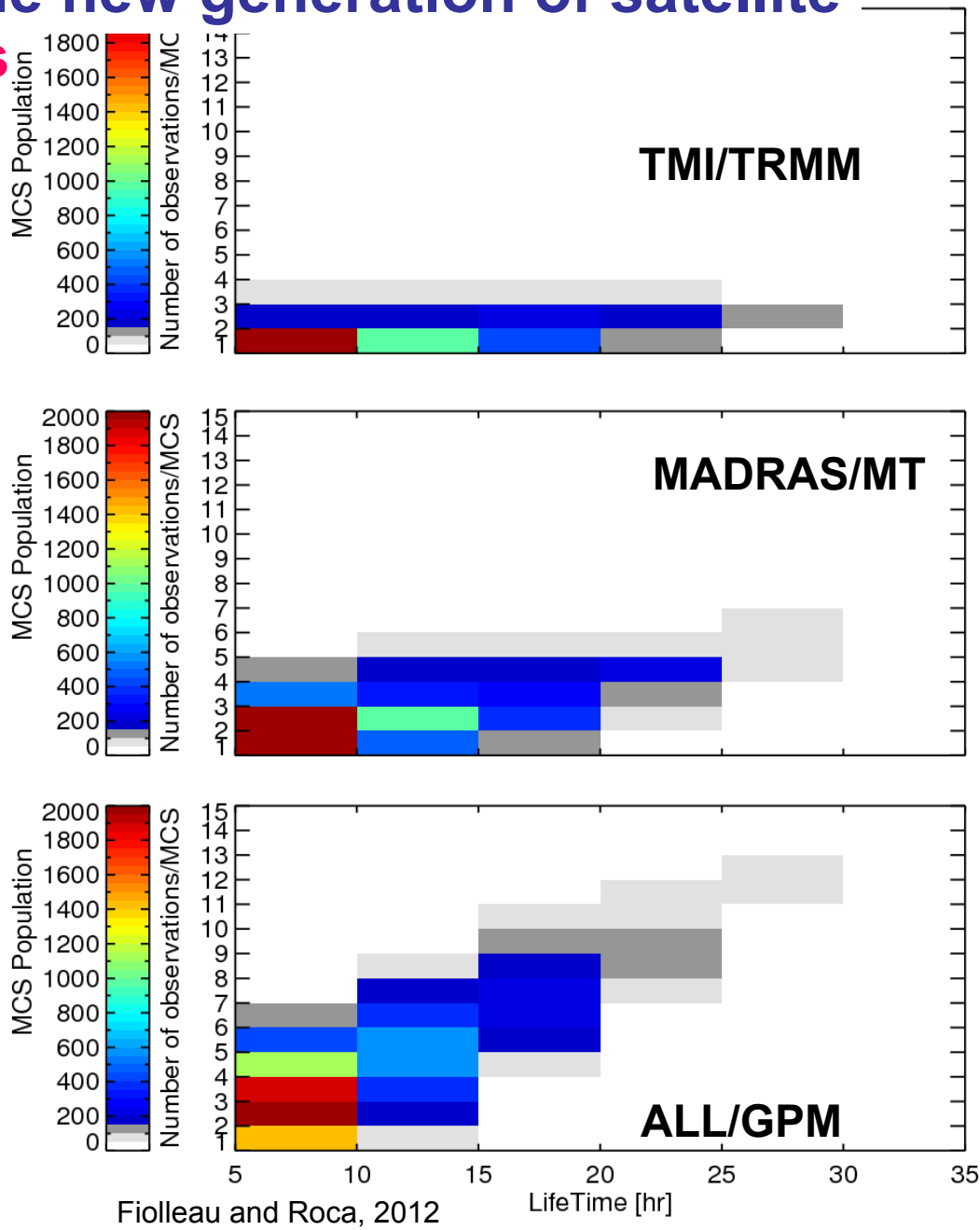


Courtesy J. Aublanc

http://meghatropiques.ipsl.polytechnique.fr/tools/Niamey/

Improved sampling from the new generation of satellite

Upcoming Megha-Tropiques And the GPM constellation



Fiolleau and Roca, 2012

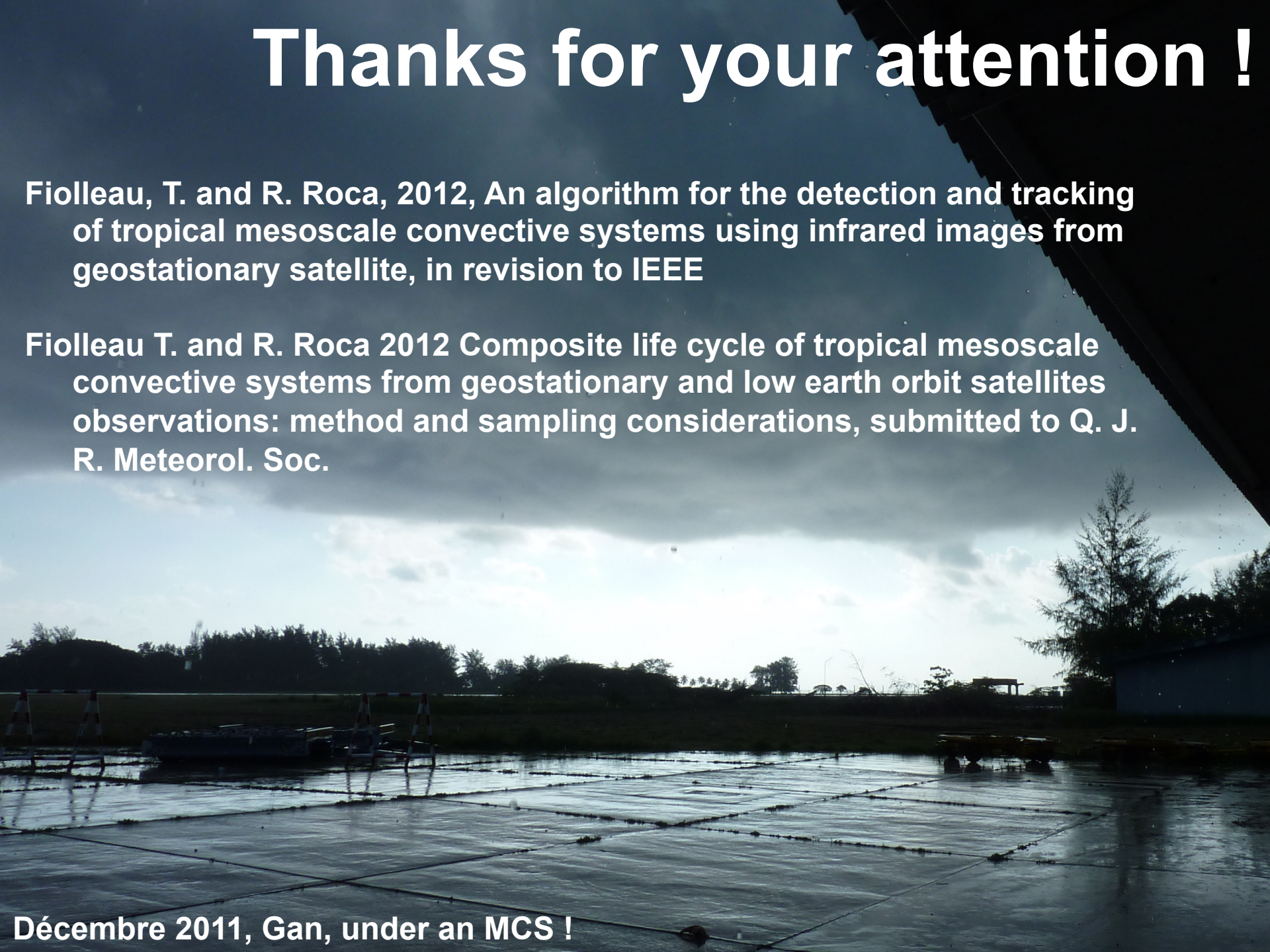
Summary and conclusions

- Automatic tracking « operational » : continous production of the record under the auspices of the Megha-Tropiques mission
- Continuity of the long term record 1983: nowadays (See Talk L. Picon et al.)
- Life cycle insights: a revisited view to be consolidated with more observations (PR, Cloudsat, etc..)
- New detection and tracking algorithm
- Various data bases available upon request and on AMMASAT and AMMAEU database

Thanks for your attention !

Fiolleau, T. and R. Roca, 2012, An algorithm for the detection and tracking of tropical mesoscale convective systems using infrared images from geostationary satellite, in revision to IEEE

Fiolleau T. and R. Roca 2012 Composite life cycle of tropical mesoscale convective systems from geostationary and low earth orbit satellites observations: method and sampling considerations, submitted to Q. J. R. Meteorol. Soc.



Décembre 2011, Gan, under an MCS !