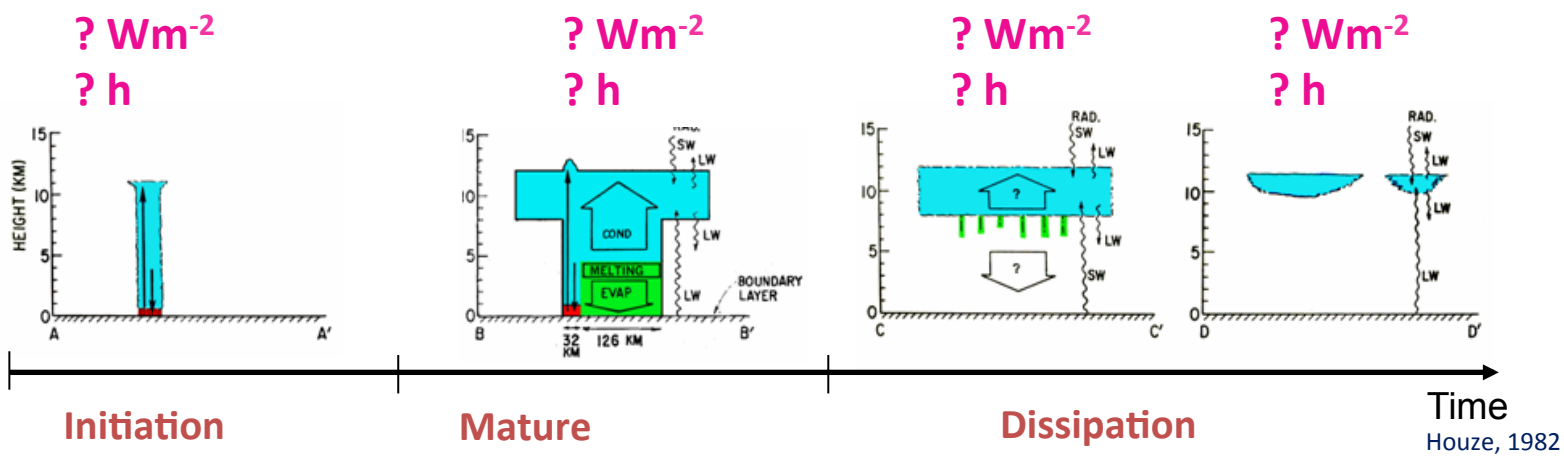
MCS life cycle
TOA flux from SCARAB



Houze, 1982

Rémy Roca, CNRS/OMP/LEGOS, Toulouse, France

B. Rouquié, T. Fiolleau, O. Chomette, P. Raberanto and D. Bouniol

Object-oriented investigations

Importance of large clusters to the distribution of CRF

CERES on board TRMM product

1 APRIL 2001 WILCOX AND RAMANATHAN

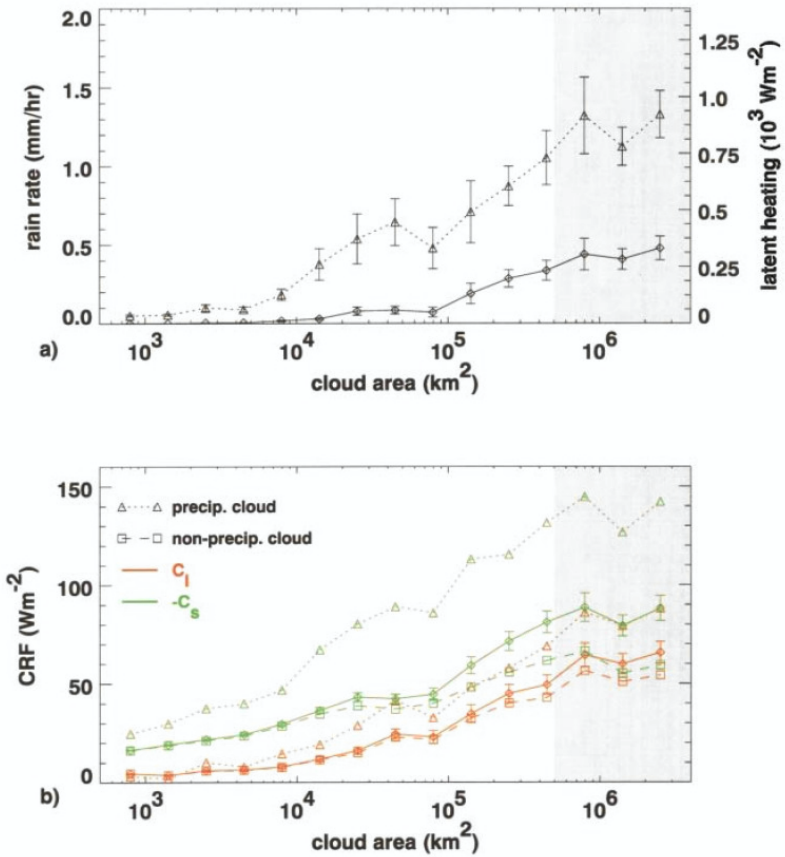


FIG. 5. Cloud-averaged properties as a function of cloud area. (a) Rain rate; right-side axis scaled to show vertically integrated latent heating; (b) C_l (red) and $-C_s$ (green). Solid lines are averages over entire cloud, dotted lines are averages over precipitating portions of cloud, and dashed lines are averages over nonprecipitating portions of cloud. Error bars indicate one standard deviation of the mean.

15 SEPTEMBER 2002 DEL GENIO AI

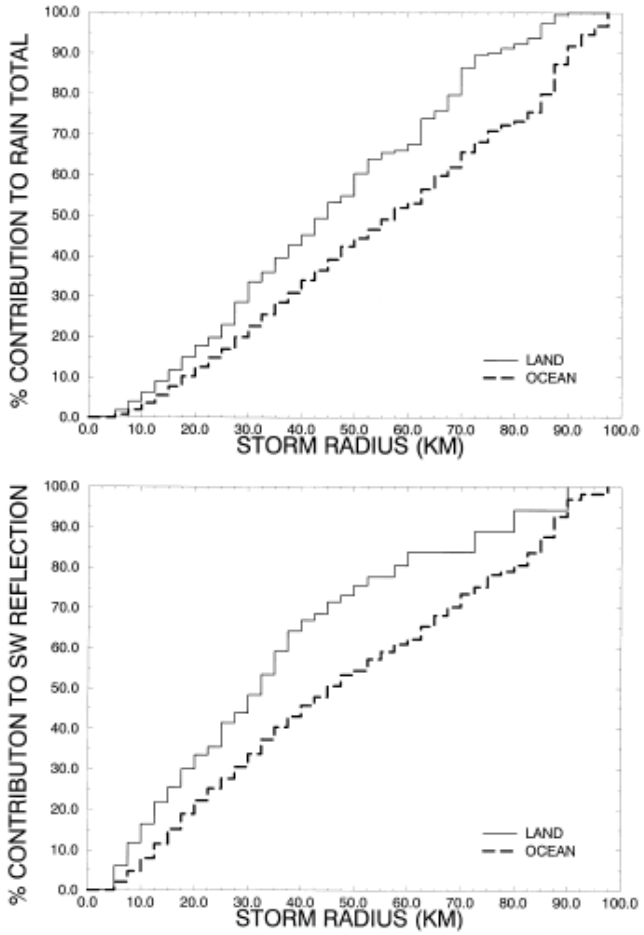


FIG. 2. Cumulative distribution functions of the percent contributions to (upper) rain total and (lower) shortwave reflection by land and ocean storms.

Clouds in their environnement

Importance of « Agregation » & organisation of convection

Thampi and Roca, ACP , 2014

Detailed investigation of the near cancellation & strong net negative regime using CERES data

The water vapor damping of the LWCRF when deep convection is present dominates the TOA budget

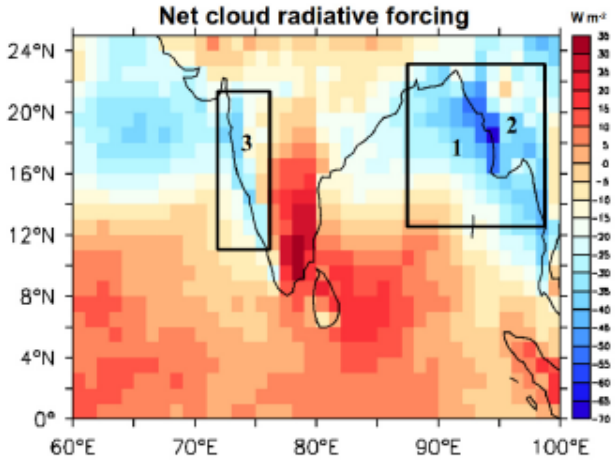


Figure 3. Seasonal mean map of NETCRF over the Indian region during the summer monsoon season of 2002–2005. The negative NETCRF regimes – (1) Bay of Bengal, (2) Myanmar and (3) the Western Ghats (marked in boxes) – are also shown. The color bar represents the NETCRF values in Wm^{-2}.

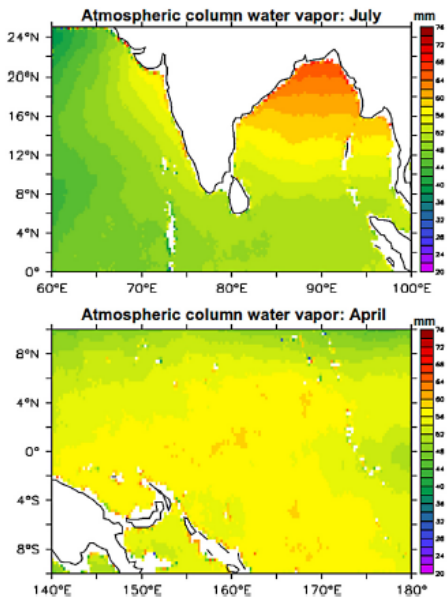
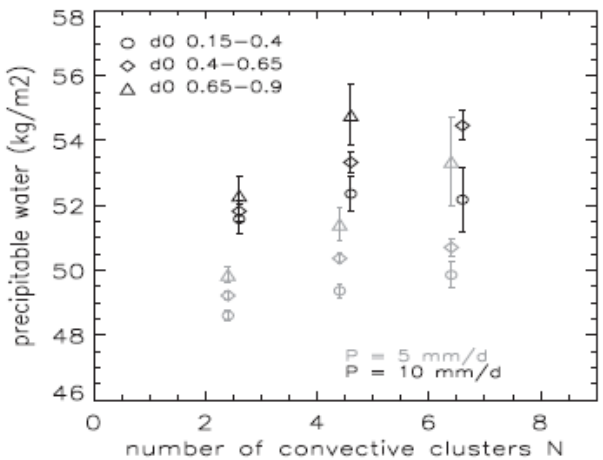


Figure 9. Regional variation in monthly mean atmospheric water vapor (mm) from SSM/I over the Indian region (top panel) during the month of July and the western Pacific (bottom panel) during the month of April for the years 2002–2005.



Tobin, Bony and Roca, J Clim, 2012

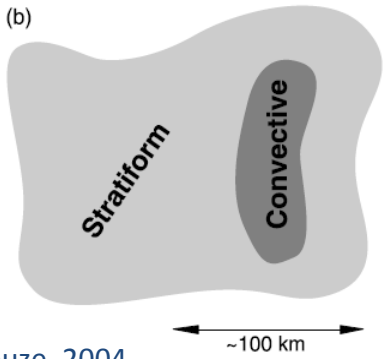
Observational analysis of the depence of the energy budget to the agregation/ organisation of convection

At a given large scale forcing (here Precip), the less clusters (more agregated convection) , the dryer the atmosphere

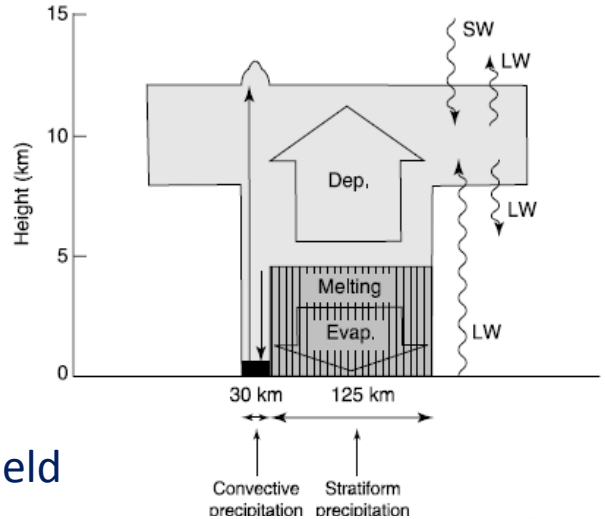
The organisation of convection is important to the TOA budget

Organized convection: what is a mesoscale convective system (MCS) ?

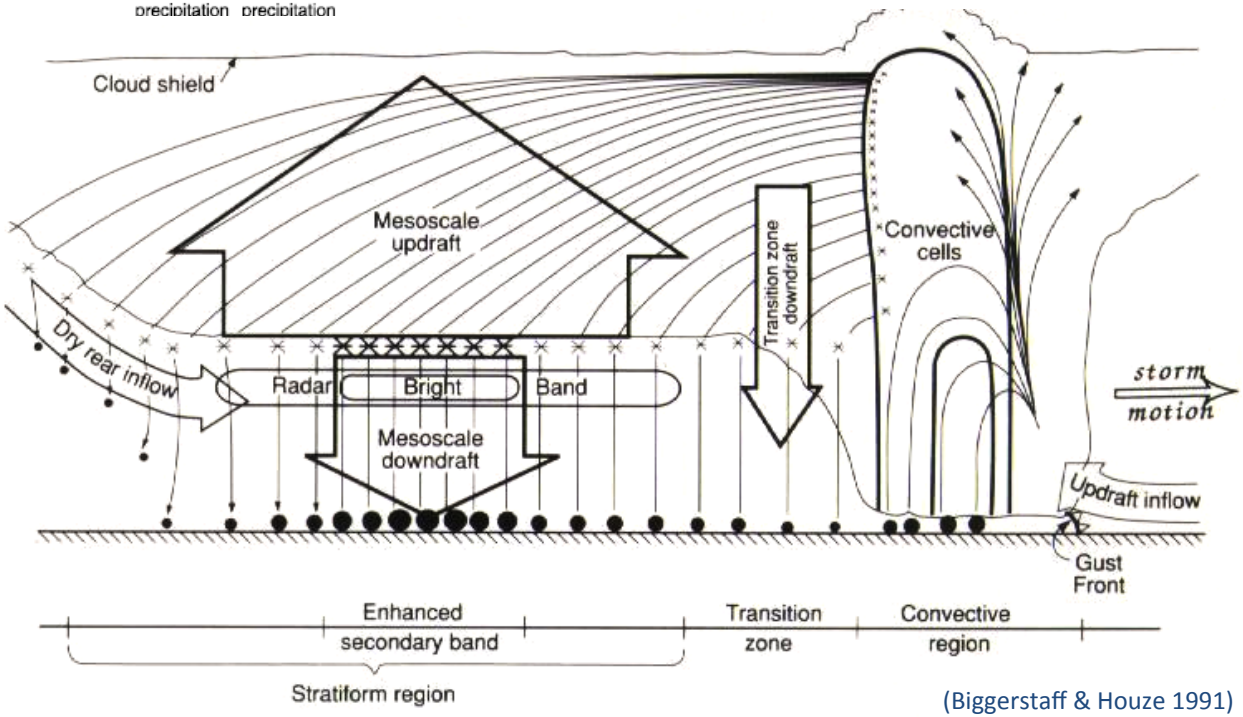
A large corpus of knowledge from radar meteorology, campaigns etc… (1/2)



Houze, 2004



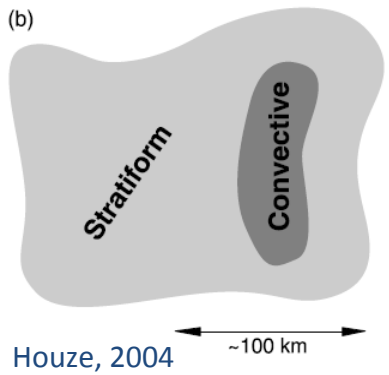
Continuous cold cloud shield



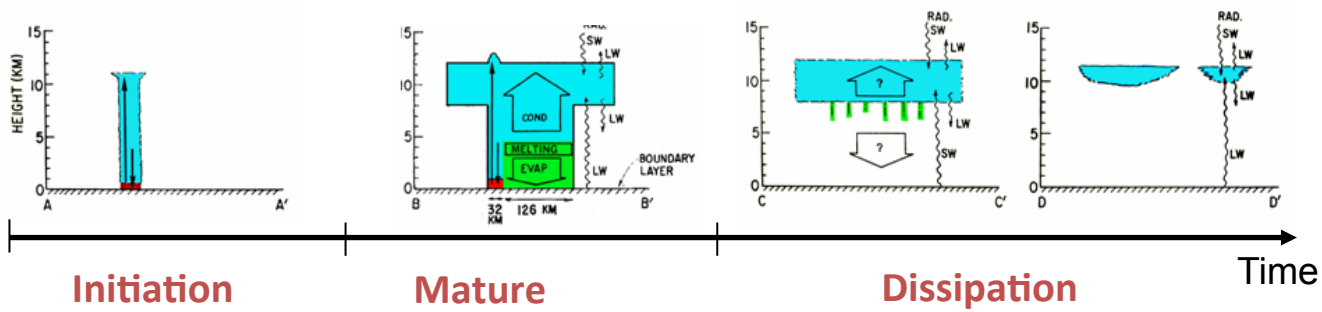
(Biggerstaff & Houze 1991)

What is a mesoscale convective system (MCS) ?

A large corpus of knowledge from radar meteorology, campaigns etc… (2/2)



Houze, 2004



Houze, 1982

Continuous cold cloud shield that evolves during its life cycle from genesis to lysis

The organization of deep convection can be characterized by the MCS dynamical morphology:

- **its duration in hours**
- **its propagation distance in km**
- **etc….**

READILY

obtained from geostationnary infrared imagery and a pattern recognition and tracking algorithm

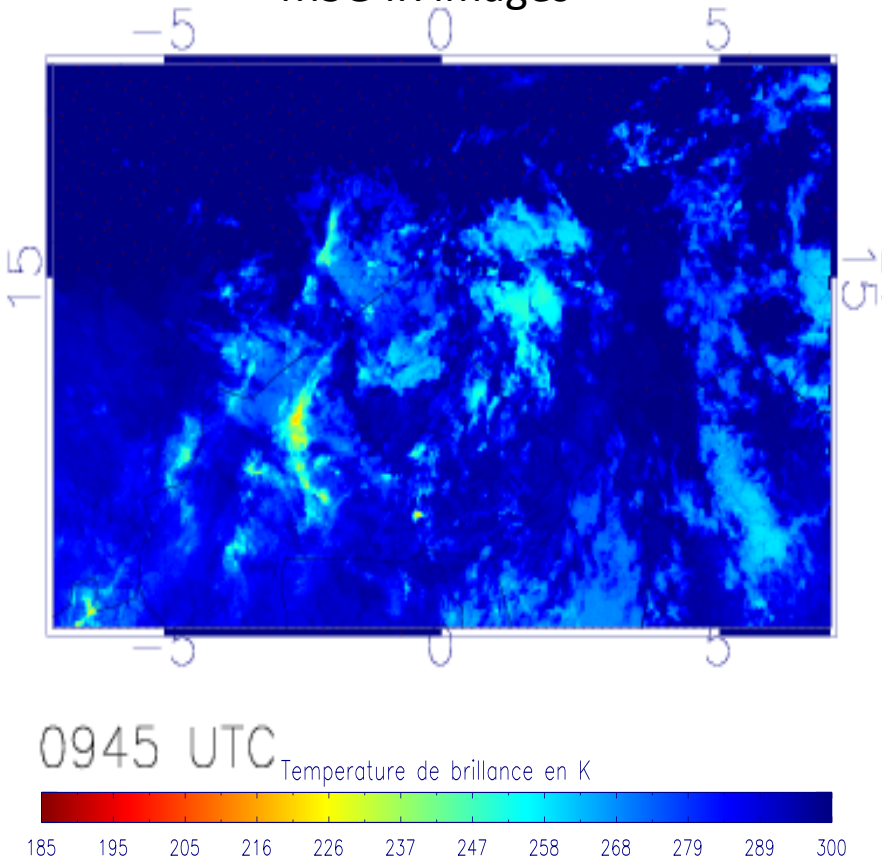
Fiolleau T. and R. Roca, (2013), An Algorithm For The Detection And Tracking Of Tropical Mesoscale Convective Systems Using Infrared Images From Geostationary Satellite, Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2012.2227762.

What is a mesoscale convective system (MCS) ?

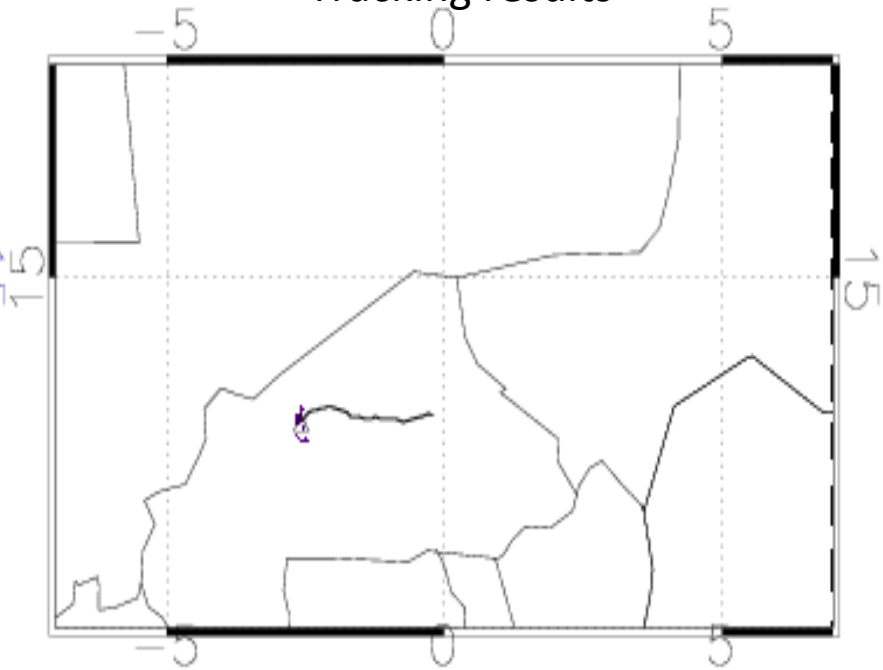
An example from METEOSAT observations

Sahel : Niger and Mali during the AMMA campaign (11/09/2006)

MSG IR images



Tracking results



The role of MCSs to the water and energy budget

Importance of long lasting systems to the water and energy budget

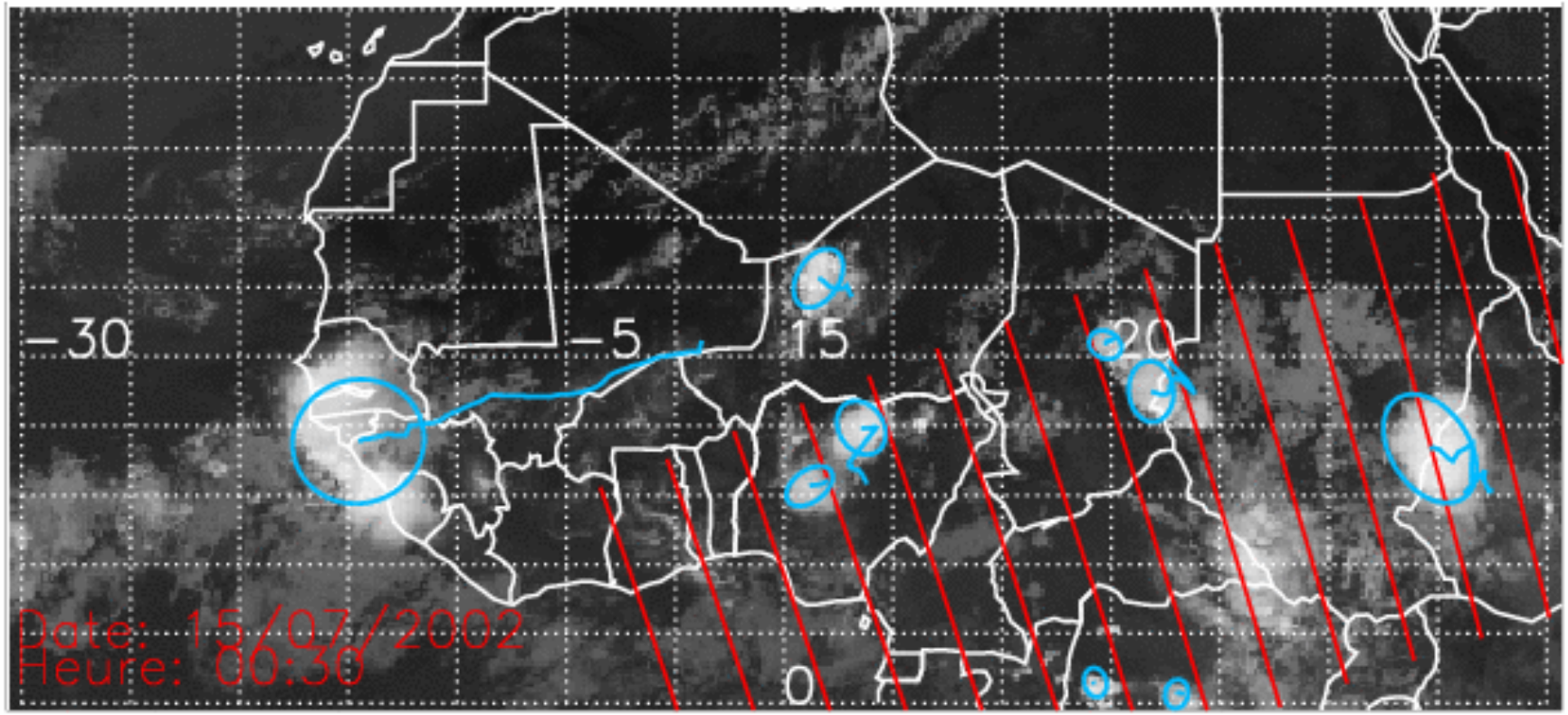
JJAS 2009 / 30°s-30°n / 1°-1day/ SYN products + « Most representative MCS of the day » product

		Occurrence	Rainfall	SWCRF	LWCRF	NETCRF
			Weighted contribution in %			
ALL MCS	Land	39	92	65	71	51
	Ocean	32	93	55	67	39
	All	**34**	**93**	**58**	**68**	**42**
Duration <12h	Land	25	36	35	37	29
	Ocean	15	21	19	25	15
	All	17	25	23	28	18
Duration >12h	Land	15	56	30	34	23
	Ocean	17	72	36	42	24
	All	**16**	**68**	**35**	**40**	**24**

Roca et al., J Climate, July 2014

Details of the compositing method

Making use of the high repetitivity of MT

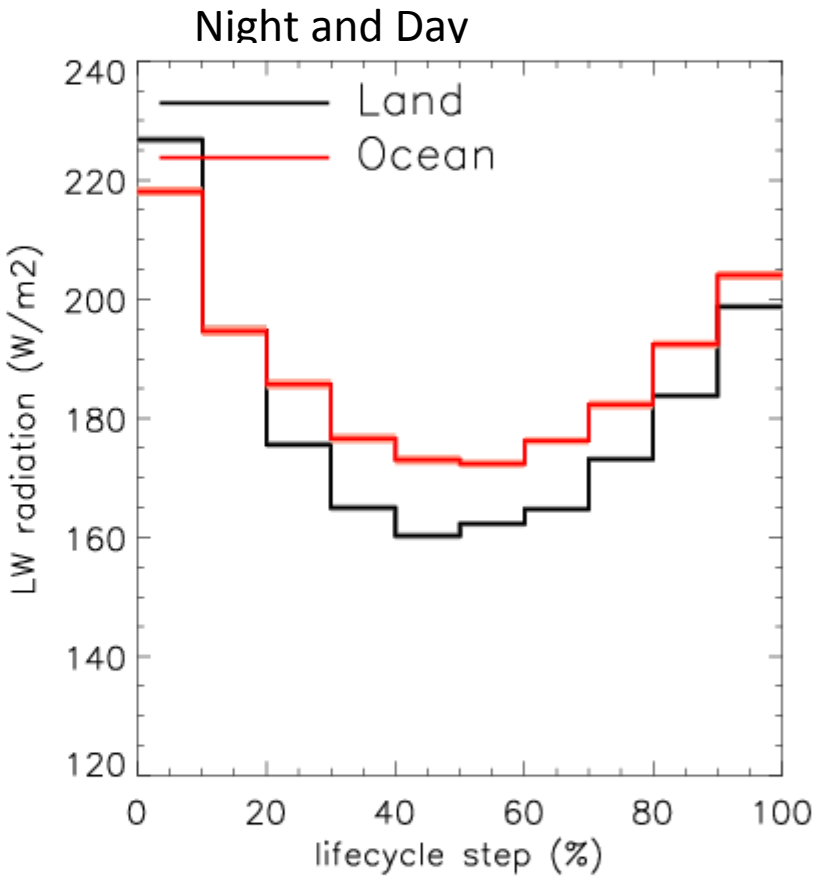


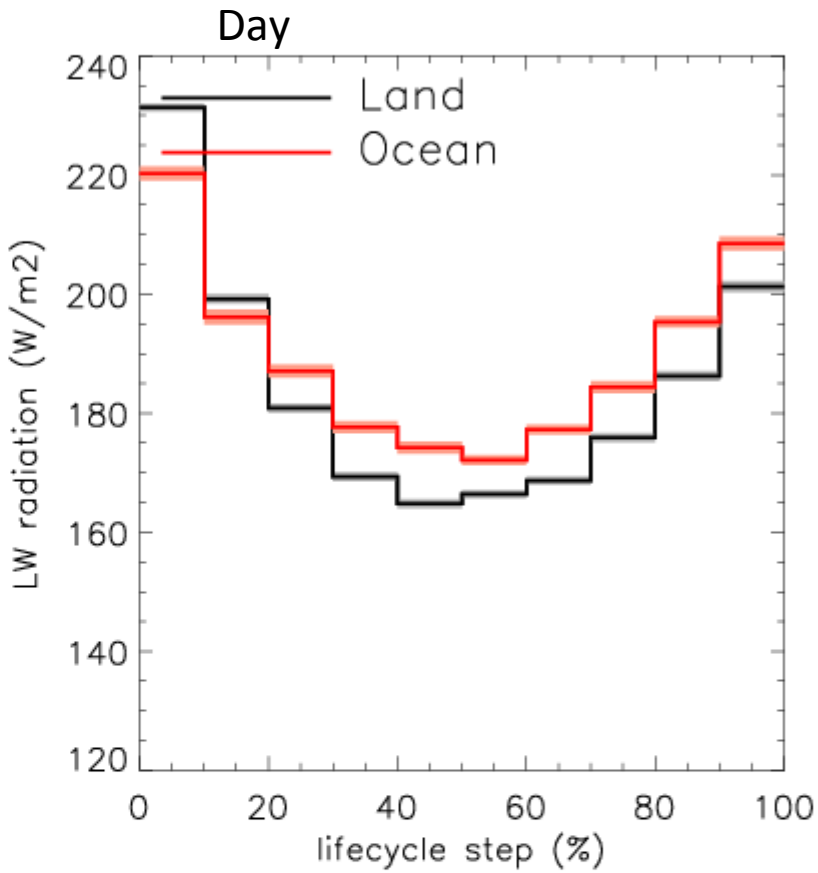
Source: Thomas Fiolleau

Details of the compositing method

Daylight only or Day and night LW composite

JJAS 2012/Class 2a/Atlantic-West Africa





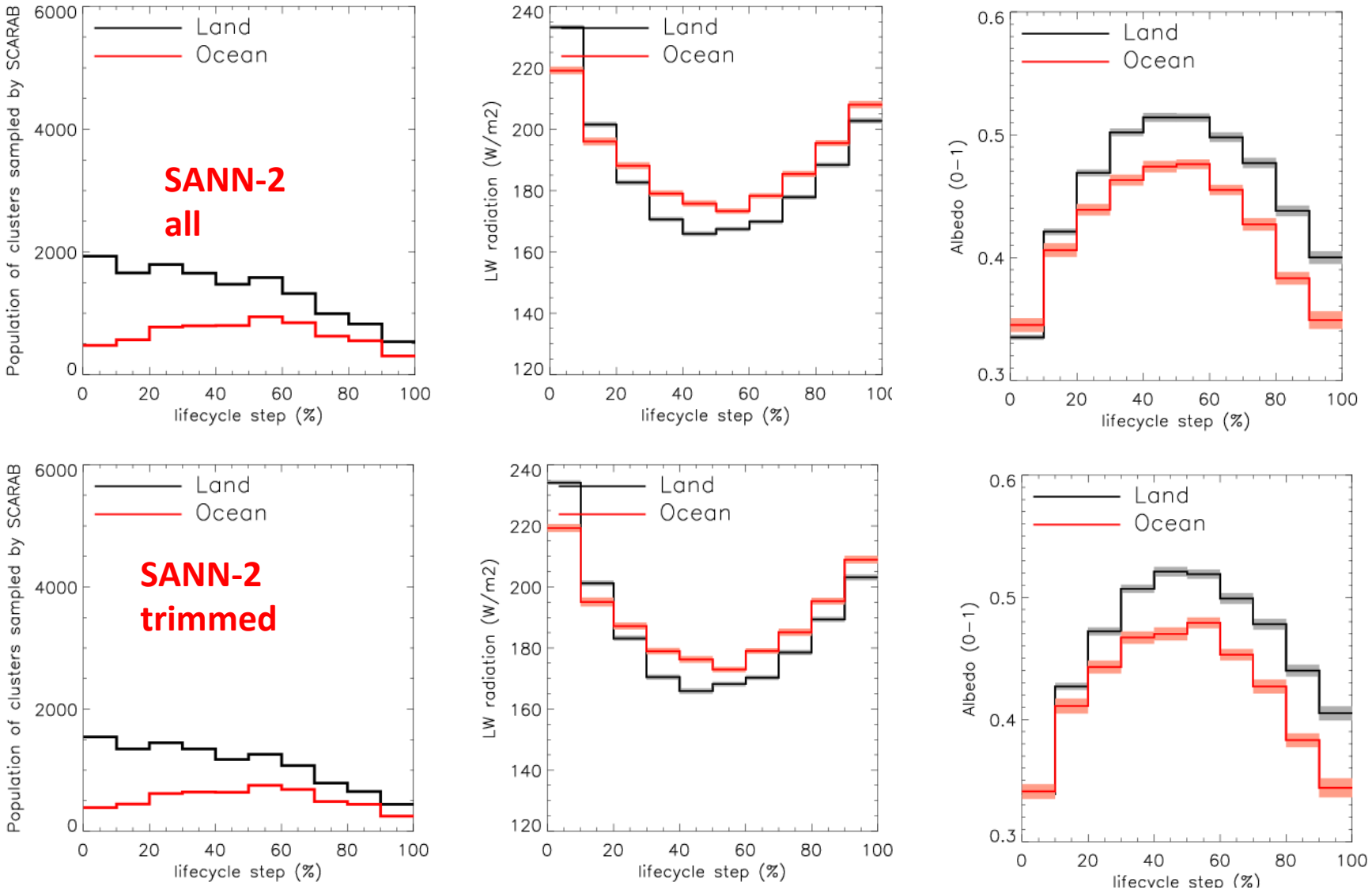
In the following we use Day light only bearing in mind

- Difference in LW retrieval between day light and night
- less sampling of each bins
- possible bias due to the aliasing of the life cycle and diurnal cycle over LAND

Details of the compositing method

Comparisons of the various L2B: impact of angular issues

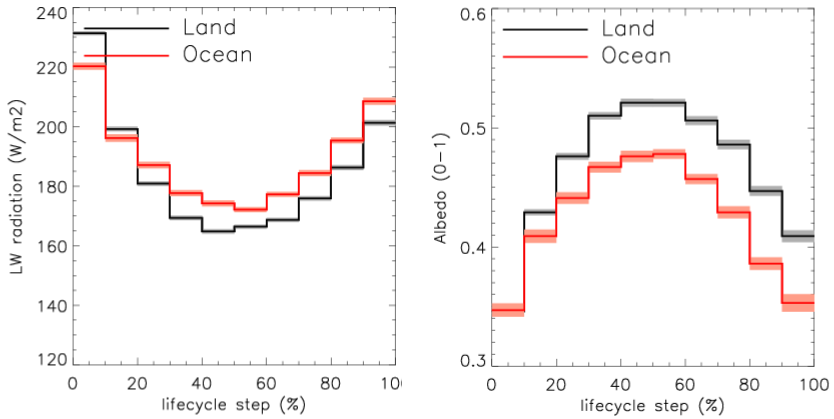
JJAS 2012/Class 2a/Atlantic-West Africa/Day only



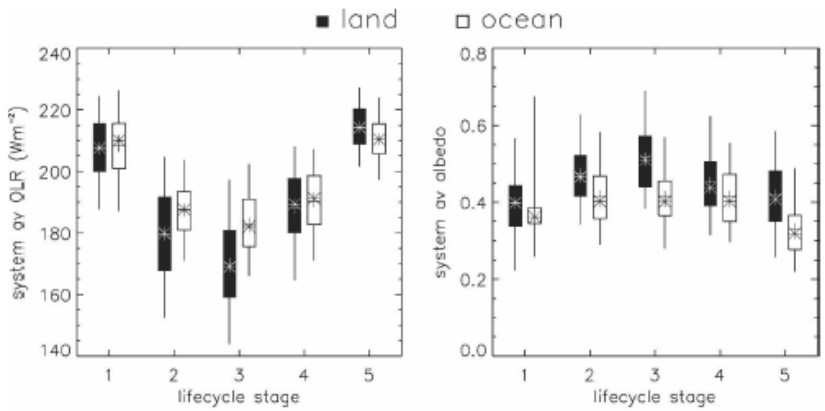
Preliminary Results

Comparisons to previous work of Futyan and Del Genio using GERB

JJAS 2012/Class 2a/Atlantic-West Africa/Day light



FUTYAN AND DEL GENIO



Flux from GERB-1

West African vs. Atlantic systems

Common features

- The LW cycle are very similar
- Cooler in the mature stage
- Brighter most of the life cycle

Differences

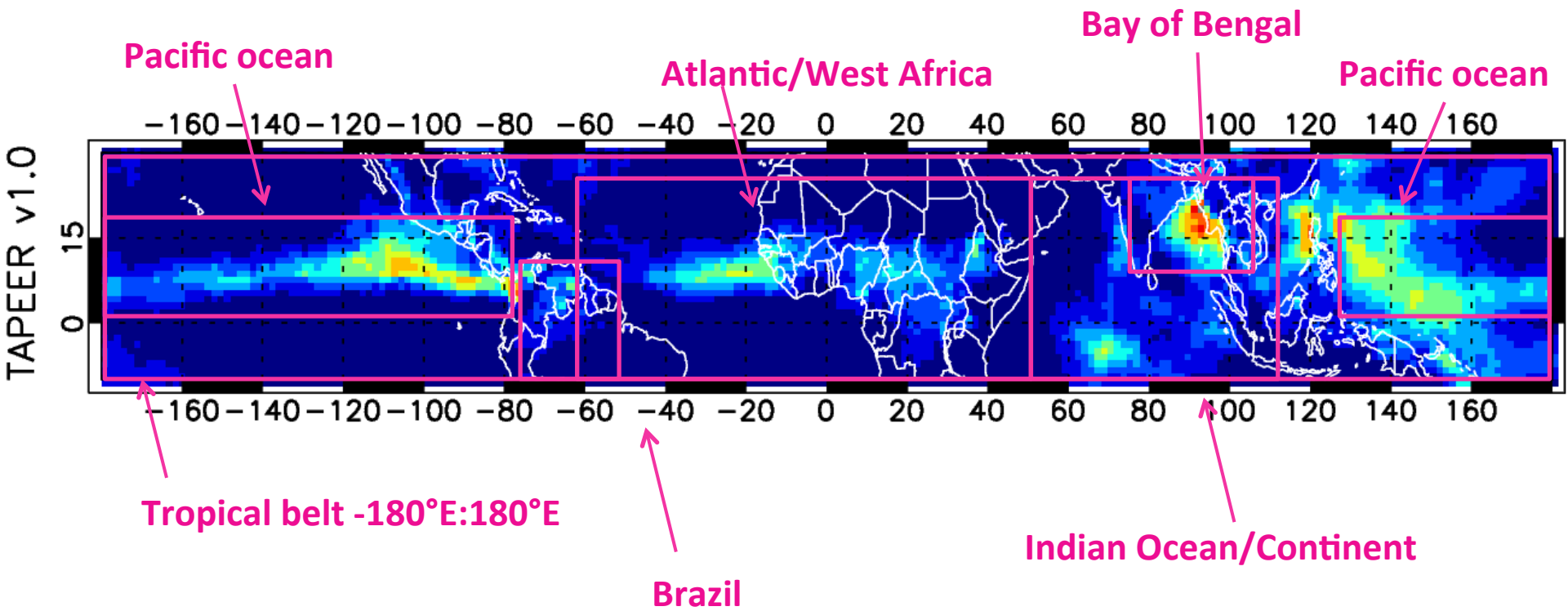
- Magnitude of the albedo cycle

How representative are these robust features of the Atlantic/West African systems of the other tropical conditions ?

Preliminary Results

Comparisons to previous work of Futyan and Del Genio using GERB

All the regions under investigations

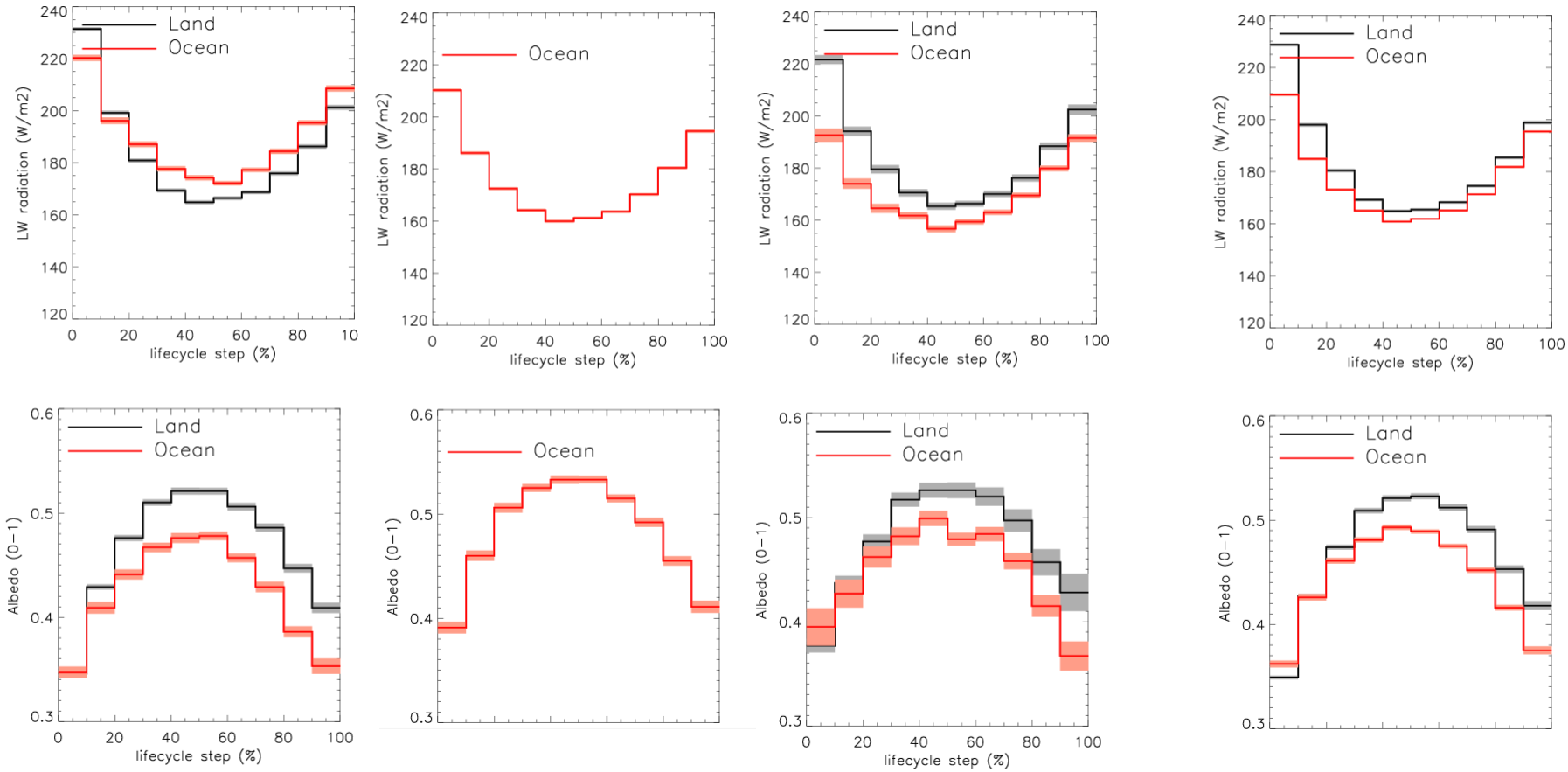


Preliminary Results

Regional commonalities and differences

JJAS 2012/Class 2a/Day light

West Africa /Atlantique | Pacific ocean | Bay of Bengal | Tropical belt



Summary and conclusions

Towards a new product for scientific investigation

- A tracking algorithm is coupled to a classification/composite scheme to document the radiation properties of the MCS over the whole tropical belt.

  This object-oriented approach adds the time dimension.

- The life cycle is similar across regions but with a different scaling (e.g., brighter Pacific storms than over the WAM) consistent with rainfall life cycle investigation

- How to link this scaling to the local large scale environment ?

- Merging with A-Train, TRMM PR to explore the vertical distribution of radiation (see next talk)