

# Atypical and overland systems

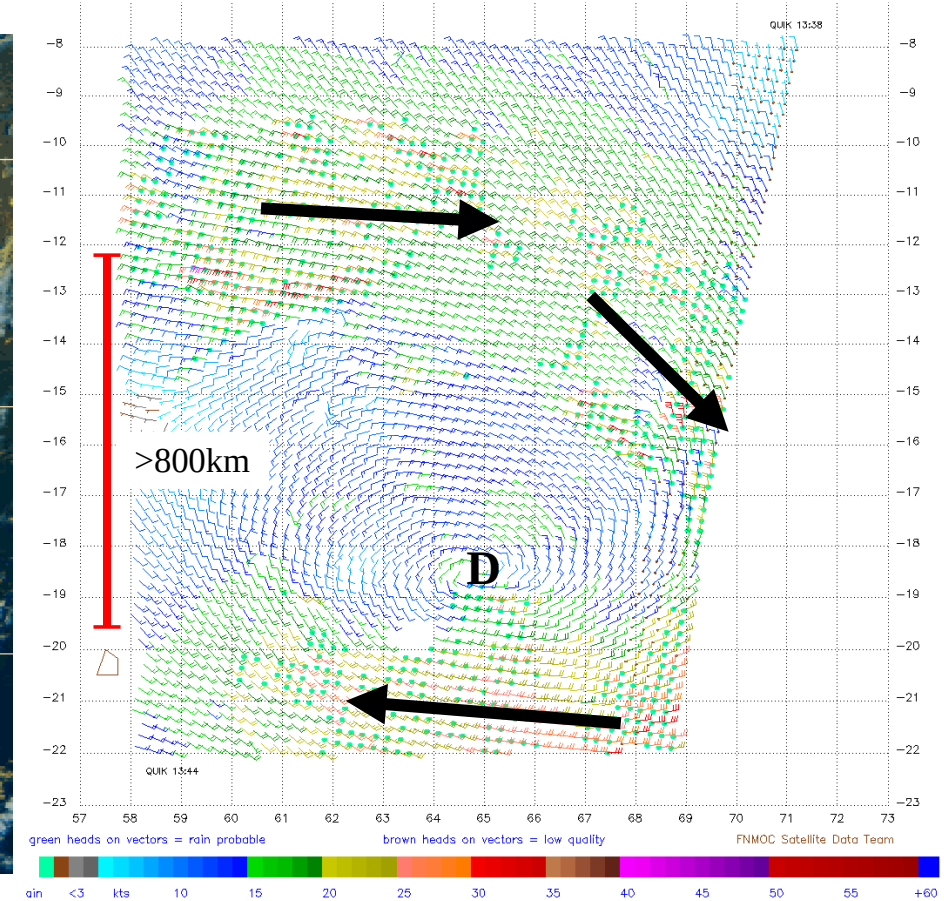
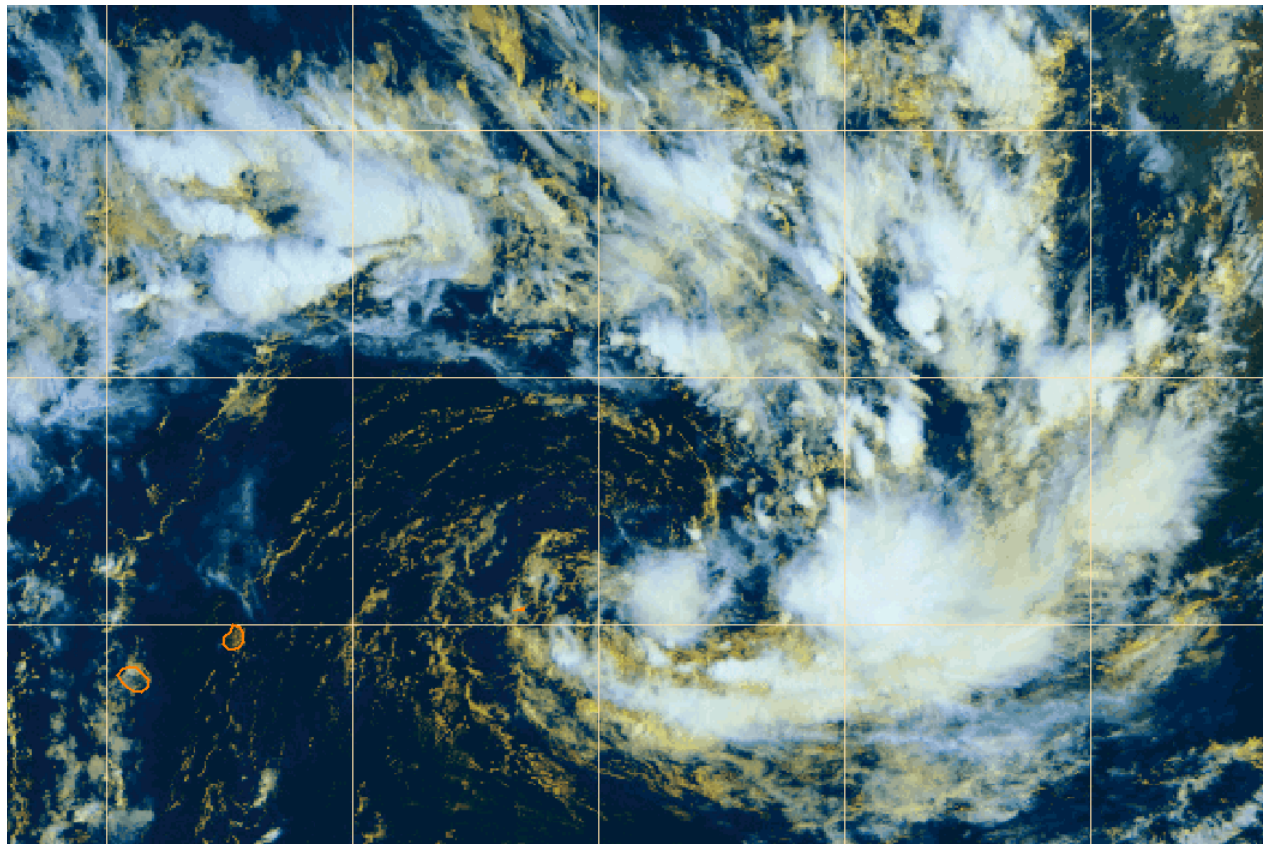
Tarik Kriat / Sébastien Langlade / Adrien Colomb  
RA I Training Course on Tropical Cyclones – 11th session  
September 2023

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# 1. Atypical / Hybrid systems

## Monsoon depression

Very broad systems quite asymmetric. They tend to form within vast monsoon troughs.



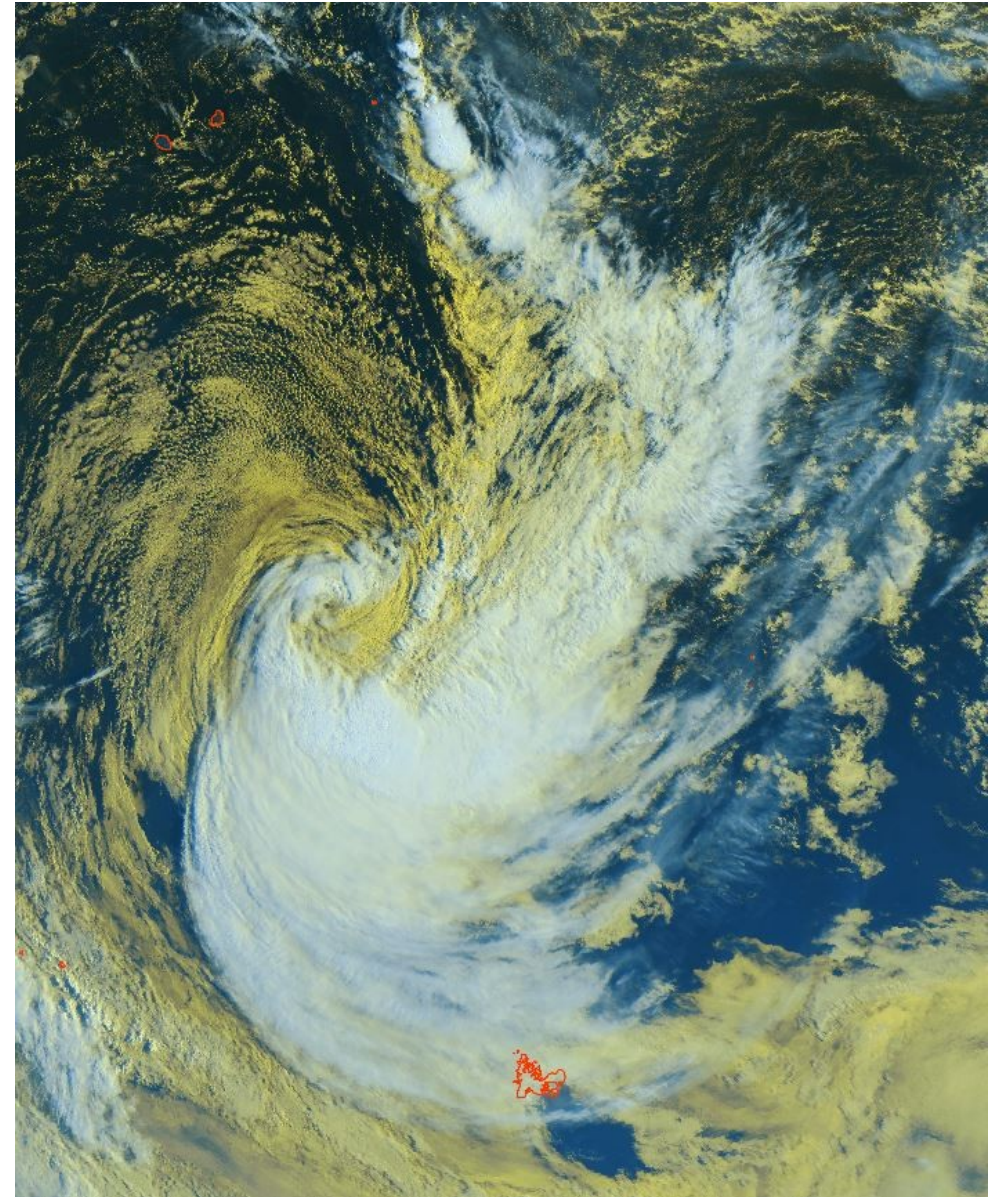
Gerard (2005)



## Post-Tropical depressions

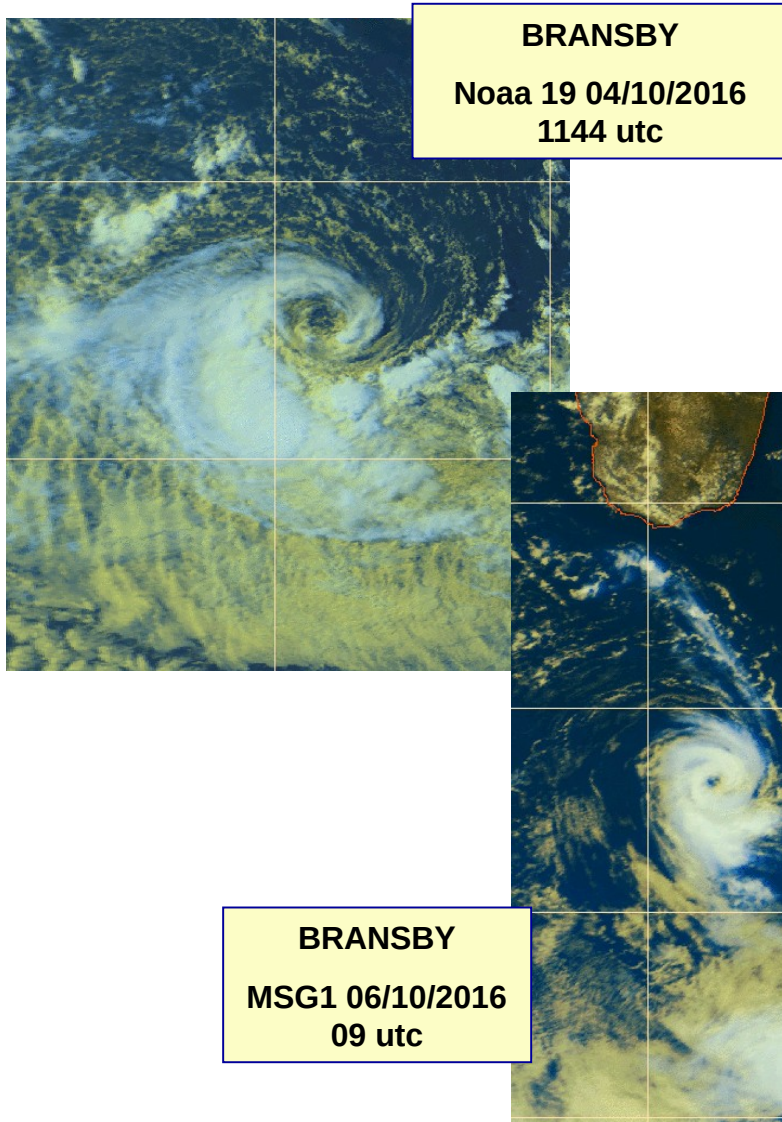
Next stage of the evolution of a mature TC within the mid-latitudes in a baroclinic environment

- Warmer cloud tops with the decrease of the SST
- Loss of symmetry with broader wind fields on the polar side due to the stronger shear and pressure gradient
- Appearance of cold and warm fronts.



EX-DUMAZILE (2018)

## Subtropical depressions



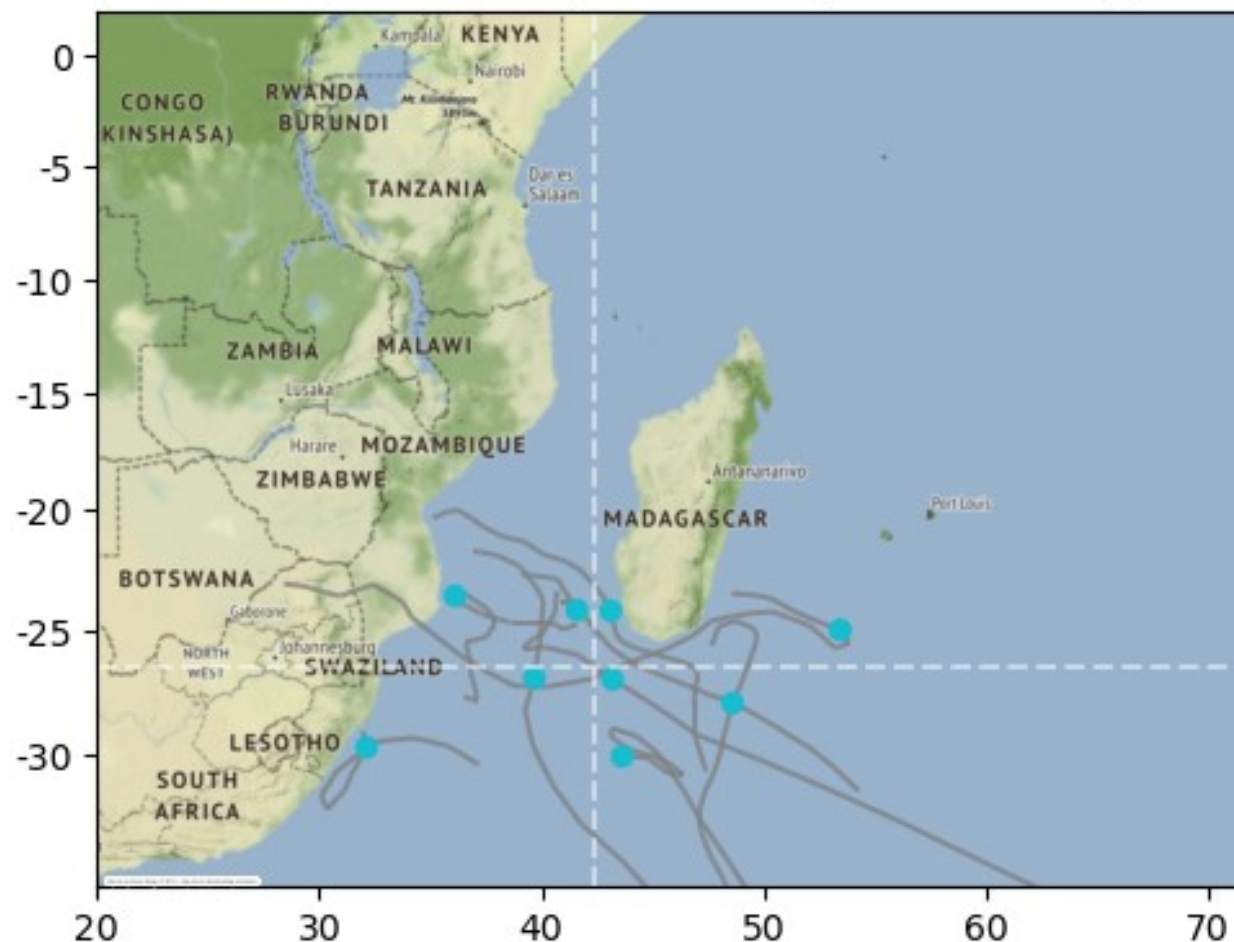
Shallow warm core low (symmetric) developing within an initially baroclinic environment (often within a trough).

- Warm cloud tops (near  $-50^{\circ}\text{C}$ )
- Deepening above cold/cool SST ( $20\text{-}25^{\circ}\text{C}$ )
- Winds can still reach hurricane force ( $>65\text{kt}$ )



## Subtropical depressions climatology

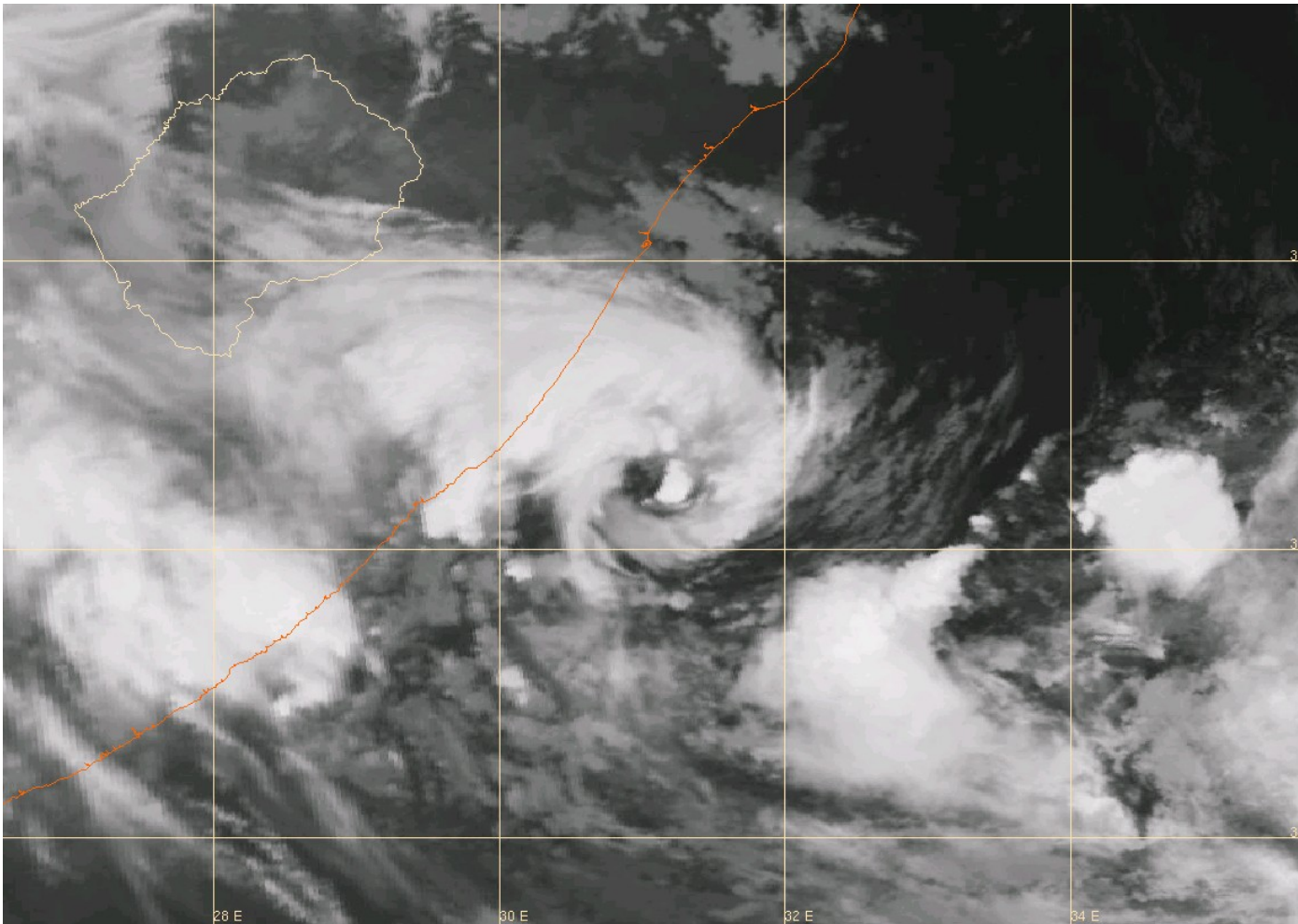
TCG from Jan to Dec (2% : 0.30 TC/year, 52kt avg LMI) [1992-2023]



- Forms south of the Mozambique Channel
- Mostly in April or May
- Generally 1 in every 3 years

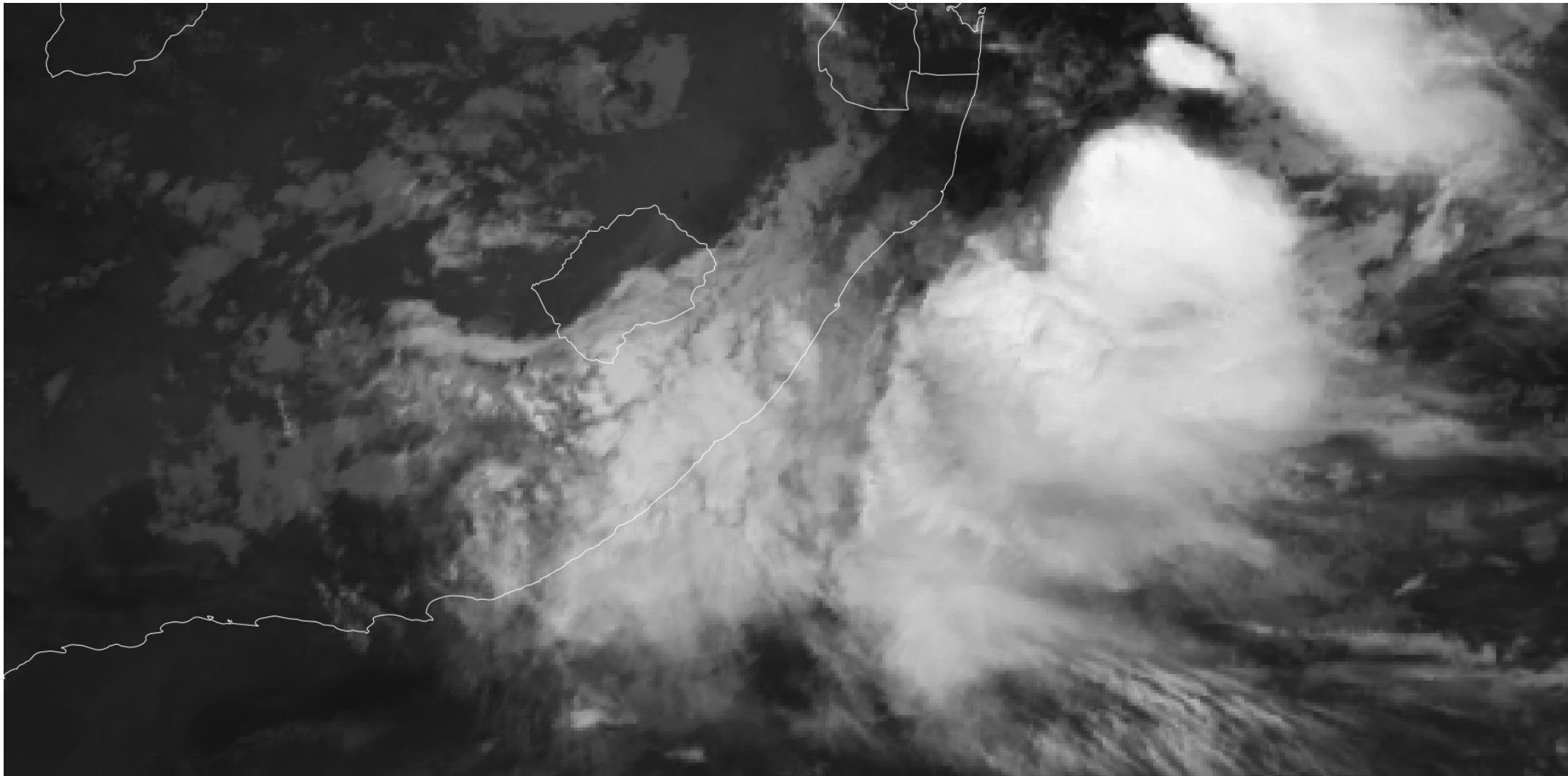
## Subtropical depressions : ISSA 11-14 April 2022

ISSA 12/04 1905Z Metop1



- Severe convection under a cutoff-low generates heavy rains and catastrophic flooding near Durban (South Africa)
- Under the trough (low shear), this convection builds a warm core system during the 12 April

## Subtropical depressions : ISSA 11-14 April 2022



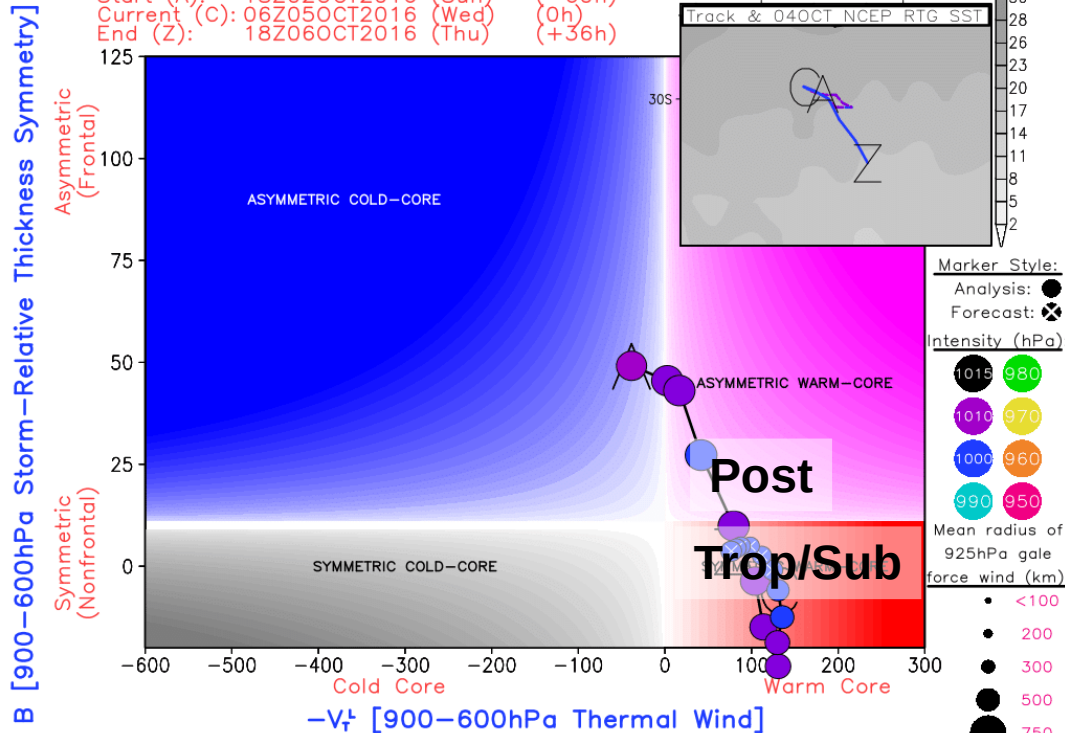


## Hybrid systems – In operations

	Tropical	Post Tropical	Subtropical
Symmetric	Yes	No	Yes
Warm core	Deep	Deep	Shallow

0.25° NCEP GFS (06Z05OCT2016 run) Cyclone #14 (Existing cyclone)

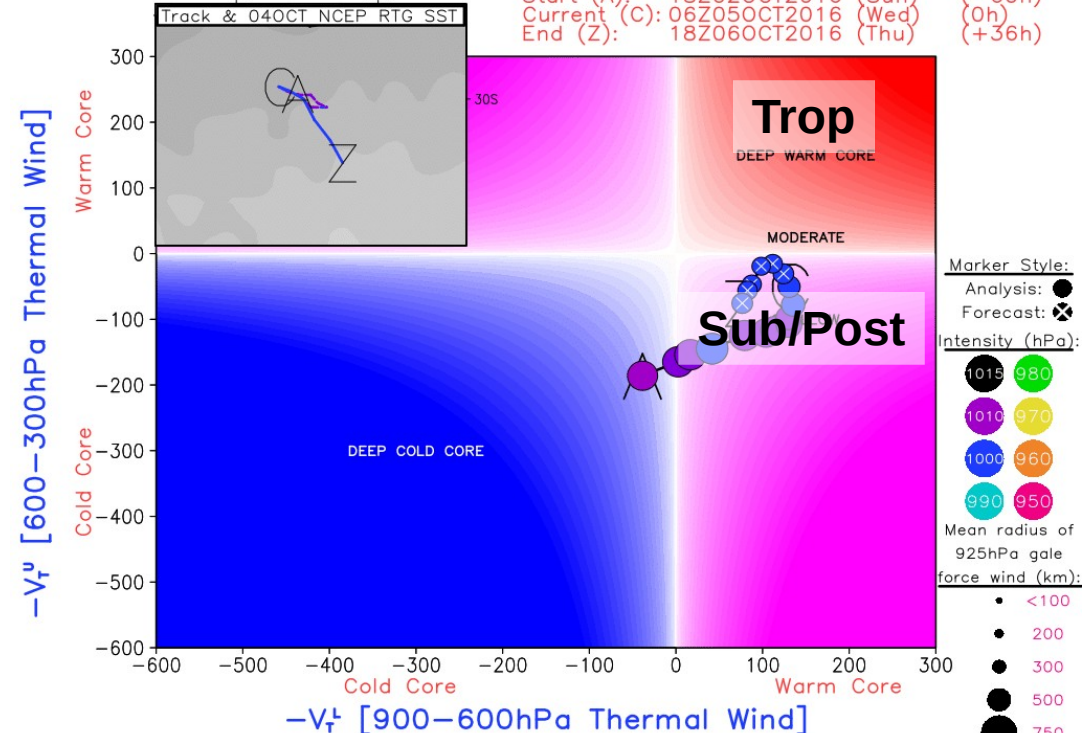
Start (A): 18Z02OCT2016 (Sun) (-60h)  
 Current (C): 06Z05OCT2016 (Wed) (0h)  
 End (Z): 18Z06OCT2016 (Thu) (+36h)



NOTE: A 24hr running mean smoother is applied to the CPS trajectory.

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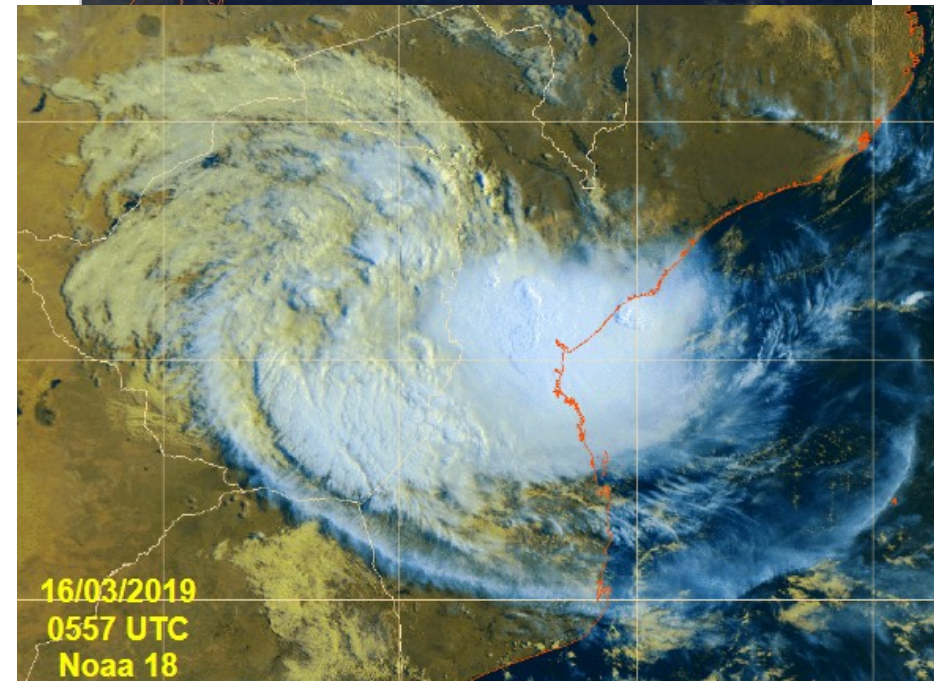
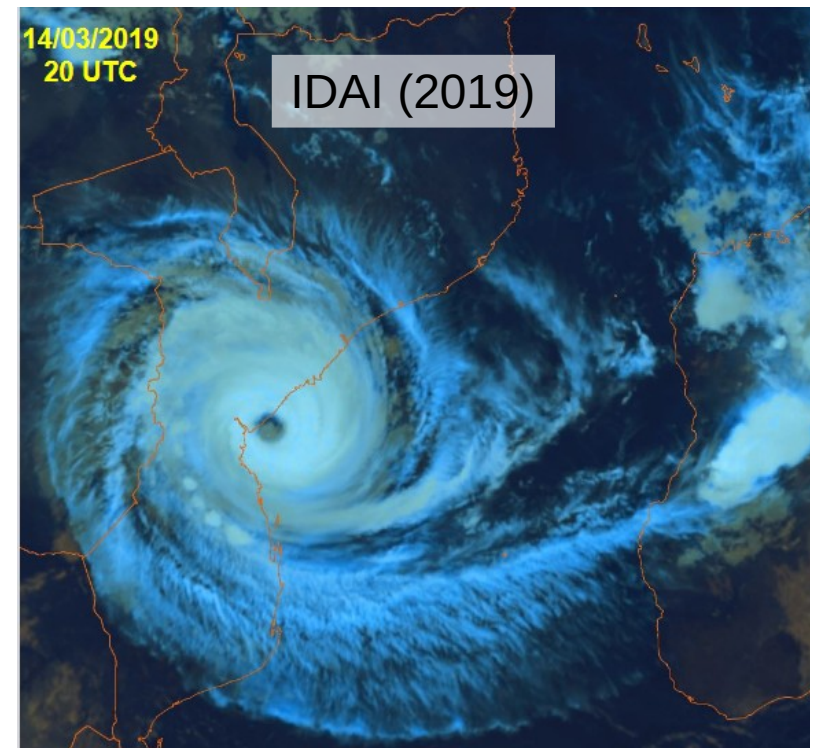
Phase diagrams on the MOE : <http://moe.met.fsu.edu/cyclonephase/>

## 2. Overland systems

## Landfalling TC

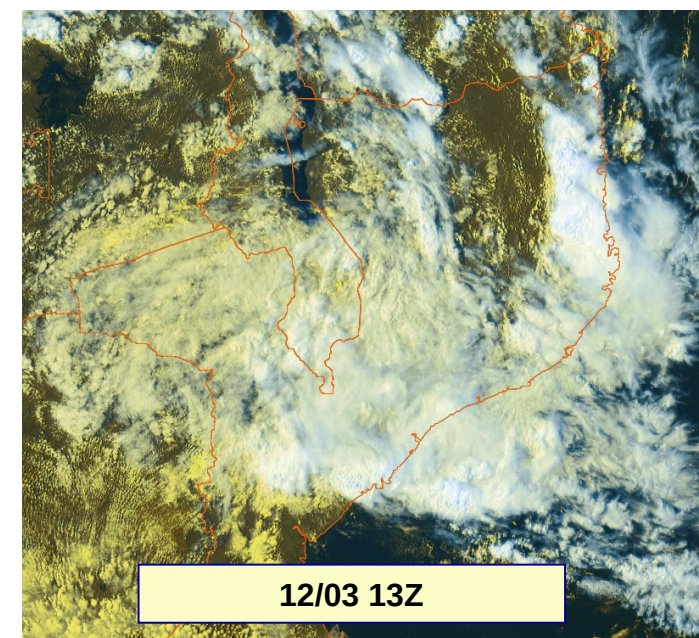
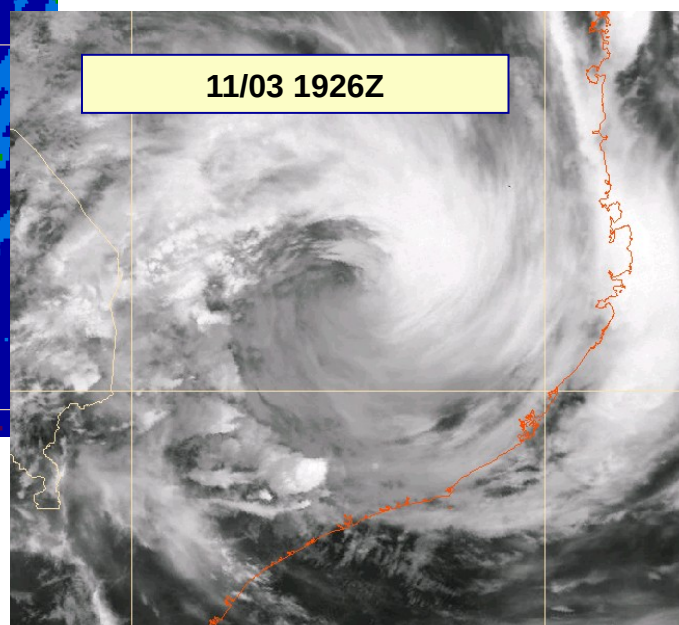
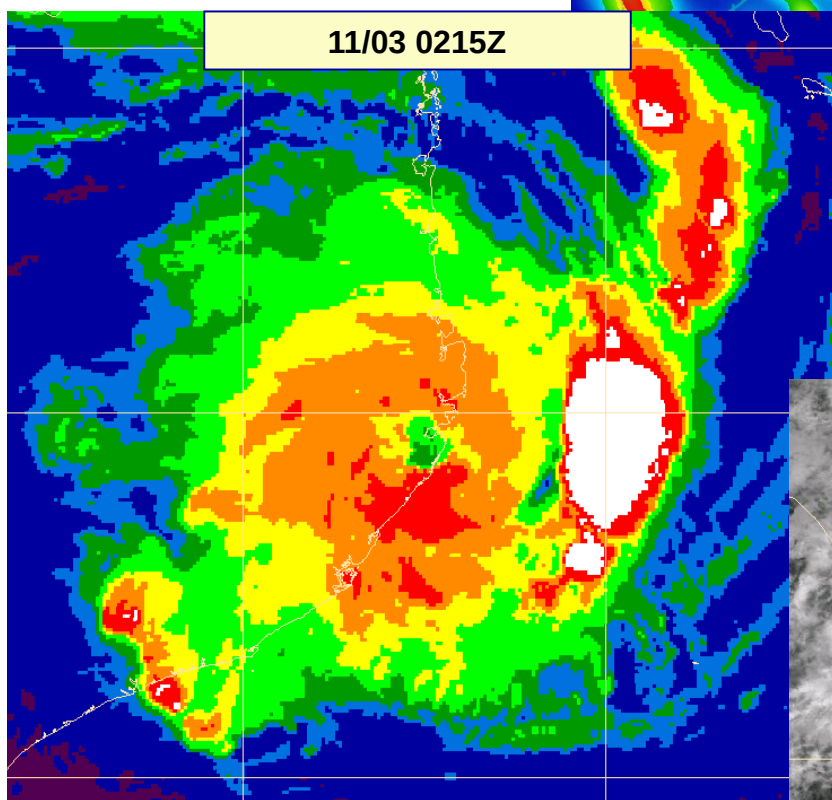
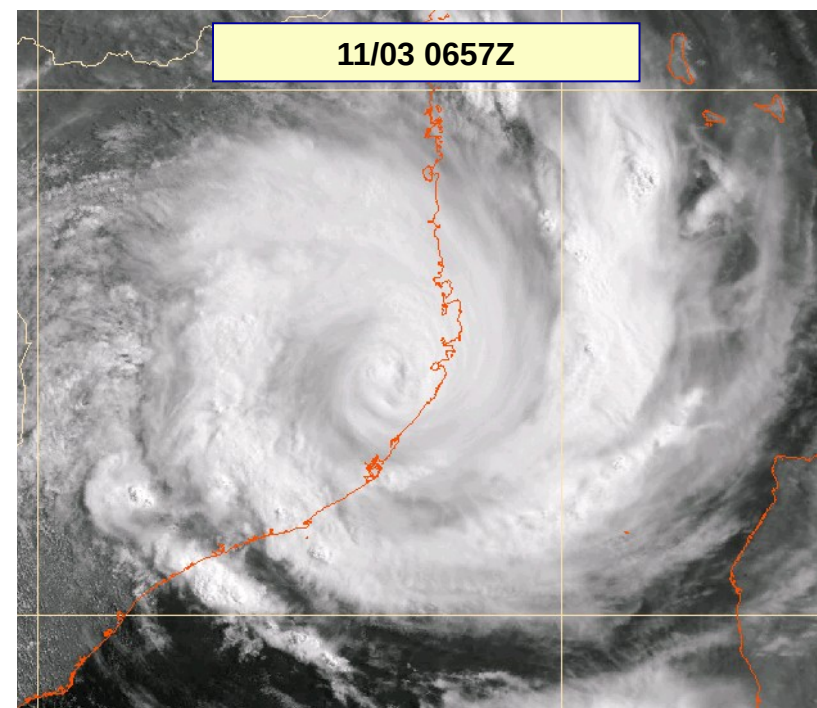
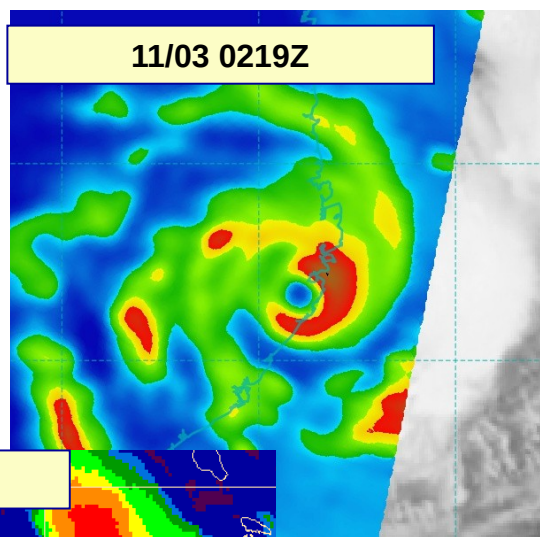
Tropical cyclones moving inland and progressively loosing their structure due to a lack of moisture and friction

- Rapid decrease of maximum winds ( $V_{\max}$  halved in around 12h)
- Slow decrease of the convective activity in the inner core during the first 12/24h. The outer rainbands can remain active during several days, especially near the coast
- May intensify again if they move oversea





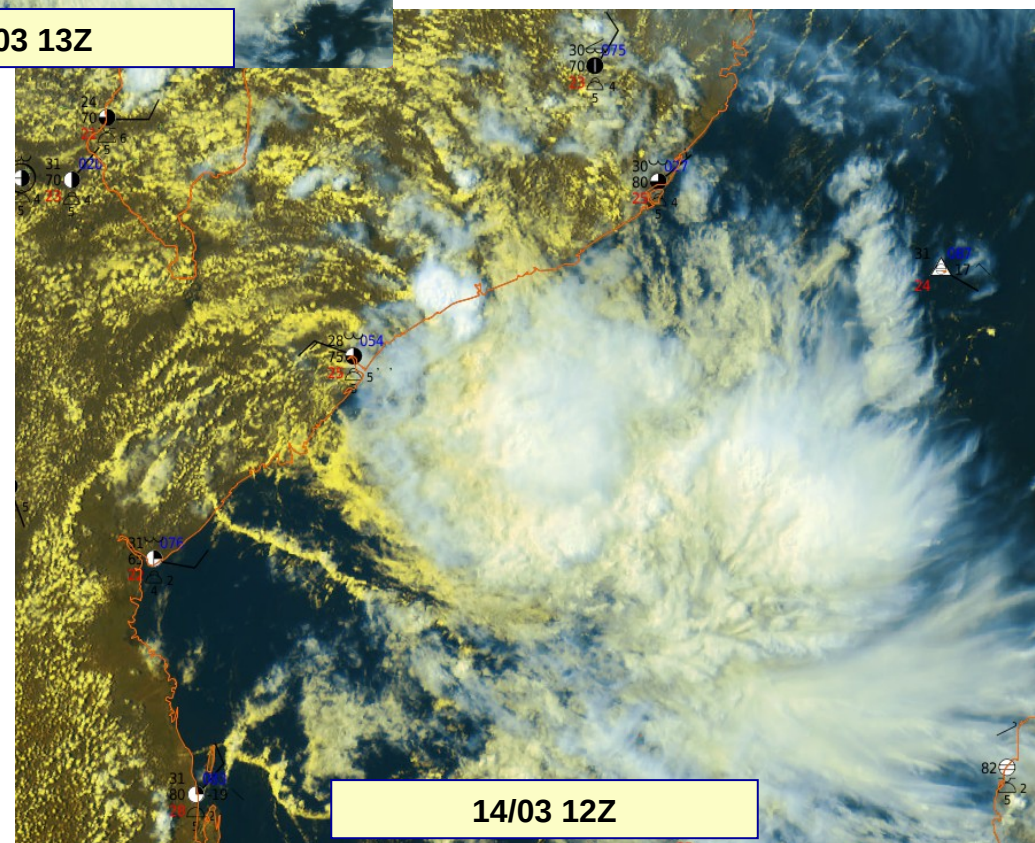
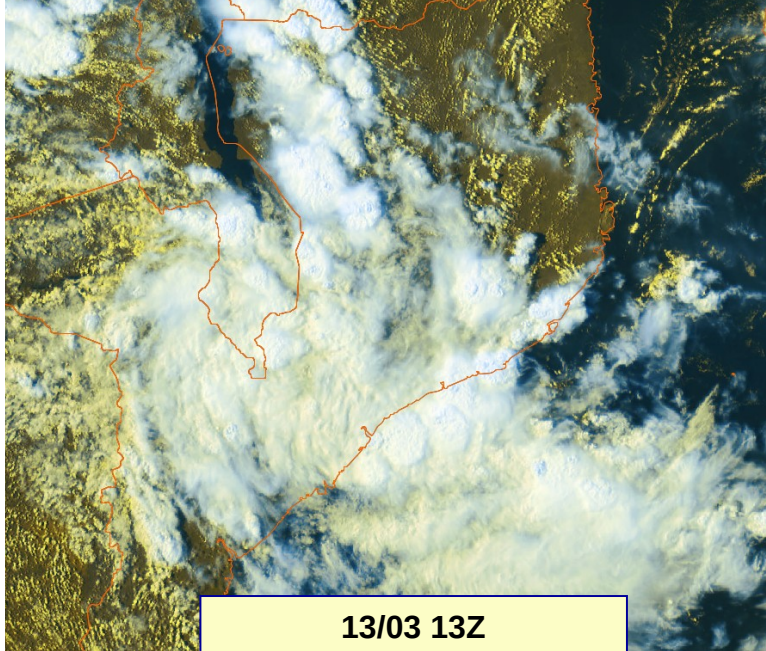
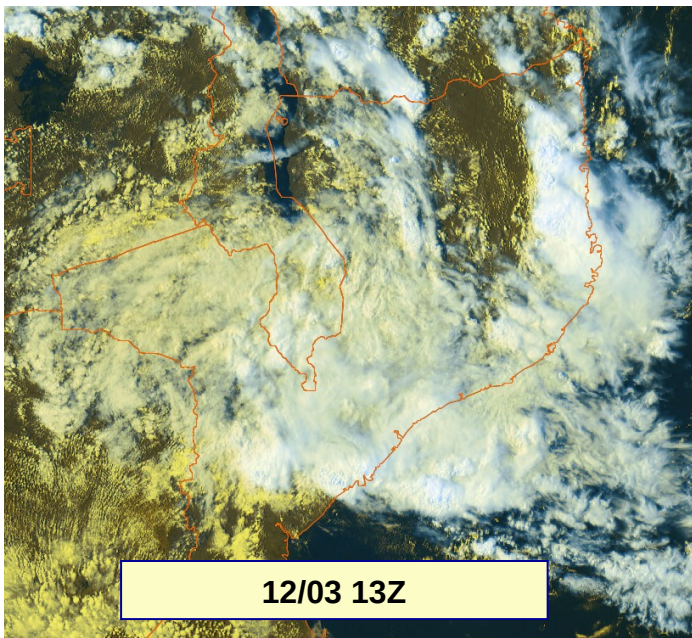
## Landfalling TC



GOMBE (2018)



## Landfalling TC

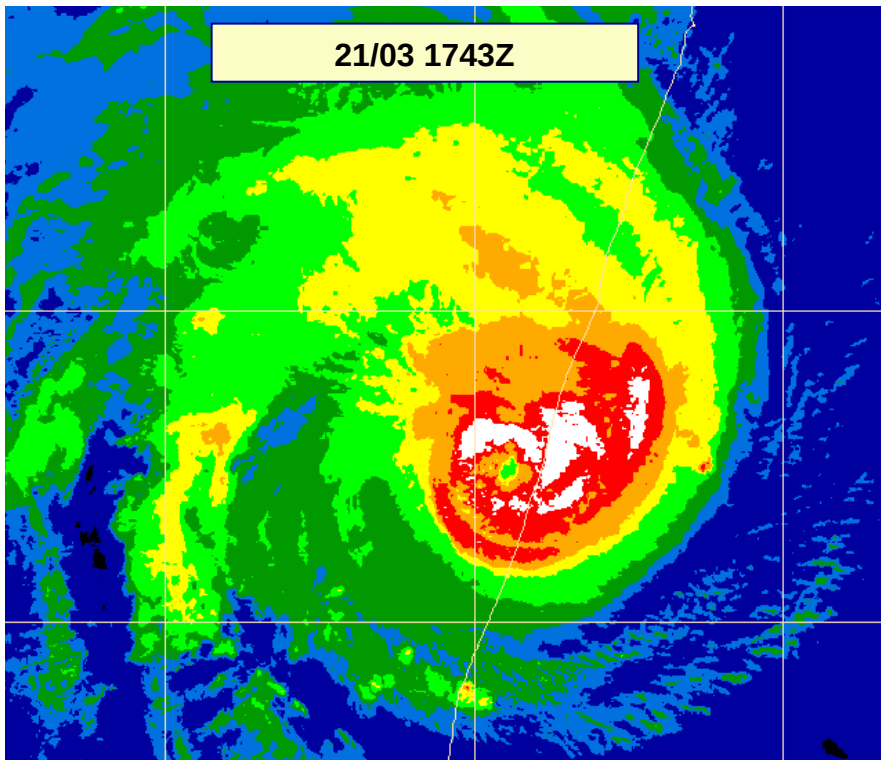


GOMBE (2018)

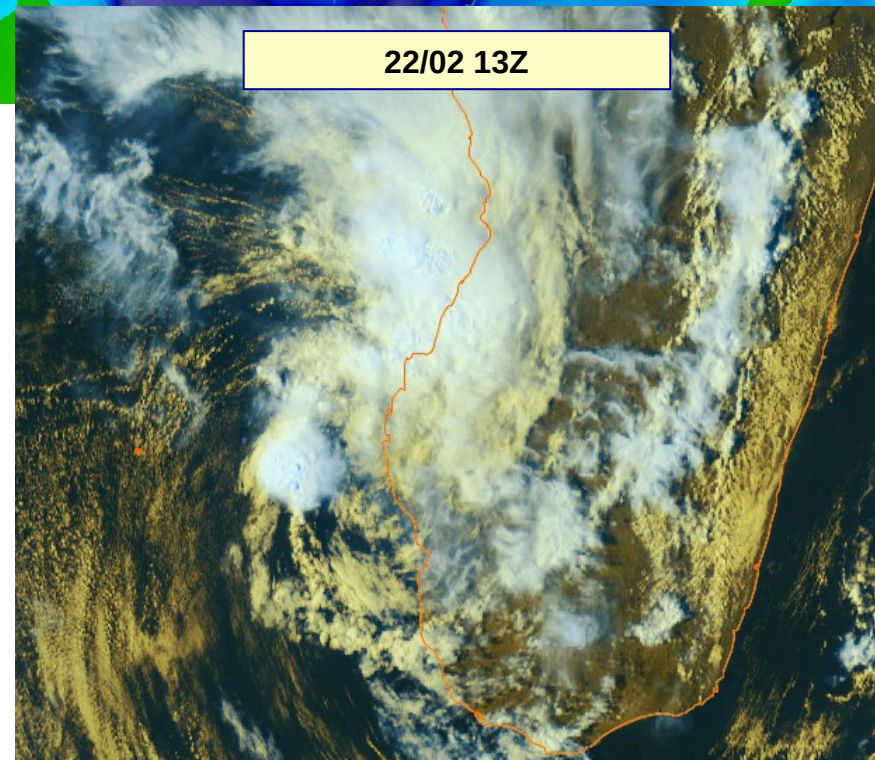
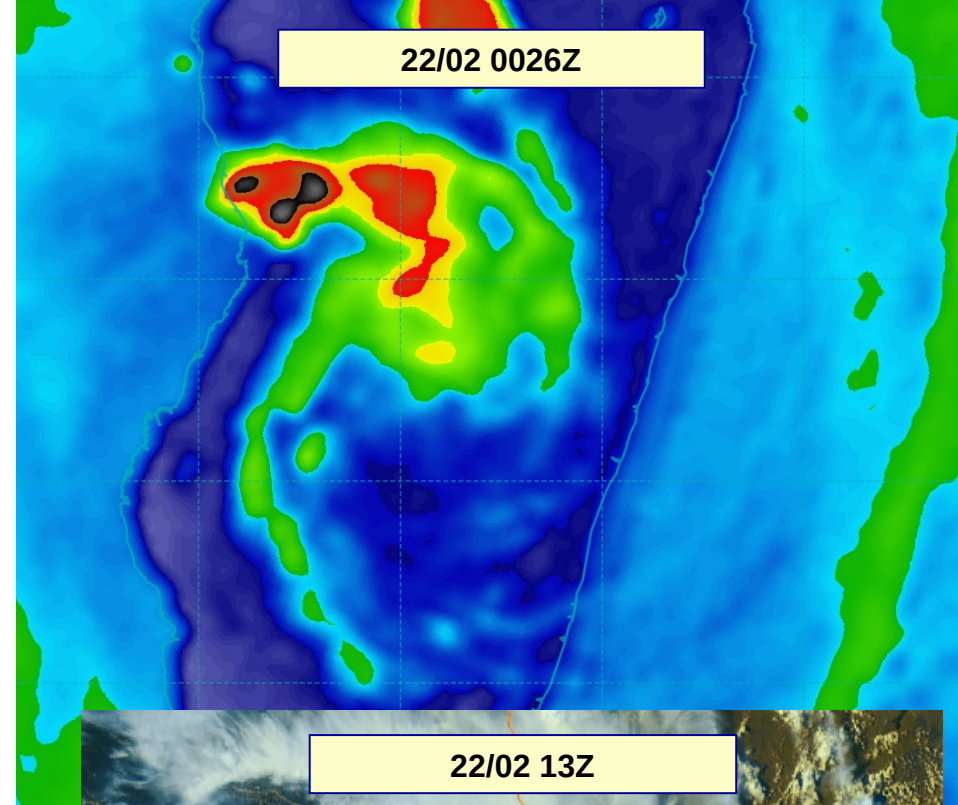


## Landfalling TC

Tropical cyclones moving inland and progressively loosing their structure



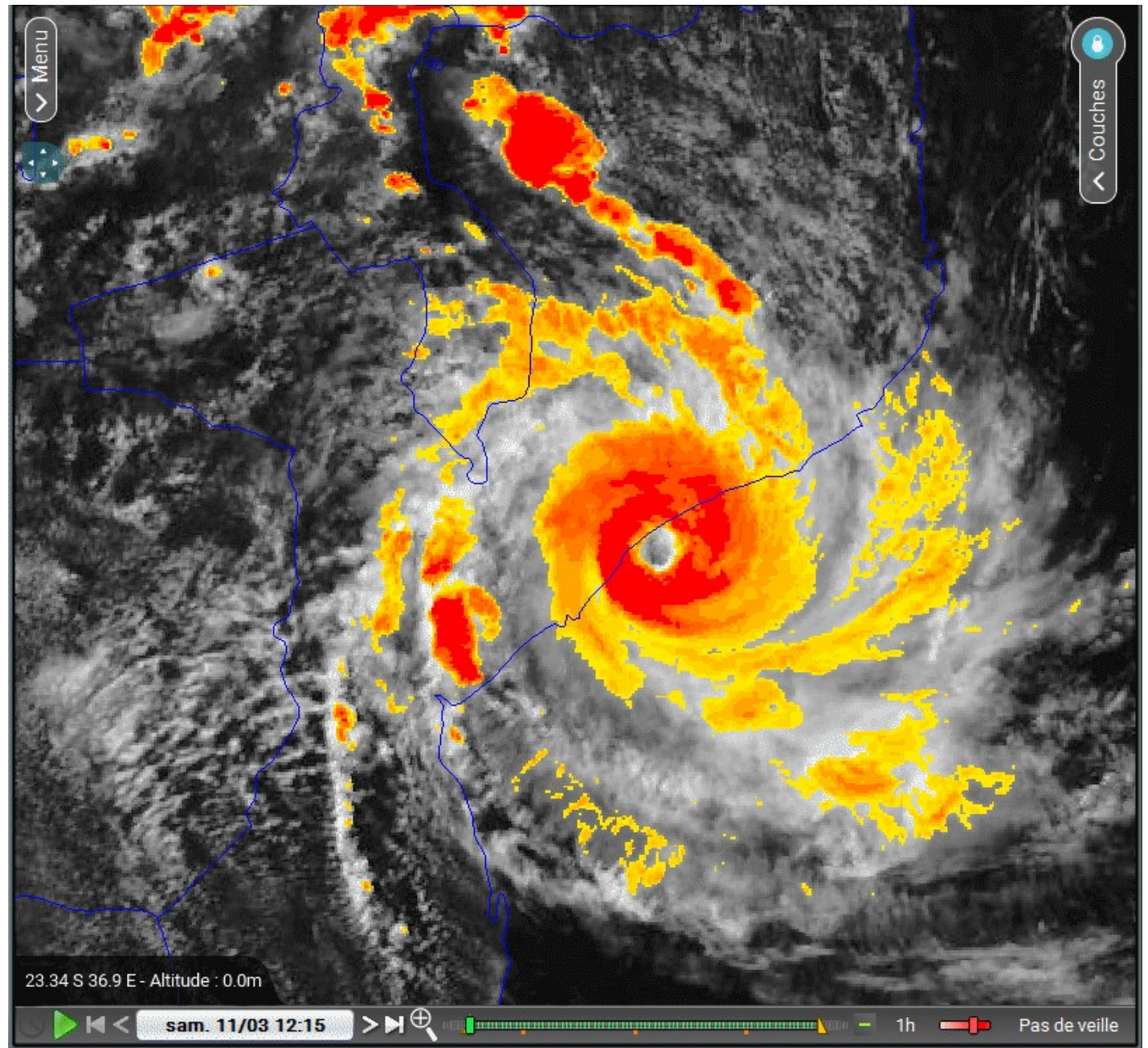
FREDDY (2023)





# Landfalling TC

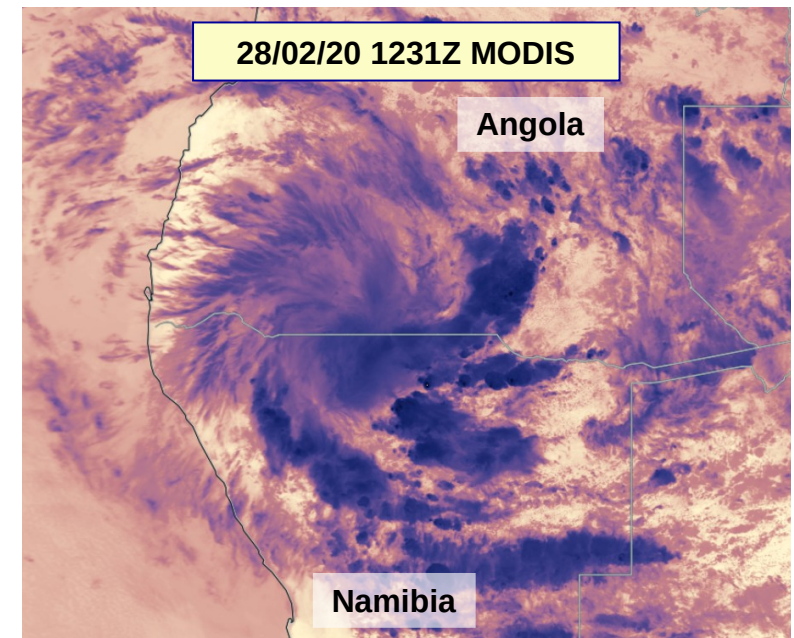
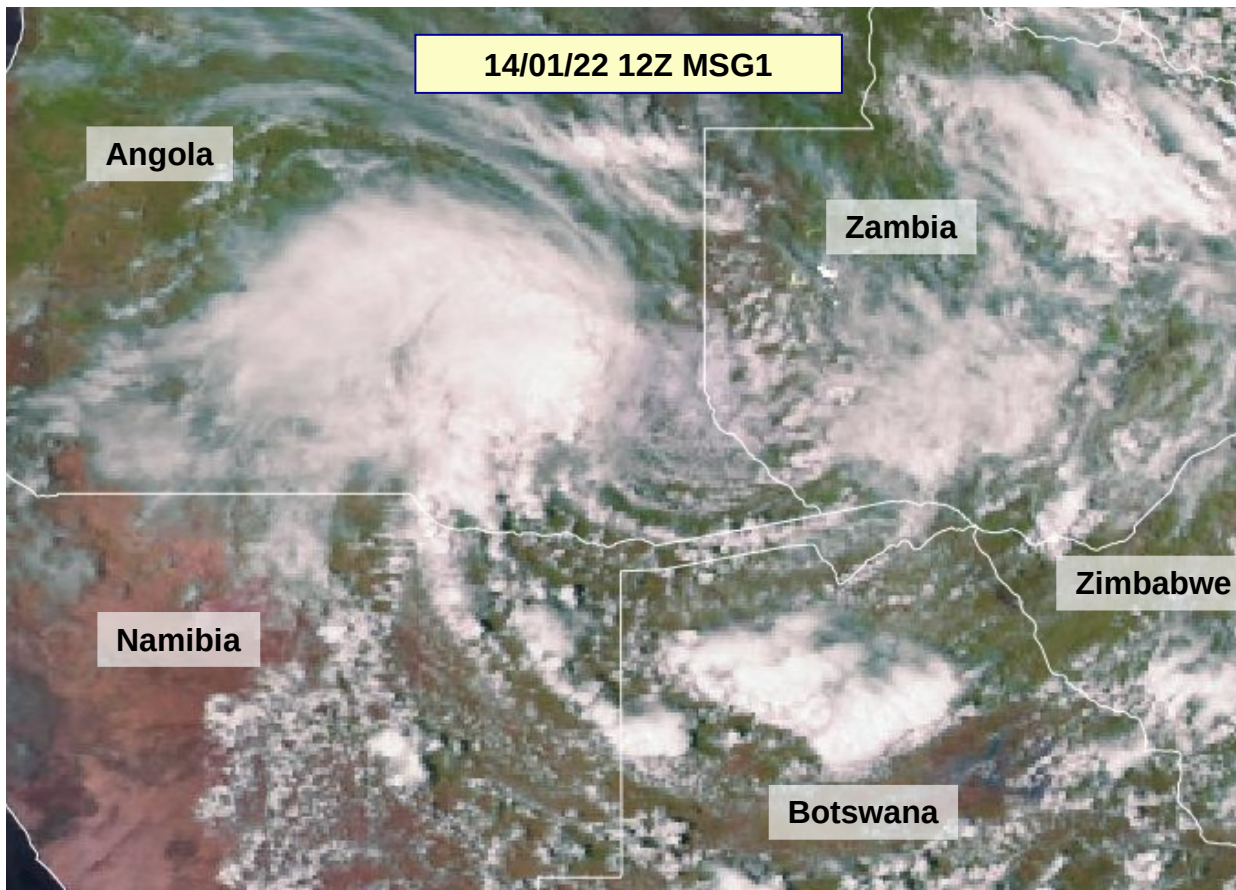
FREDDY (2023)





## « Landphoon » and overland depressions

Low pressure systems developping a warm core over the continent



- Partially due to the Brown Ocean Effect (Wet soils “acting” as an ocean) but mostly to favorable environment (“humid monsoon surge”, upper divergence,...)
- Rather frequent around the Caprivi Strip / Okavongo Panhandle during the summer
- Bring heavy rains