Interannual TC variability over the South-Western Indian Ocean

Météo France – Direction Interrégionale Océan Indien

RSMC La Réunion

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Regional Outlook Forum for South-West Indian Ocean countries

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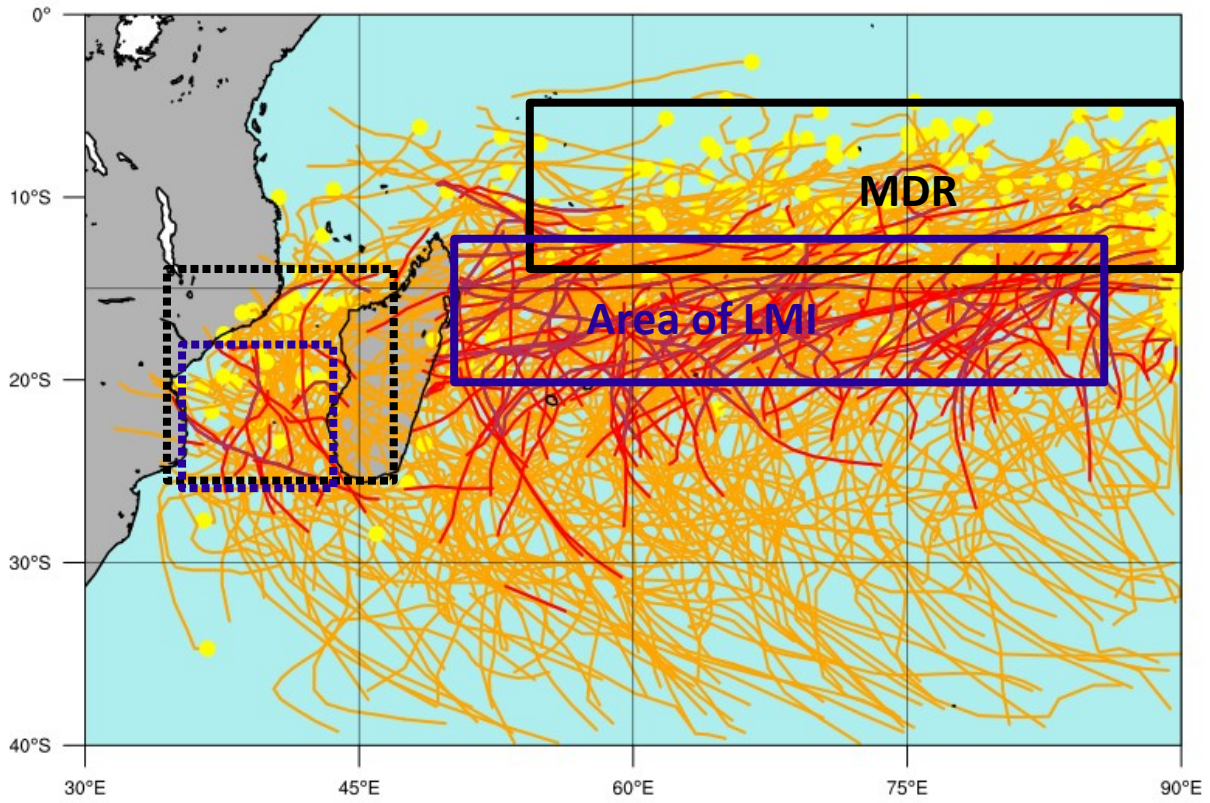
- WebConference -

TC activity over the SWIO

	Tropical storms-cyclones > 33kt	Tropical cyclones > 63kt	Intense tropical cyclones > 89kt	Very intense tropical cyclones > 115kt
Average annual numbers	9,8	4,9	2,7	0,5
Ratio	100 %	50 %	27 %	5 %

RSMC La Réunion best-tracks (1985-2018)



- Main Development Region: 10°S ± 5° and east of 55°E

- Life Maximum Intensity usually reached between 10°S and 20°S east of Madagascar

- Mozambique Channel : ~15 % of TC geneses with a local MDR and LMI area shifted southward

- In average, **4 to 5 TCs per season, bring at least moderate rain and/or wind impacts over inhabited lands**

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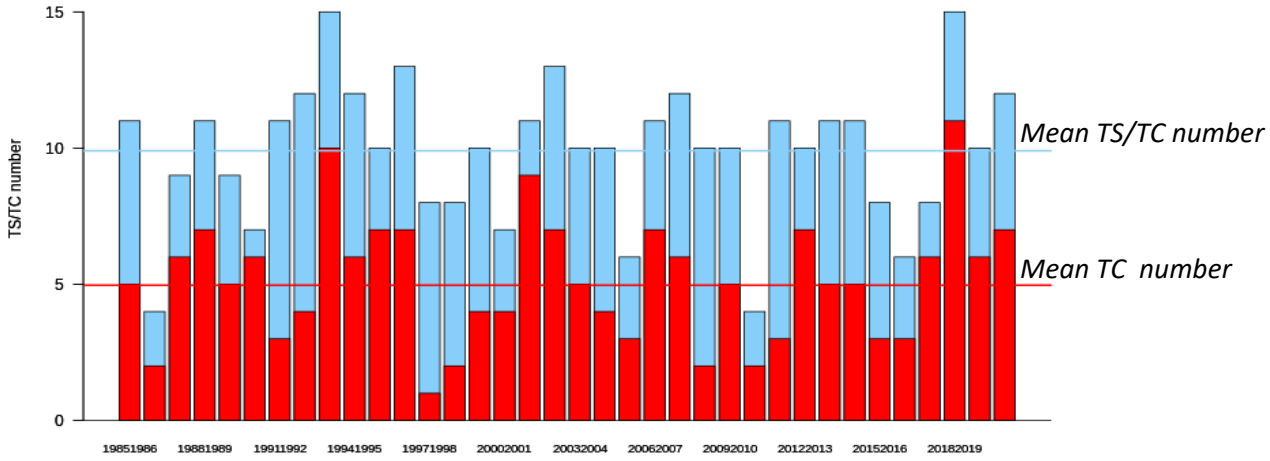
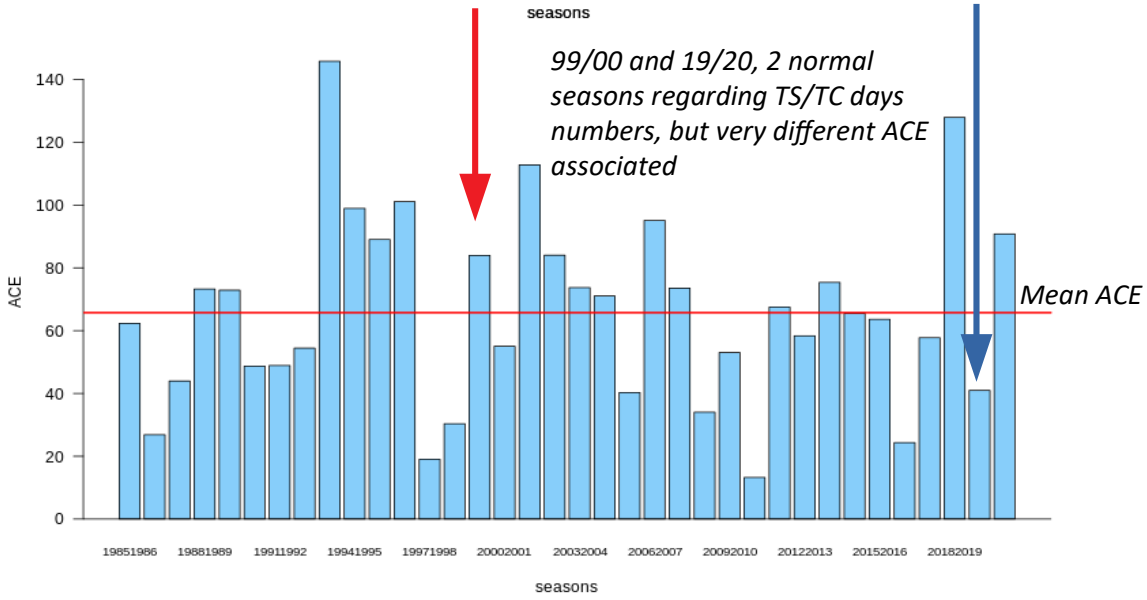
SWIO : Interannual TC activity





Means calculated over 1985-2015

→ Accumulated Cyclone Energy (**ACE**) or TS/TC days depend on TC intensity and lifetime duration. They are better metrics than TS/TC numbers to represent TC activity.

→ Large interannual variability is observed over the SWIO. A key point in TC seasonal forecast is to understand the relationship between climate drivers and SWIO TC activity

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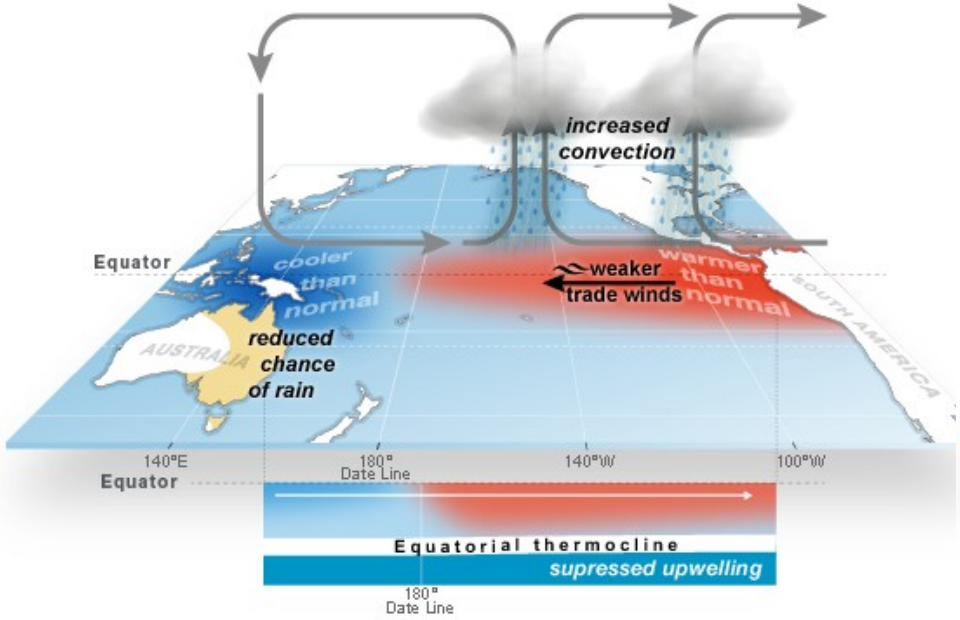
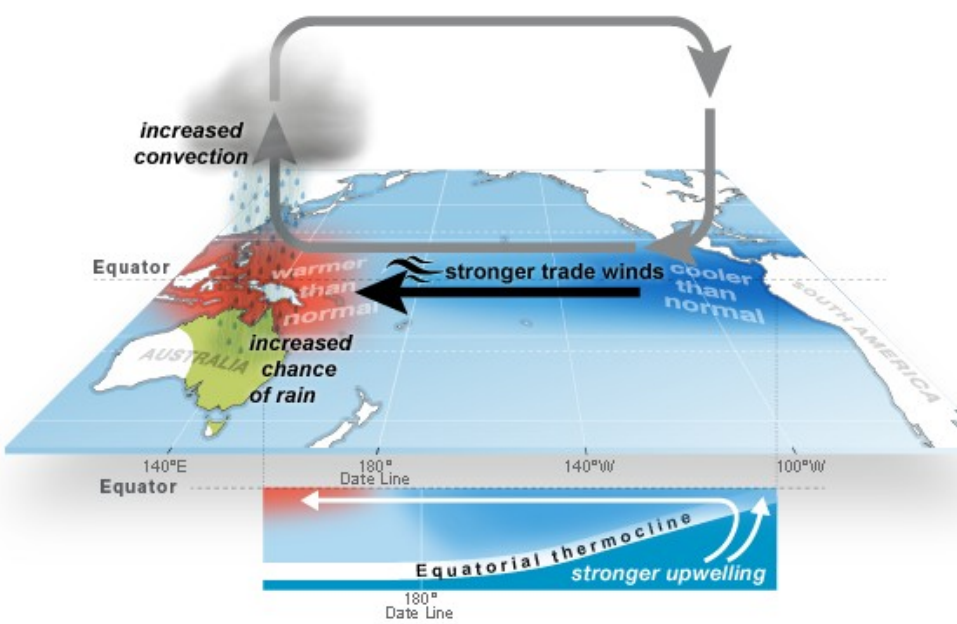
SWIO TC activity vs. ENSO



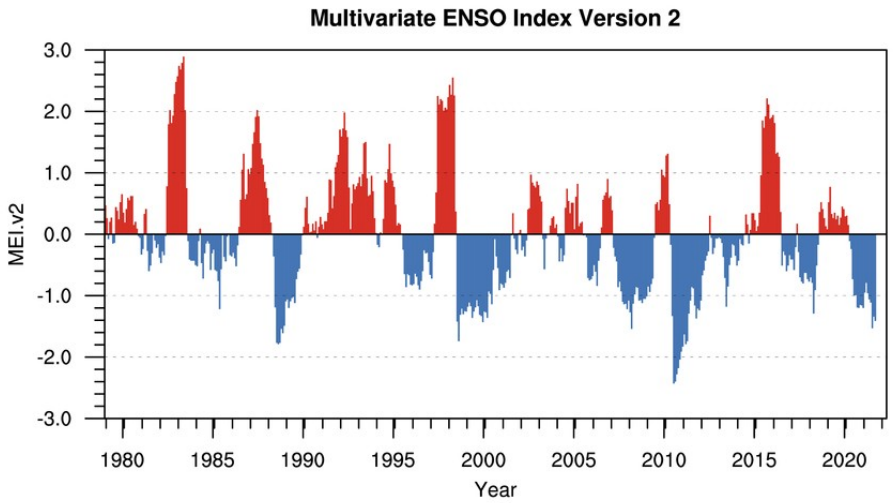
El Niño–Southern Oscillation (ENSO): **El Niño**



El Niño–Southern Oscillation (ENSO): **La Niña**

El Niño years :

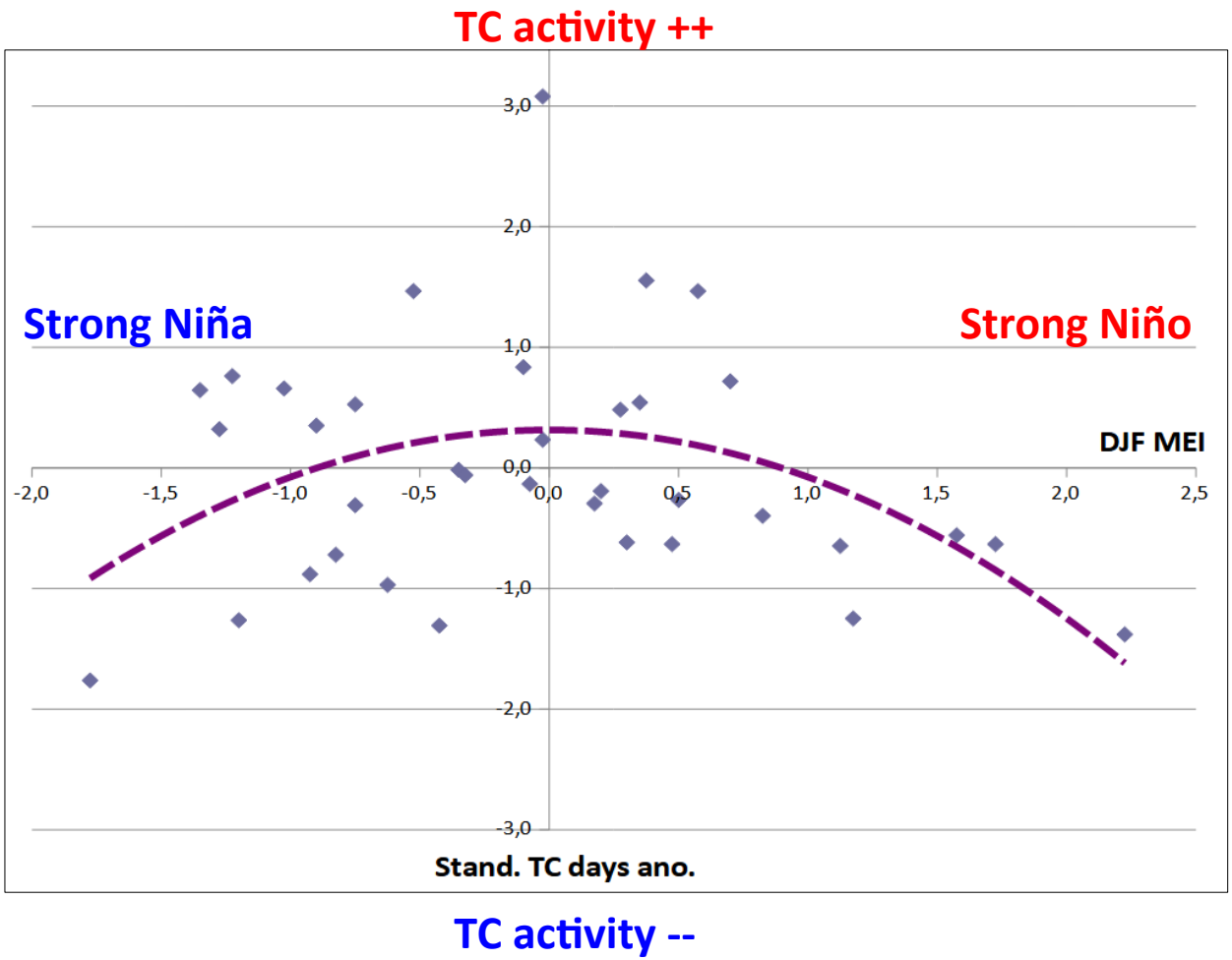
- 1982/1983
- 1986/1987
- 1991/1992
- 1997/1998
- 2009/2010
- 2015/2016



La Niña years :

- 1988/1989
- 1998/1999
- 1999/2000
- 2007/2008
- 2010/2011
- 2011/2012
- 2020/2021

SWIO TC activity vs. ENSO



→ ~Bell-shape relationship (Astier etal. 2015)

→ Moderate-strong Niño / less SWIO TC activity

→ Less clear with La Niña

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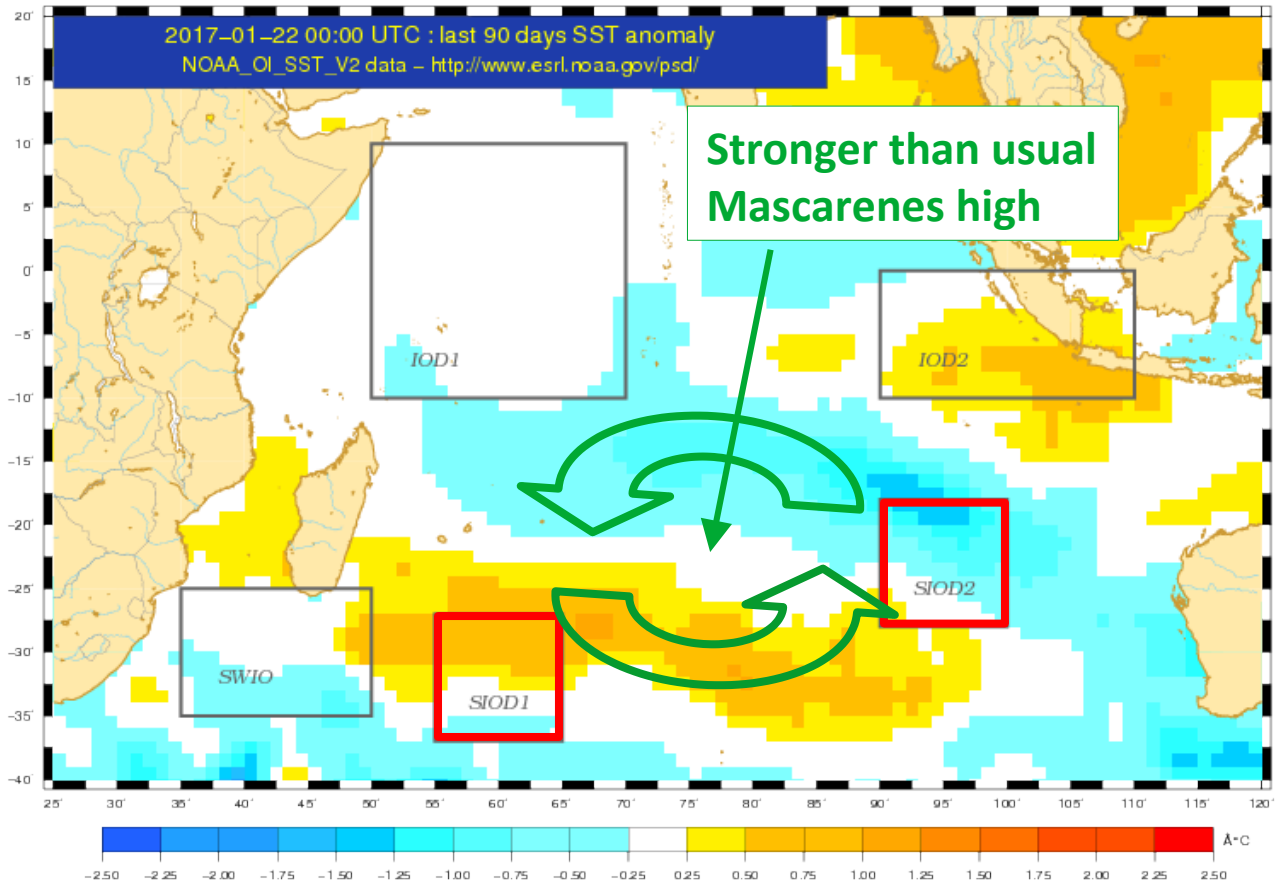
SWIO TC activity vs. SIOD



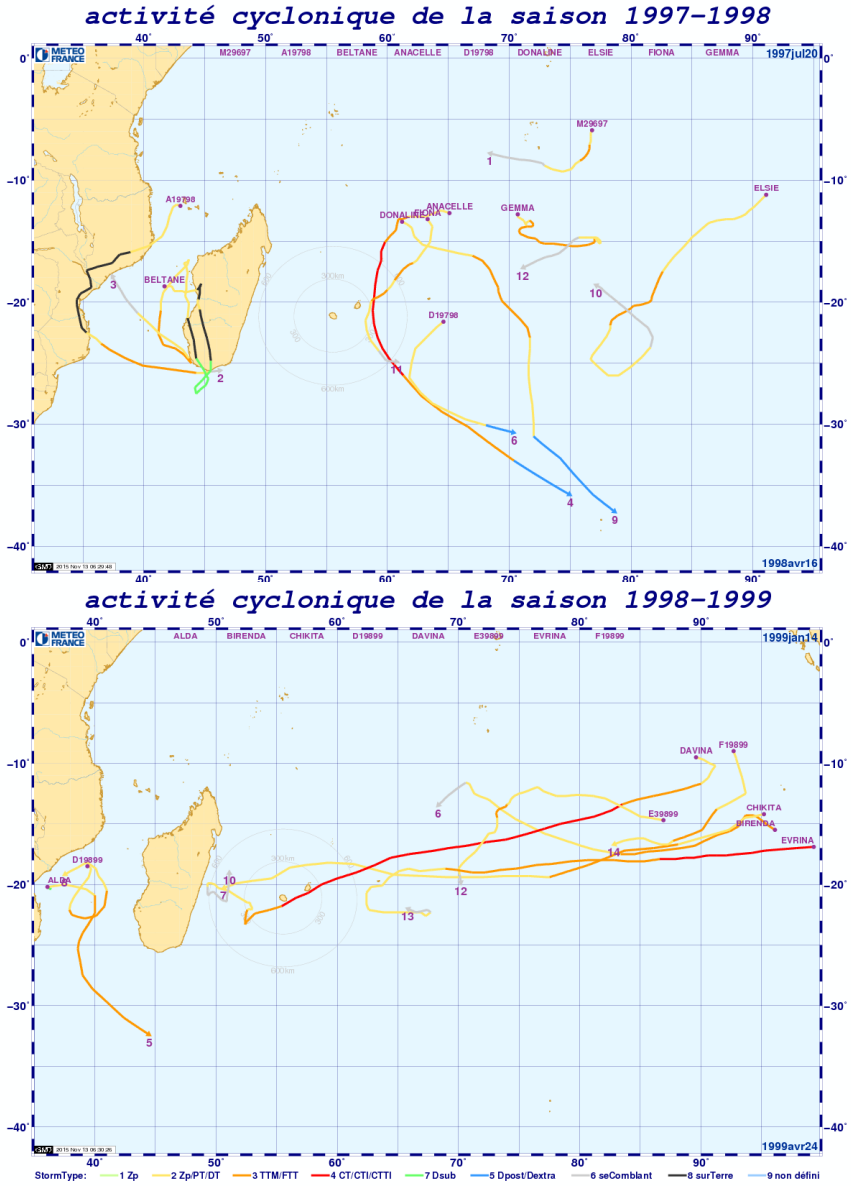
SST anomalies pattern during the strong positive 2016/2017 SIOD event.
A positive (negative) event is associated with warmer (cooler) waters south of the Mascarene Islands and cooler (warmer) waters over the eastern subtropical Indian Ocean.

→ **SIOD = Subtropical Indian Ocean Dipole** (Behera et al. 2001) Dipole SST pattern over the subtropical southern Indian Ocean associated with variability of the strength of the Mascarenes high.

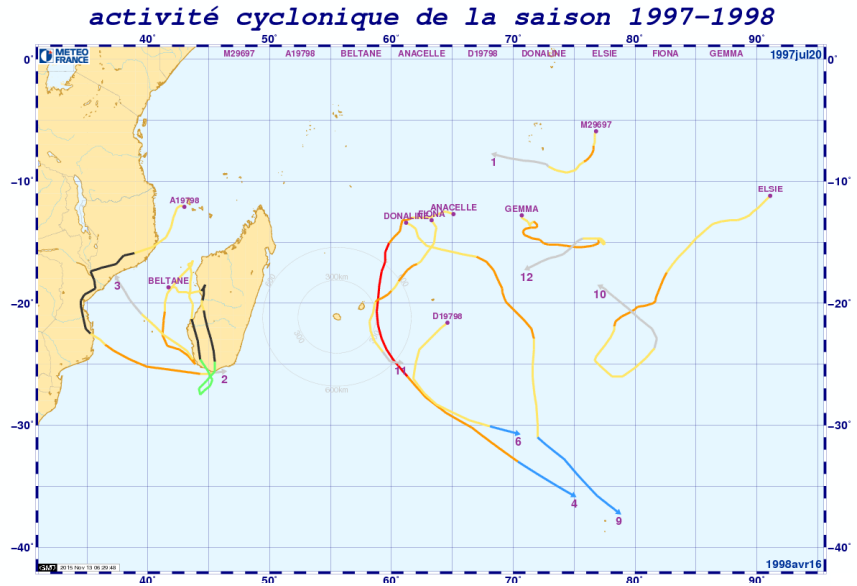
→ Associated (but not necessarily) with ENSO

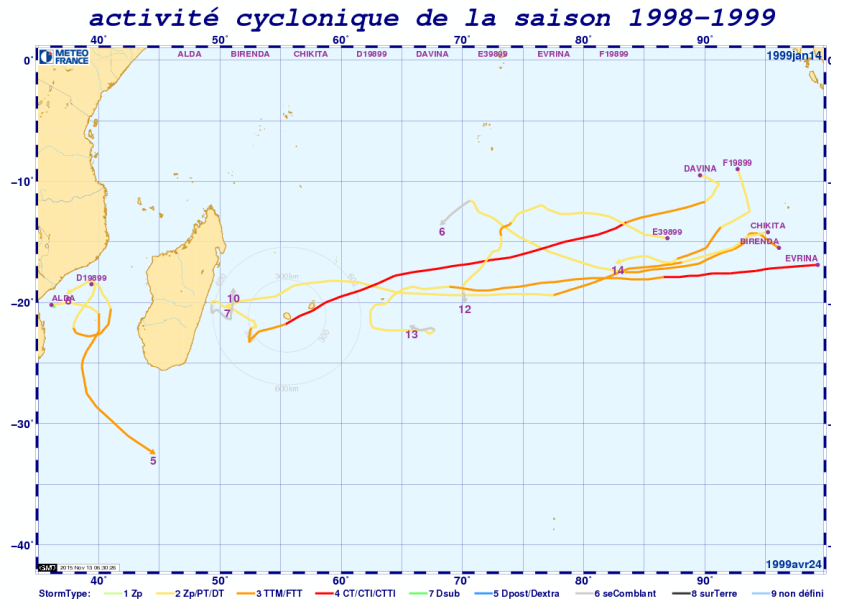
→ Positive events tend to be associated with reduced TC activity. Positive events are generally associated with dry mid-level conditions and cooler than usual SST over the central southern Indian Ocean.

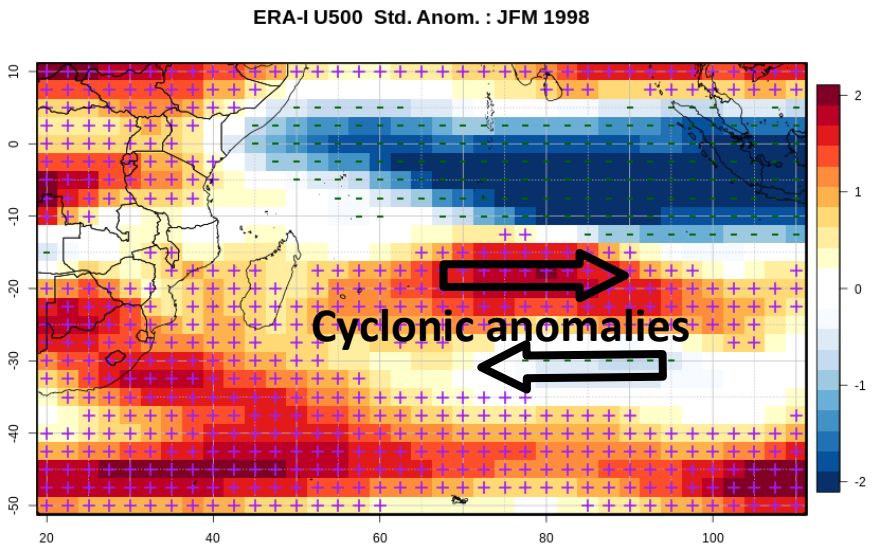
SWIO : Interannual variability vs. Tracks

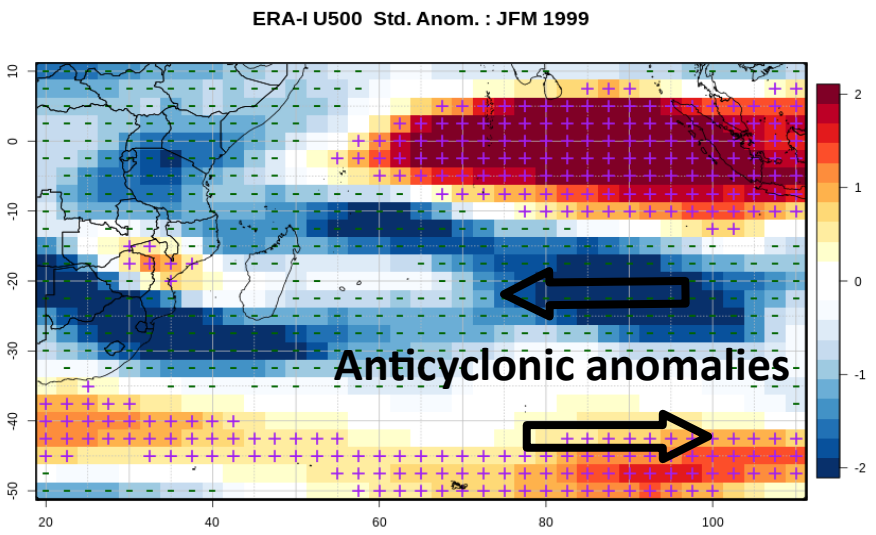


SWIO : Interannual variability vs. Tracks



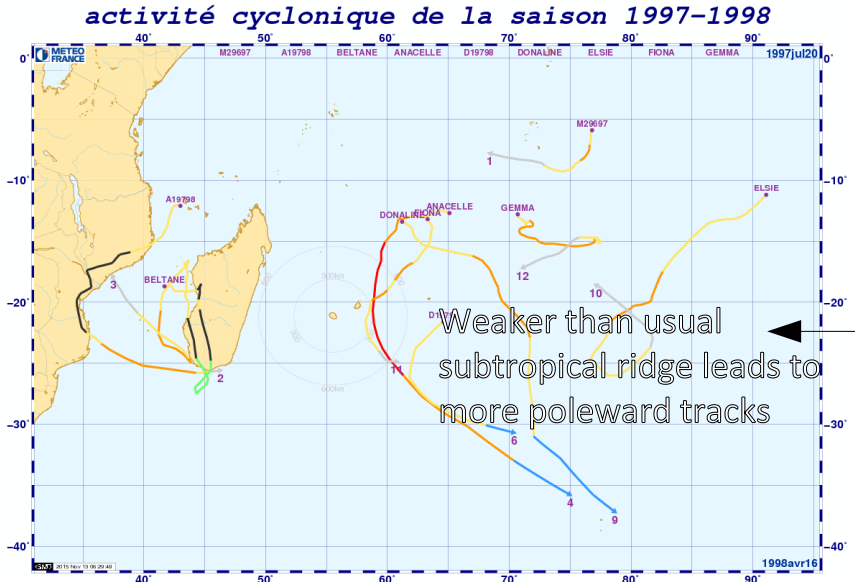




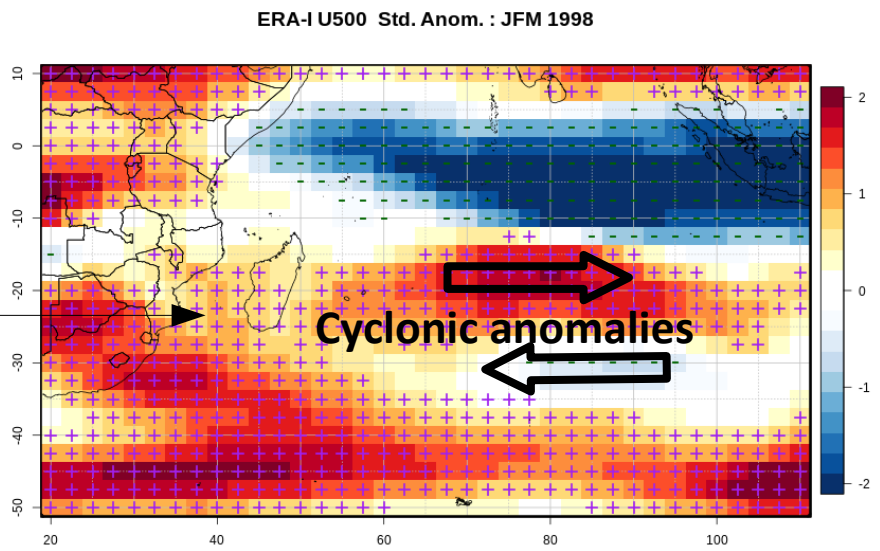


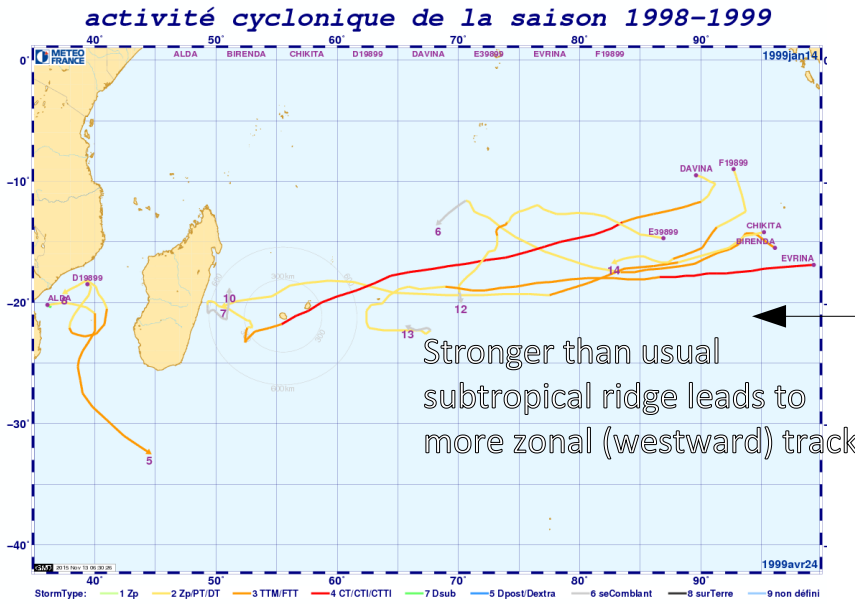
Ref: 1993-2016

SWIO : Interannual variability vs. Tracks

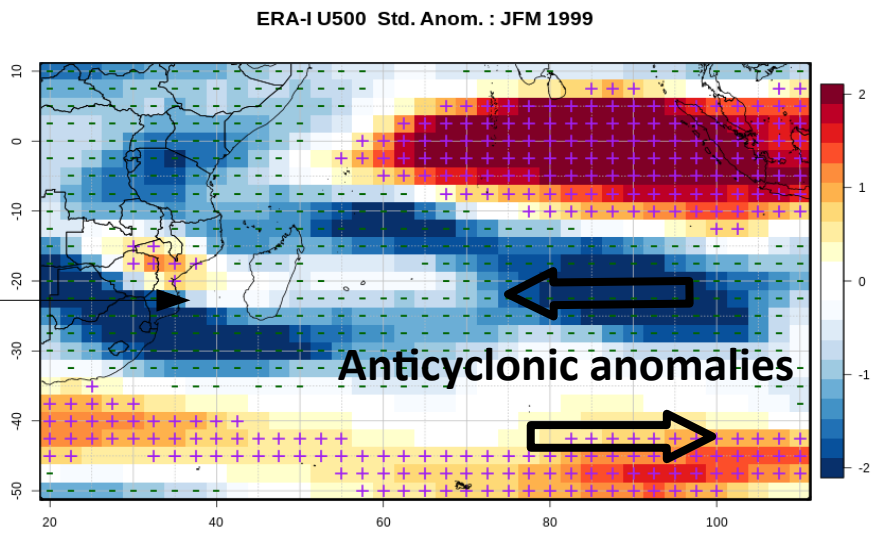


Weaker than usual subtropical ridge leads to more poleward tracks





Stronger than usual subtropical ridge leads to more zonal (westward) tracks



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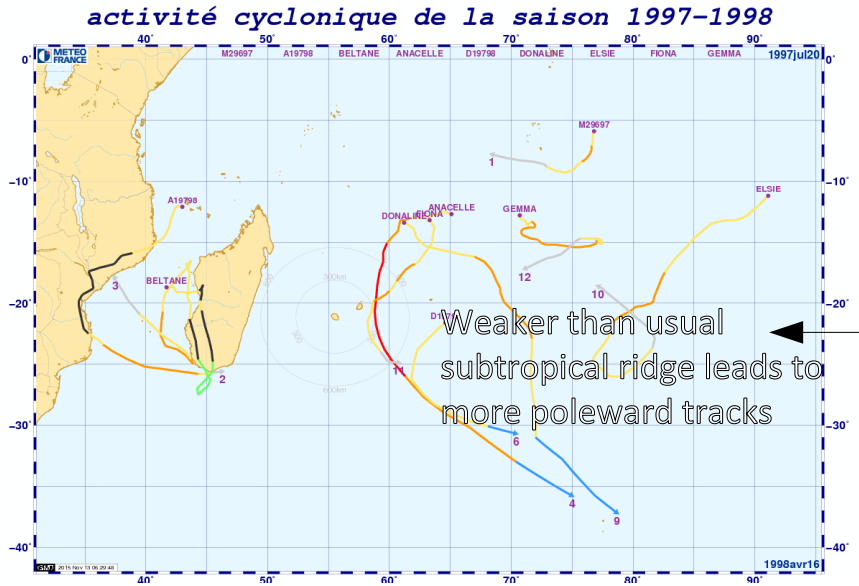
SWIO : Interannual variability vs. Tracks



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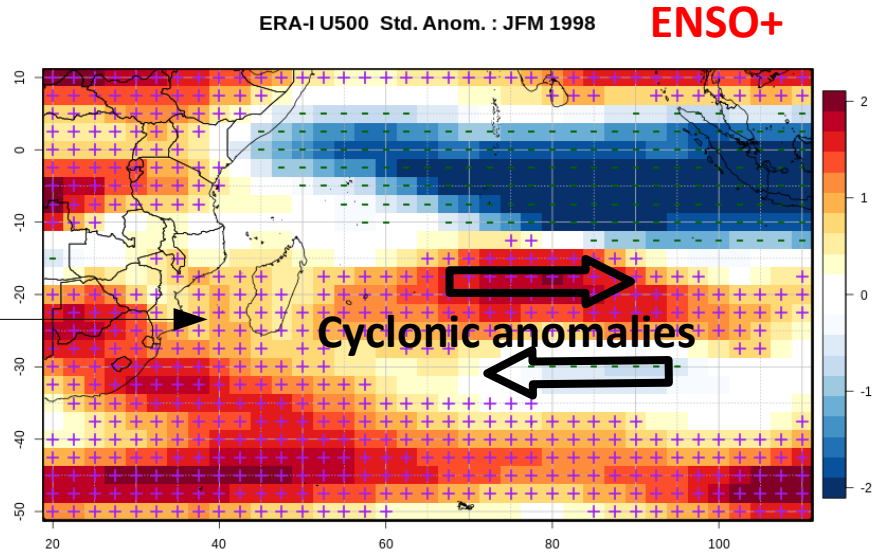

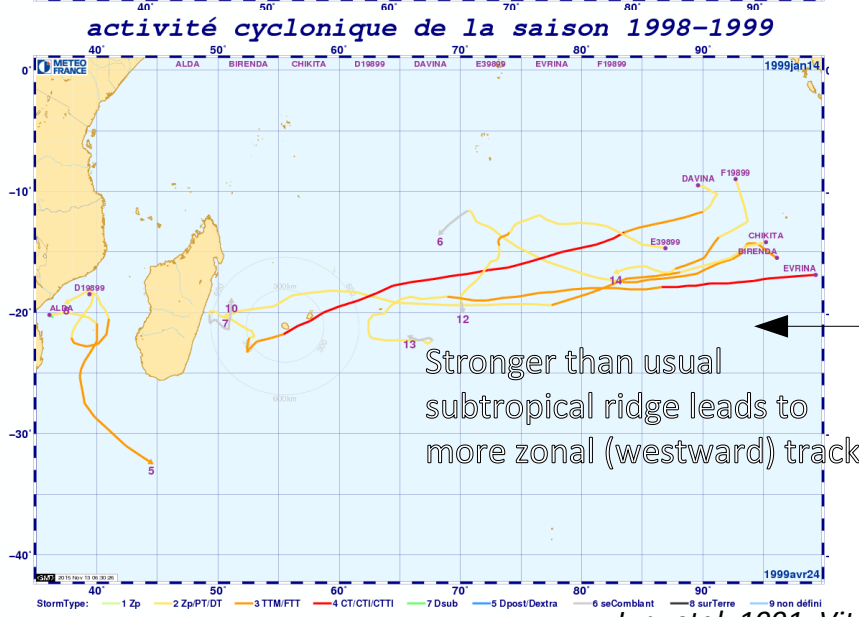

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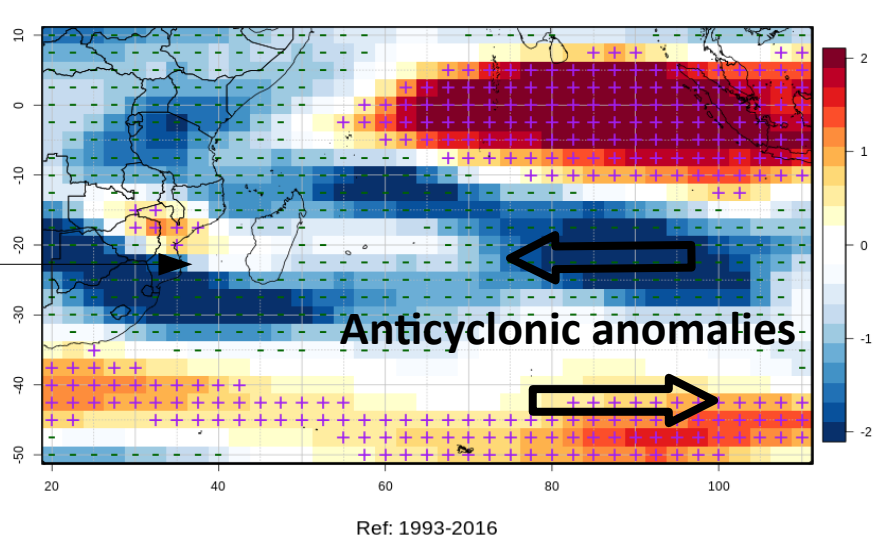
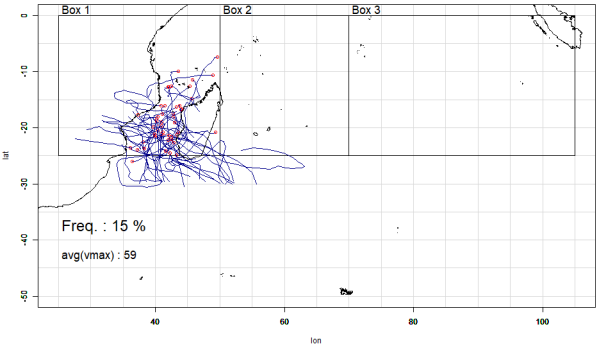


Jury etal. 1991, Vitard etal. 2003, Reason etal. 2004, Ho etal. 2006, Camargo 2007, Kuleshov 2009)

SWIO : TC tracks clustering

CLUSTER 111



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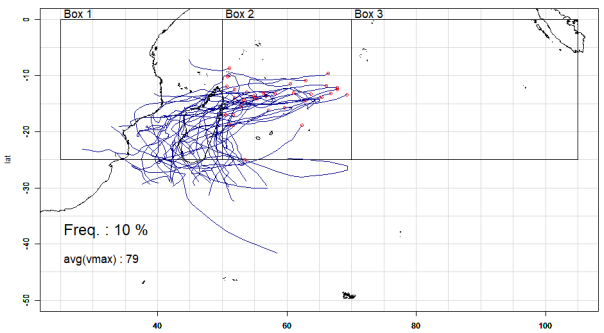

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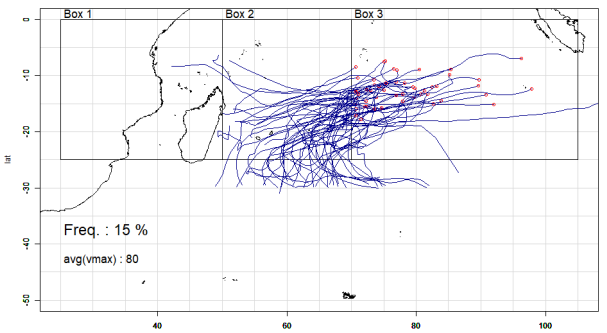

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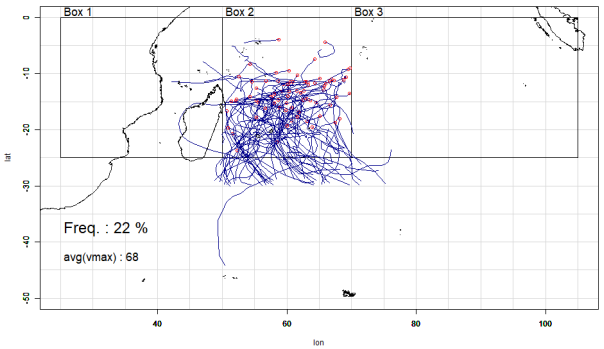

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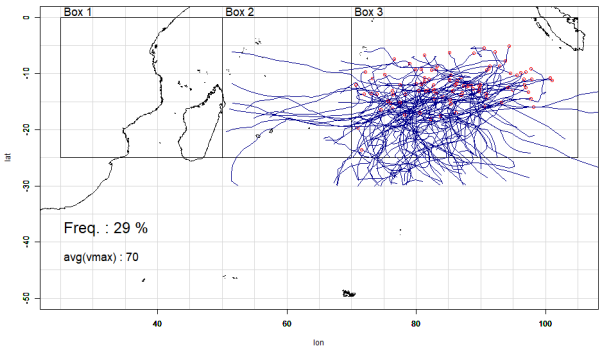


Classification of tracks with respect to :

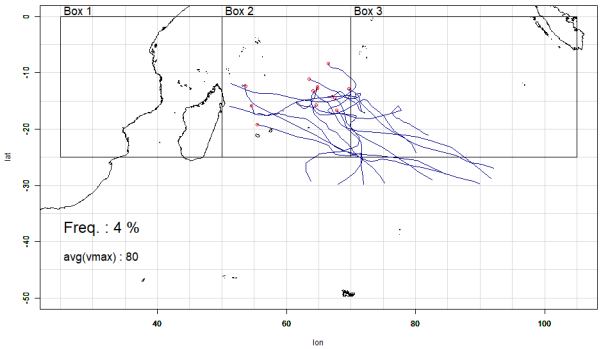
- start longitude (box 1,2,3)
- min longitude (box 1,2,3)
- max longitude (box 1,2,3)

with

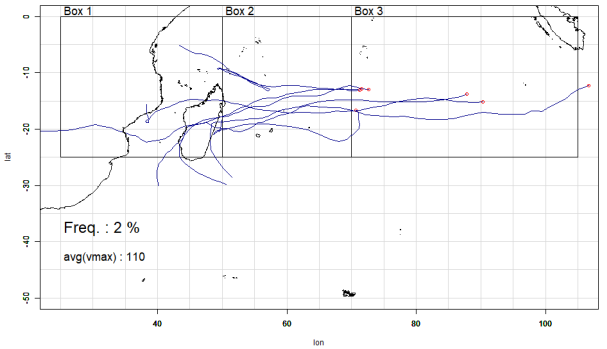
Vmax ≥ 34kt (10 minutes avg wind)

25°S ≤ latitude ≤ 0°

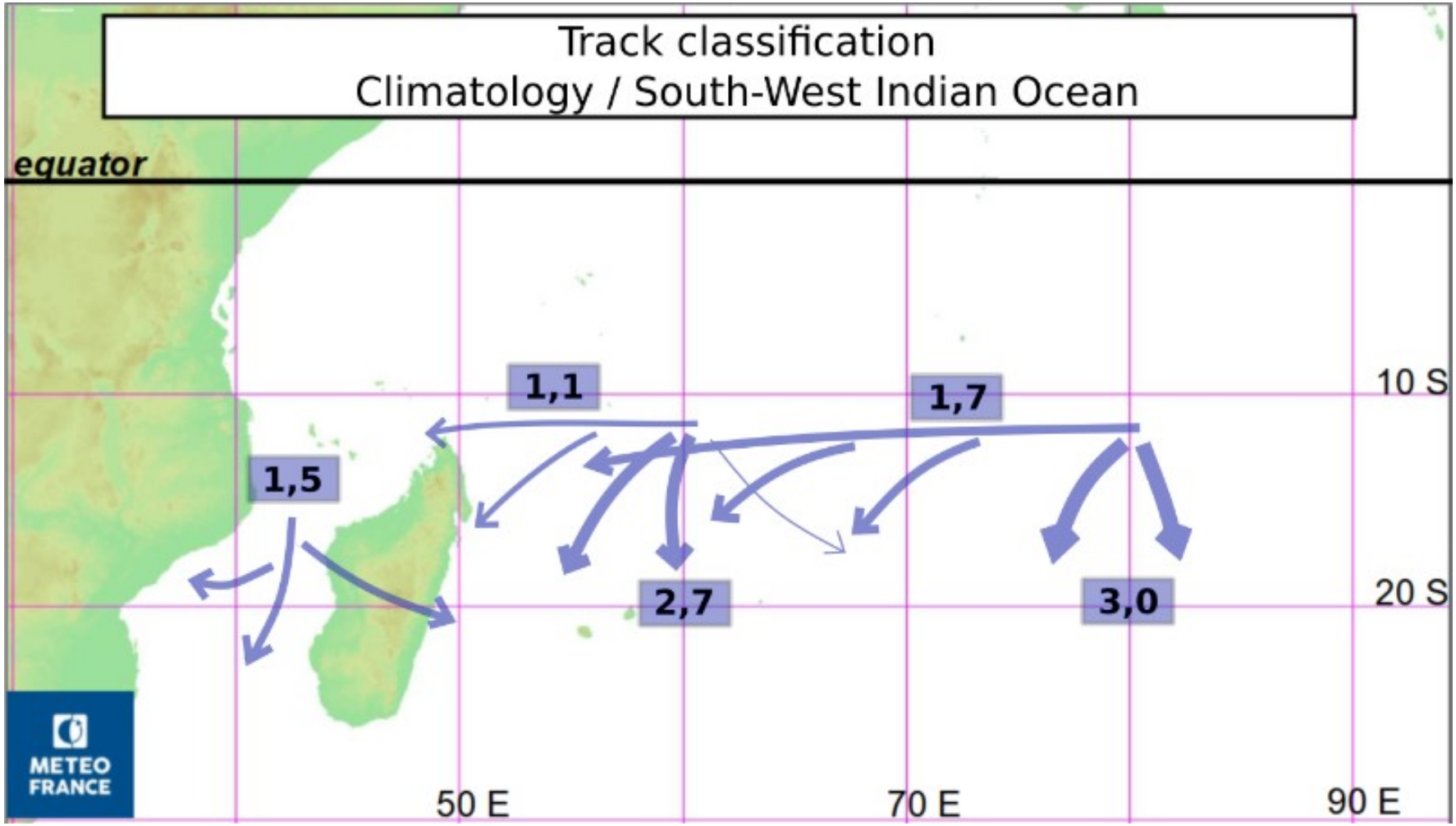
CLUSTER 223



CLUSTER 313



SWIO : TC tracks clustering



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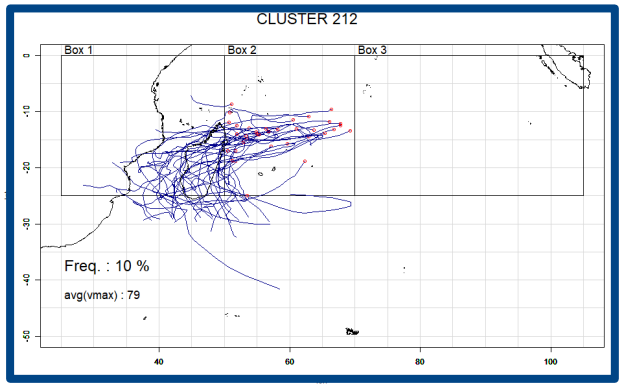
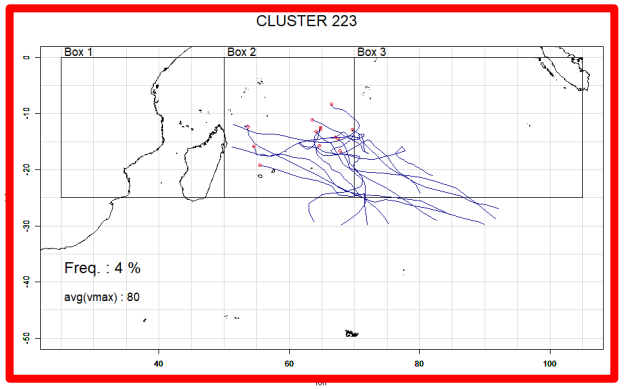
SWIO : TC tracks typology vs. ENSO

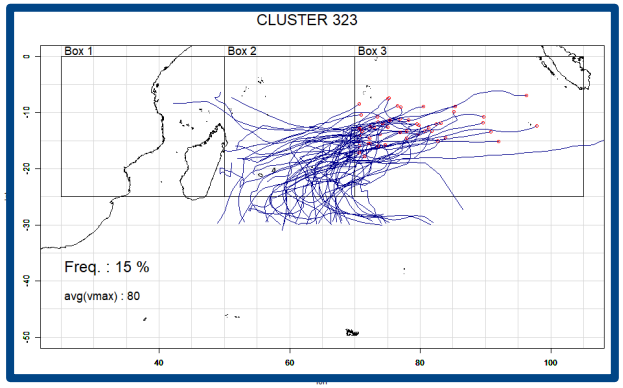


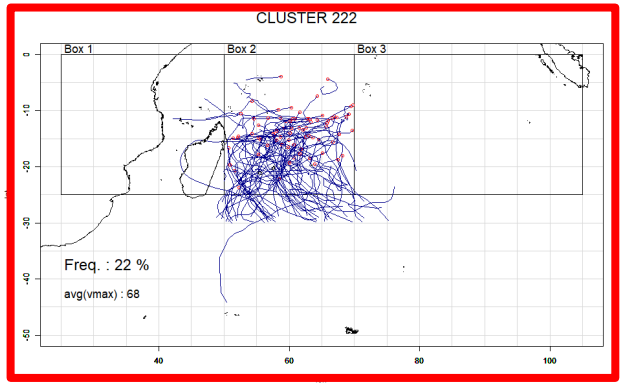
Below normal



Above normal

El Niño





→ El Niño favors central genesis and poleward tracks (southward to south-eastward).

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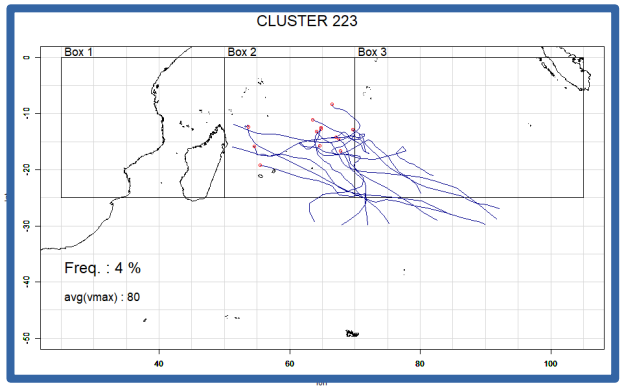
SWIO : TC tracks typology vs. ENSO



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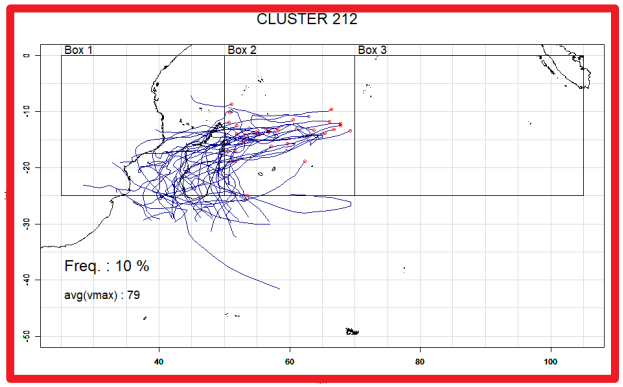
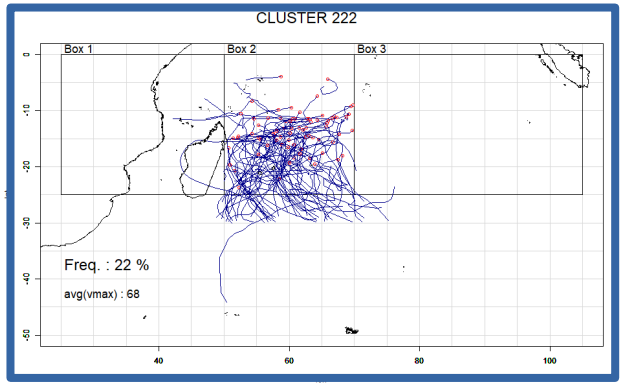
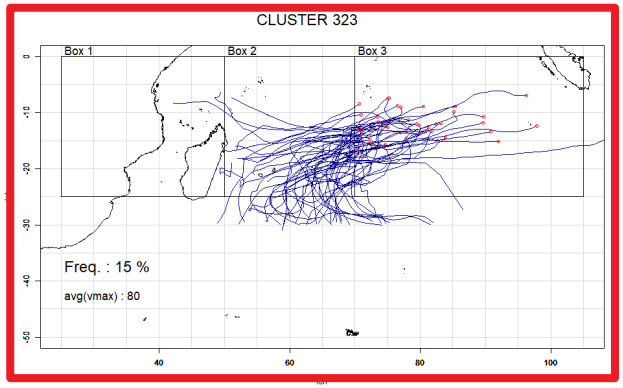


Above normal

La Niña





→ La Niña favors eastern to central genesis and zonal tracks (westward to southwestward)

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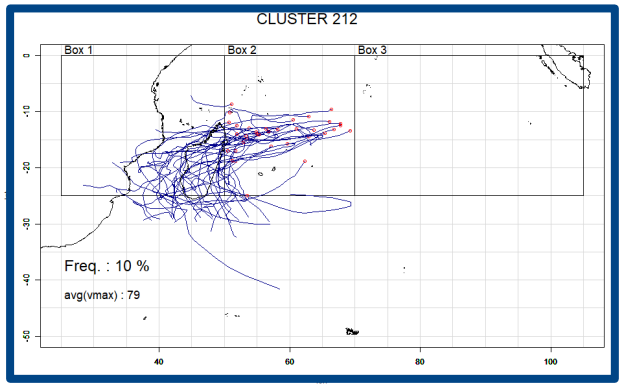
SWIO : TC tracks typology vs. SIOD



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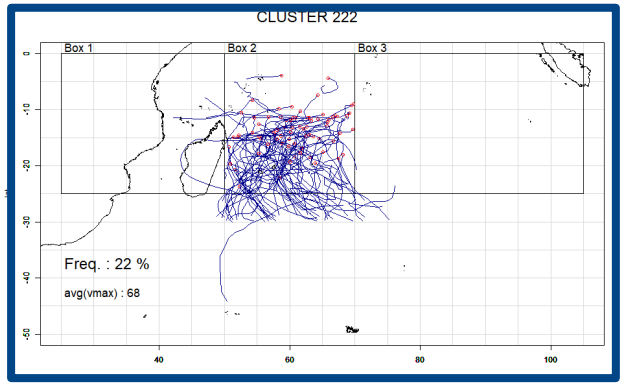
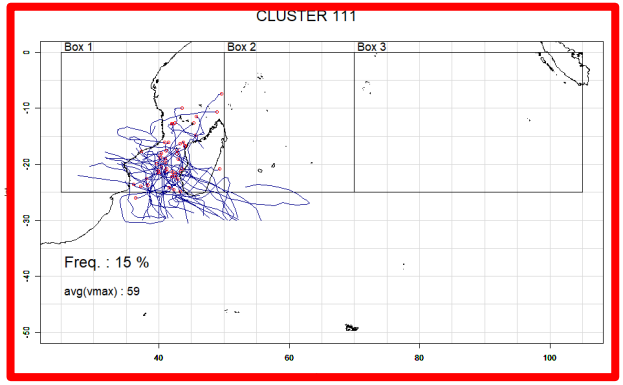


SIOD+



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→ SIOD+ favors Mozambique Channel geneses and limits TC genesis over the central Indian Ocean

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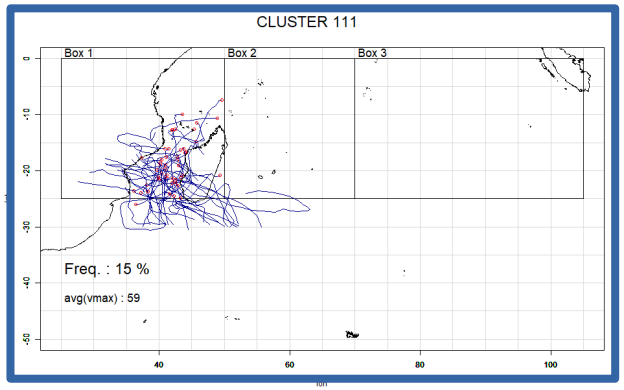
SWIO : TC tracks typology vs. SIOD



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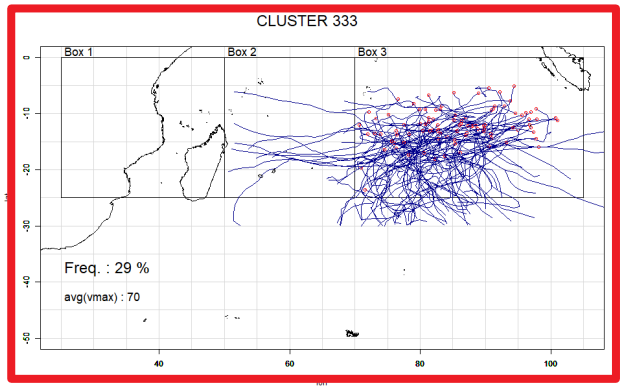

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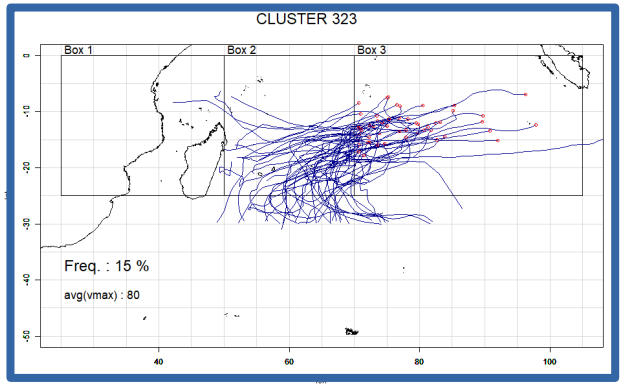
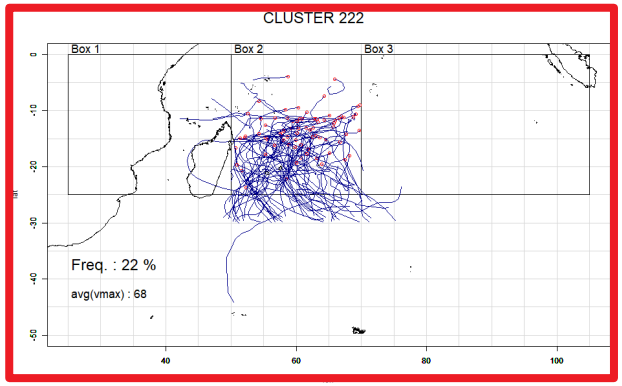
SIOD-





→ SIOD- favors less TC geneses over the Mozambique Channel and poleward tracks.

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