

Tropical cyclone seasonal forecast over the SWIO at RSMC La Réunion

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Outline

- What is a TC seasonal forecast – or is not?
- Methodology
- Assessment of the seasonal forecasts issued for 2015-2016 and 2016-2017 TC seasons
- Conclusive remarks and future work

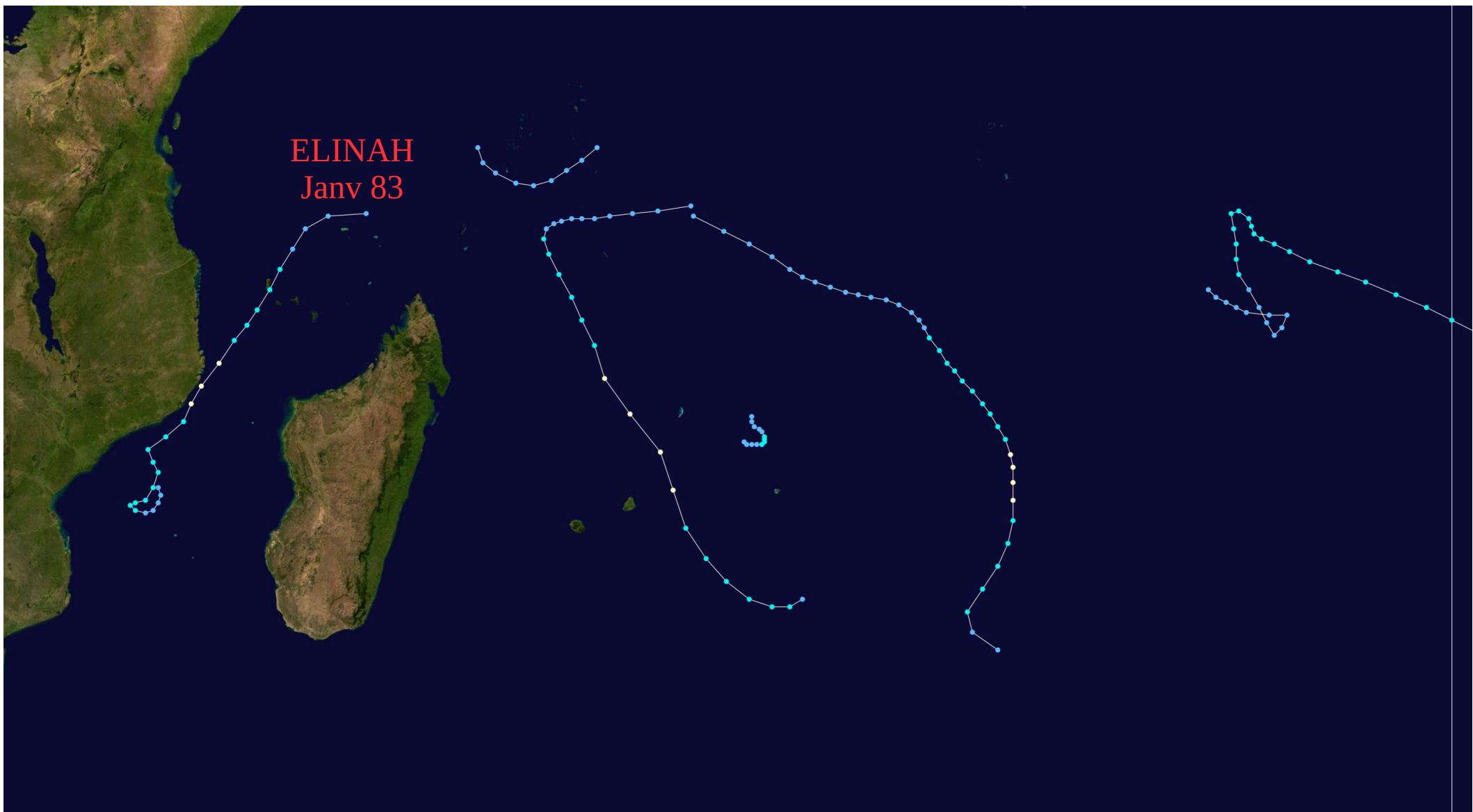
What is a TC seasonal forecast?

- A forecast of the general characteristics of the forthcoming TC season.
- Our approach focuses on :
 - TC activity (ACE, TS/TC number, TS/TC days ...)
 - Preferred genesis location
 - Track typology
- Required:
 - A better knowledge of what explains TC interannual variability over SWIO

What a TC seasonal forecast is not?

- A forecast of TC impact for a specific region or island
- A way to reduce my preparedness if the season is forecasted to be below normal activity.
One only can be a disaster! (many examples worldwide of a single dreadful TC during a season with below normal activity)

One only ...



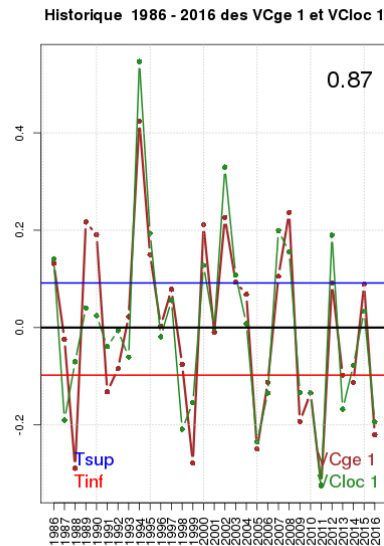
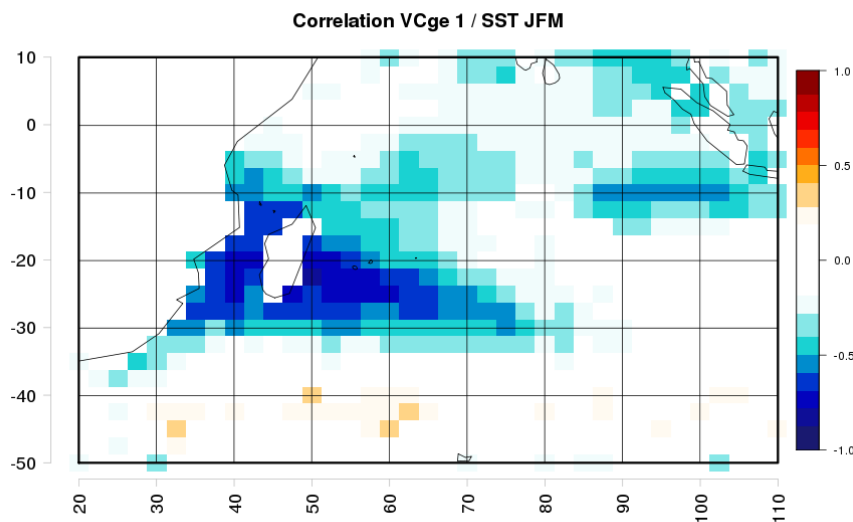
1982-1983 SWIO TC season

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Methodology

- Statistical-dynamical approach to link the interannual variability of some of the large scale parameters (SST, U850 etc ...) to key features of a TC season.



Correlation VCloc 1 / param

NB_TTCT	NB_CT	ACE
0.85	0.79	0.98
JOUR_TTCT	JOUR_CT	
0.95	0.94	

- Correlation between large scale parameters from ERA-Interim and a set of TC activity parameters is assessed through canonical correlation analysis over a period starting in 85-86 (more than 30 years)

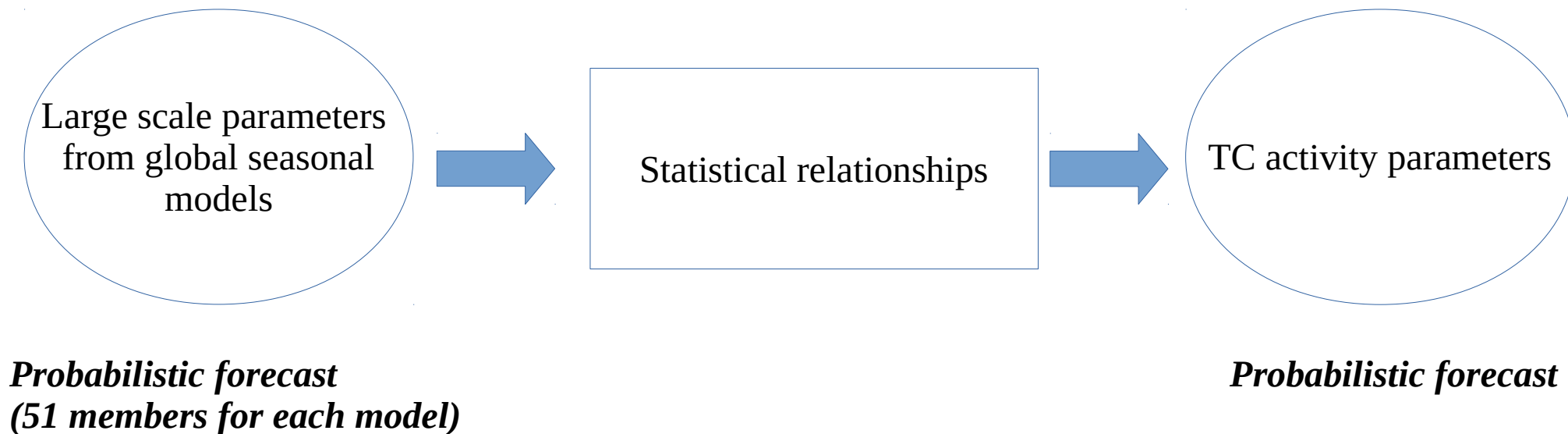
Methodology

	TC activity	Track typology	Genesis repartition
SST	Good skill	Good skill	Good skill western area
U850	Good skill	Good skill	Low skill
V850	Low skill	Neutral skill	Good skill central and eastern area
U200	Neutral skill	Low skill	Neutral skill western area
Velocity potential 200 hPa*	Neutral skill	Good skill	
Total water vapor content			Good skill central and eastern area
MSLP	Low skill	Good skill	

- The skill of each parameter is assessed through a « **leave-one-out-cross-validation** » **method** associated with **correlation** and **Tercile Heidke skill scores**

Methodology

- Statistical relationships found previously are applied to large scale parameters forecasted from numerical seasonal models (ECMWF and ARPEGE-Climat) to get the expected TC activity parameters.



Methodology

ECMWF Seasonal Forecast Accumulated Cyclone Energy

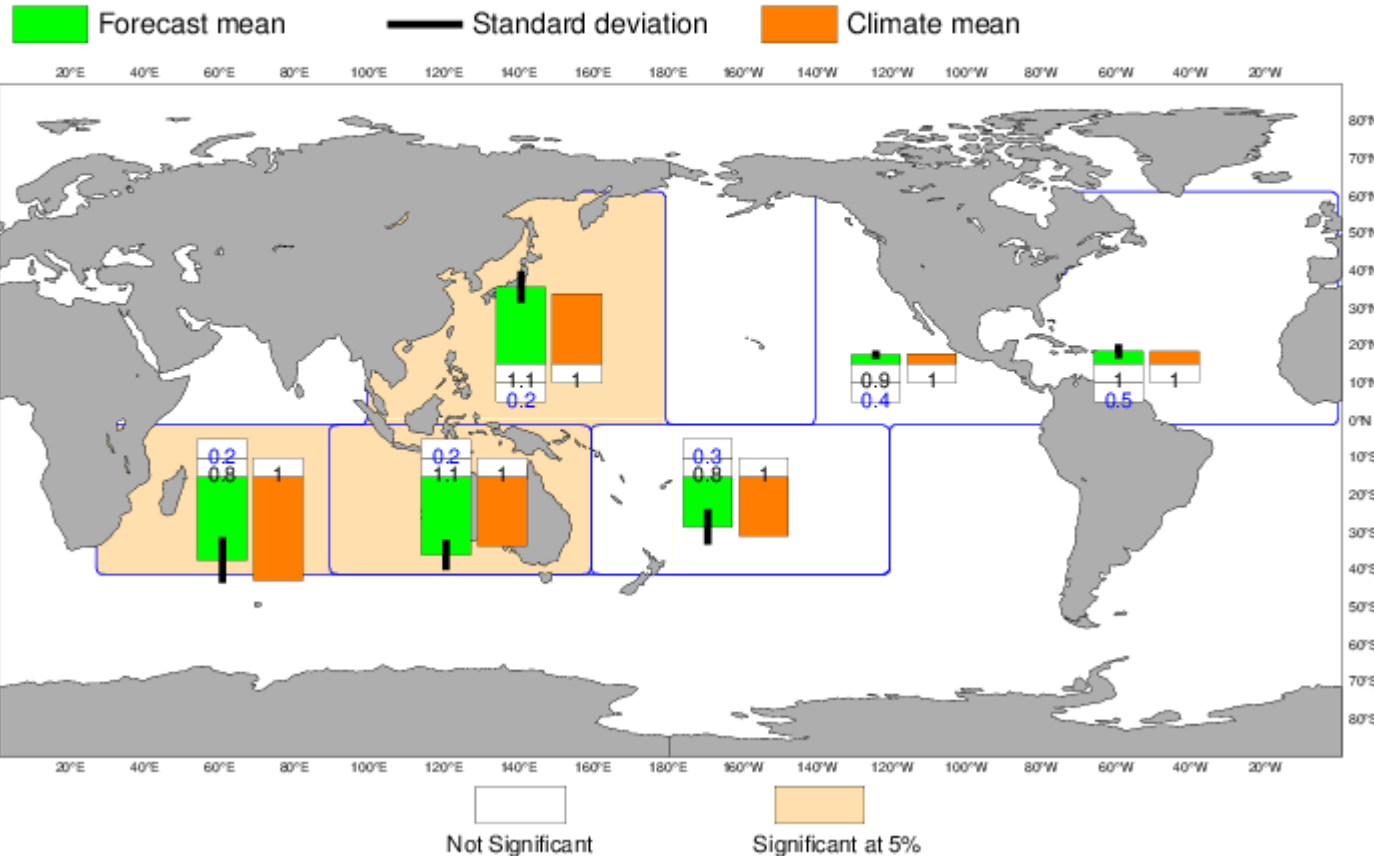
Forecast start reference is 01/09/2016

Ensemble size = 51, climate size = 300

System 4

ONDJFM 2016/17

Climate (initial dates) = 1990-2009



- Also a look at the TC seasonal forecast products from ECMWF
- Based on a tracking of TC in the predicted meteorological fields

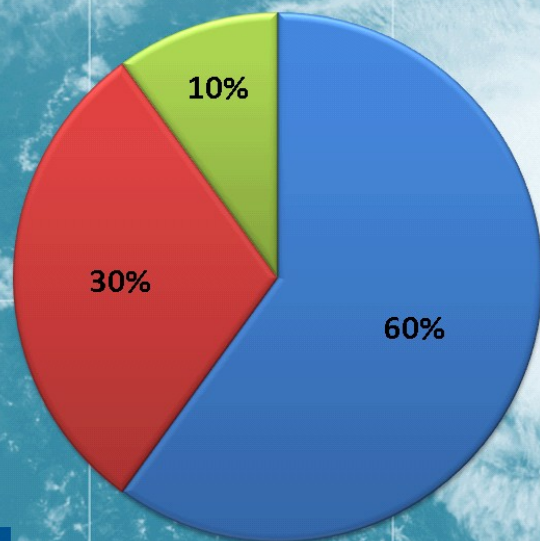
→ Final forecasts are based on blending. They are issued shortly before 15 November.

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2015/2016 & 2016/2017 assessment TC activity

**Prévision d'activité cyclonique
sur le Sud-Ouest de l'océan Indien:
saison 2016-2017**



Probabilité prévue :

- Inférieure à la normale
- Proche de la normale
- Supérieure à la normale

Tenez vous informés:
www.meteo.re
www.meteofrance.yt

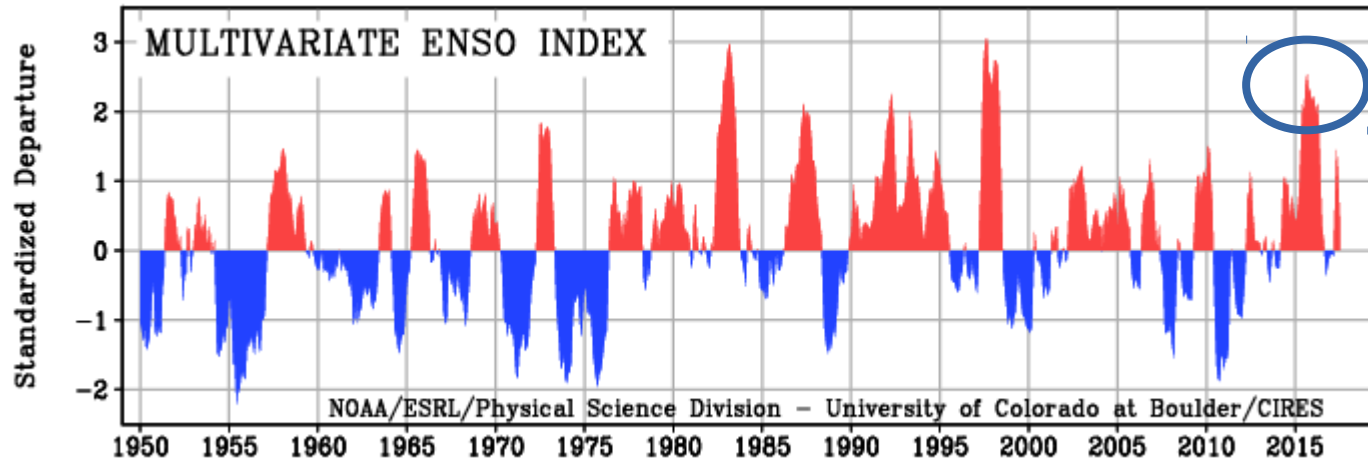
TC seasons	Forecast	Observed
2015-2016	Below to normal	Below
2016-2017	Below	Below

ACE TS/TC days TC days Total TS/TC Total TC Overall qualification

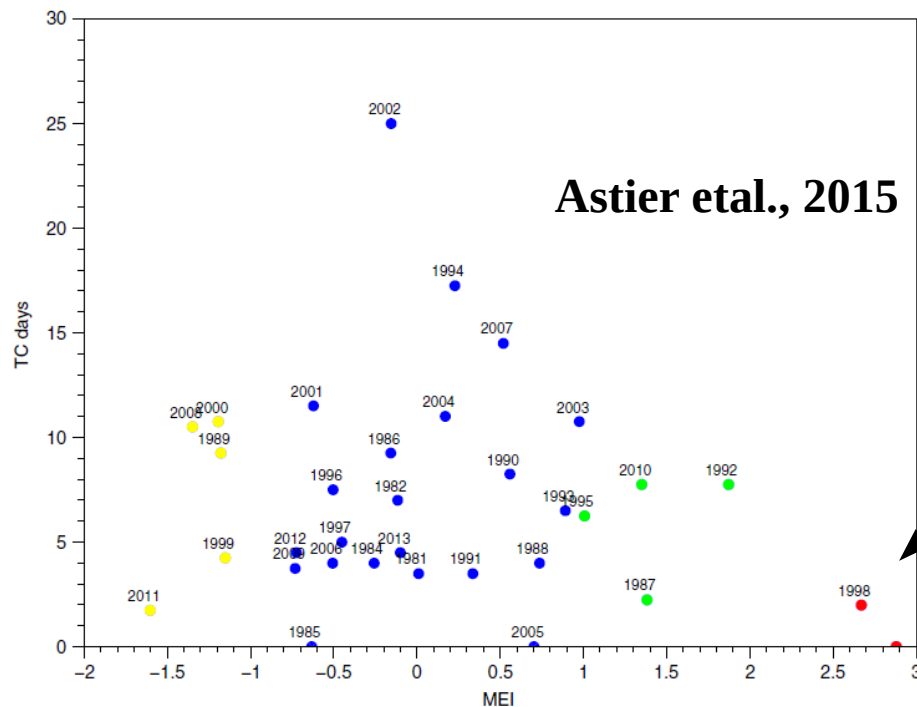
20152016	-0.1	-0.6	-0.2	-0.8	-0.9	inf.
20162017	-1.4	-1.3	-1.7	-1.6	-0.9	inf.

Normalized anomalies

2015-2016 : Strong El Nino



→ One of the **three strongest El-Nino events** on record

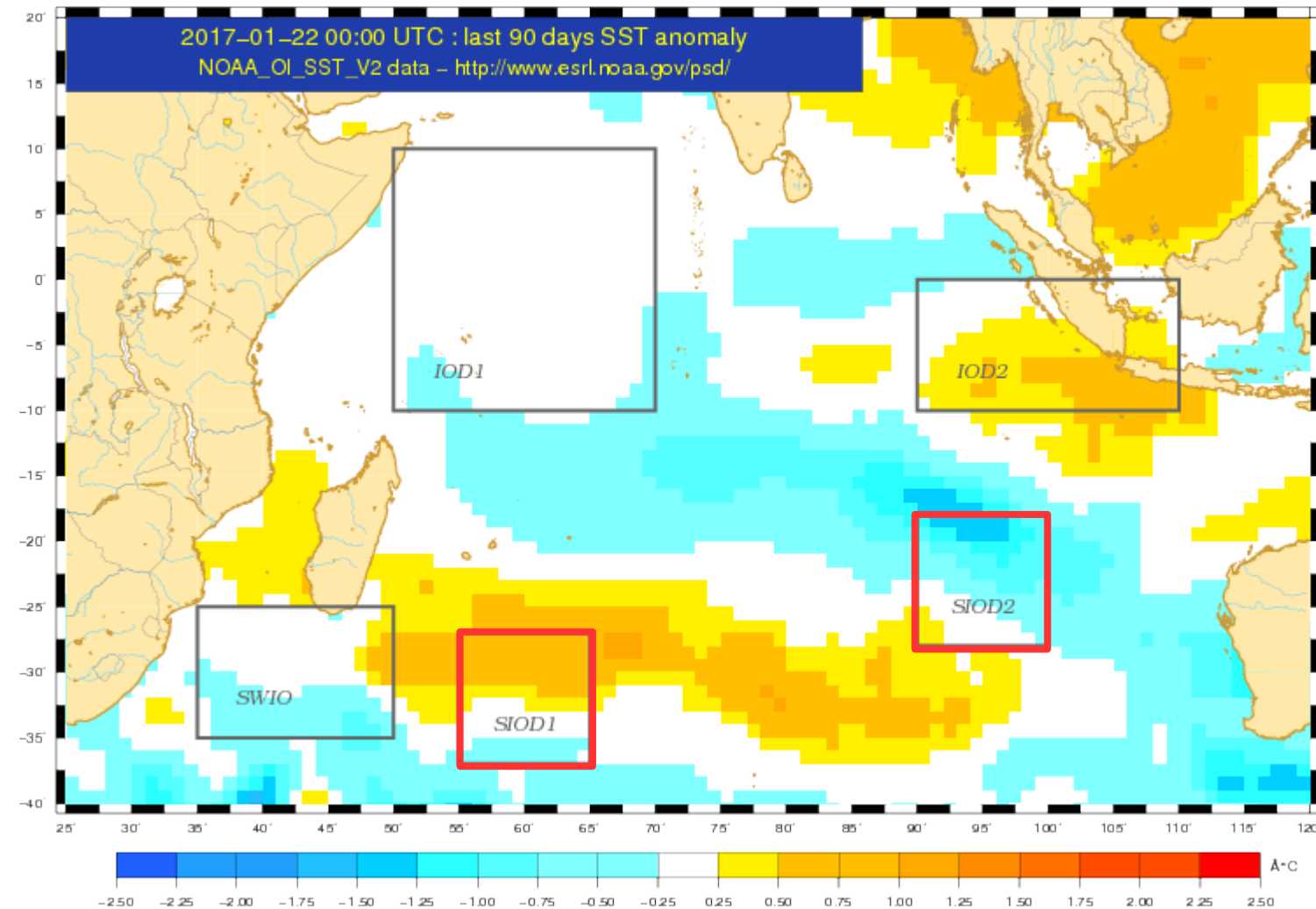


→ Below normal activity during strong El-Nino is consistent with what has been observed in the past ... but only a few cases ...

→ Warmer SST and low level moisture on average over SWIO during El Nino, but increase of the windshear ...

Figure 3. TC-days (y) versus MEI (x) for all the TC seasons of the database. ENSO++ seasons are in red, ENSO+ in green, ENSO- in yellow and neutral seasons in blue.

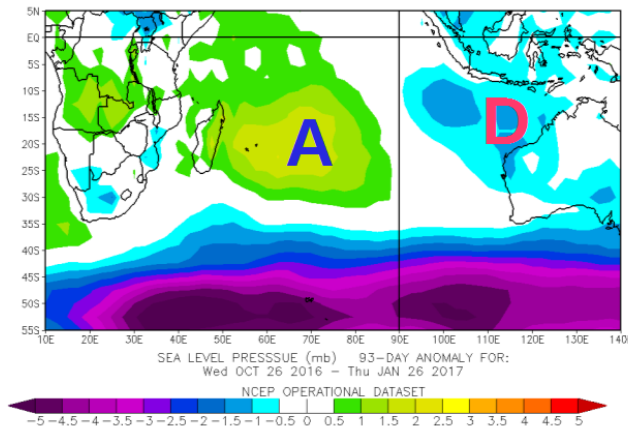
2016-2017 : Strong positive Subtropical Indian Ocean Dipole



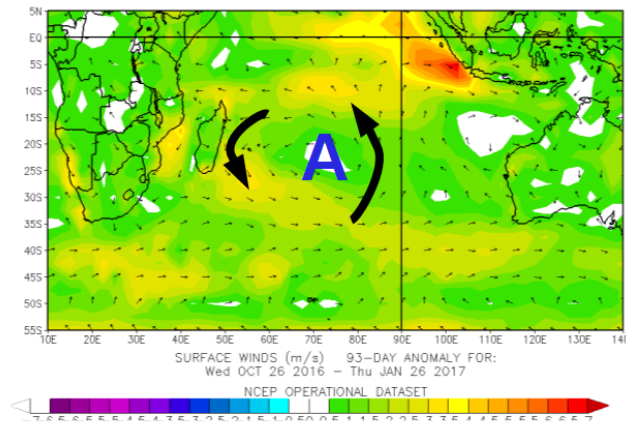
→ Strong dipole in the subtropical South Indian Ocean ...

2016-2017 : Strong positive Subtropical Indian Ocean Dipole

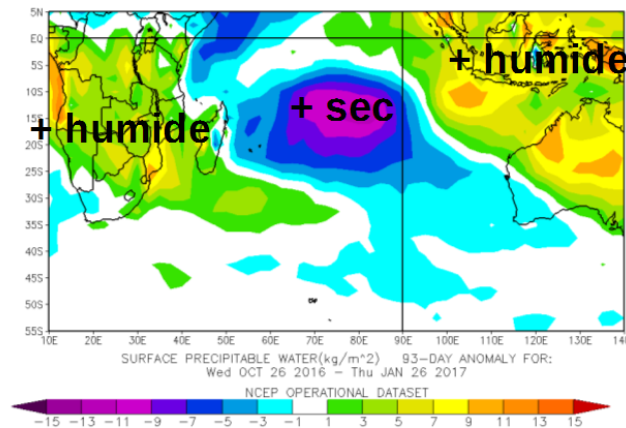
Anomalies de pression



Anomalies de vents en surface



Anomalies d'eau précipitable



NOV 2016 → JANV 2017
***26/10 → 26/01**

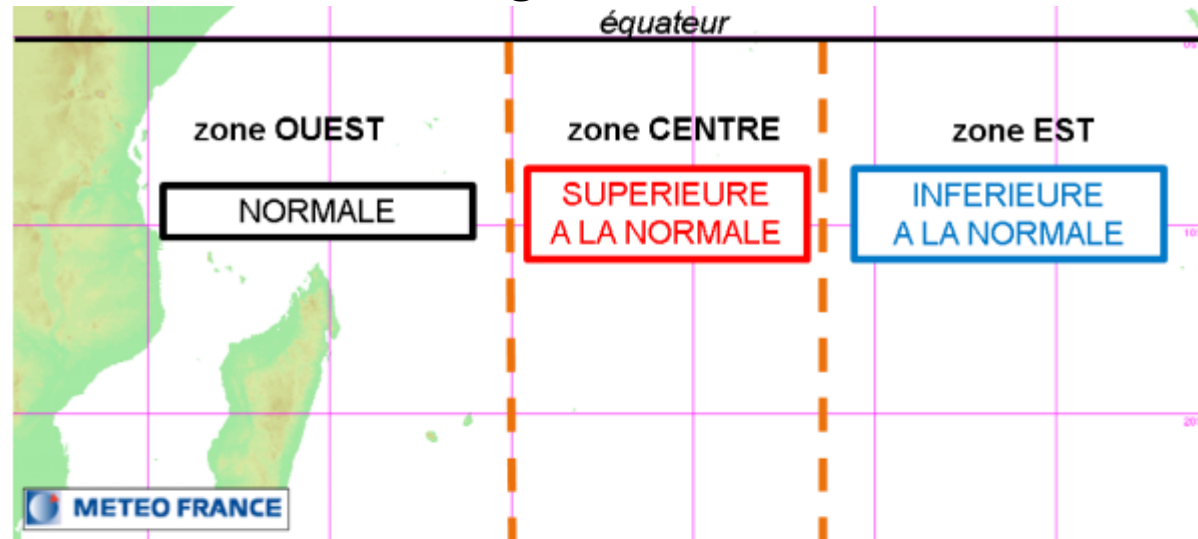
Source : NOAA/ESRL

→ ... strongly related to the atmospheric anomalies of the strength of the Mascarenes High and of the large scale subsidence over the tropical Central Indian Ocean.

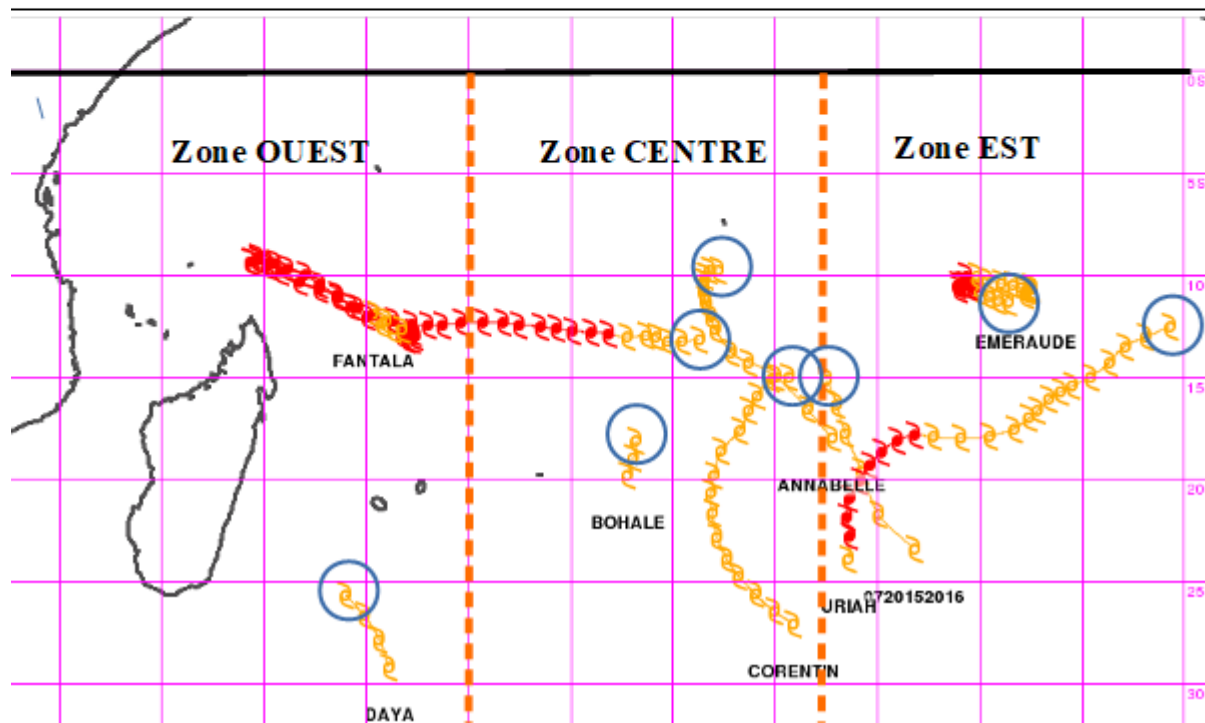
2015/2016 & 2016/2017 evaluation

TC genesis and track typology 2015-2016

Preferred genesis location forecast



- Good anticipation for central area
- Failed to predict proper tendency for western and eastern areas.



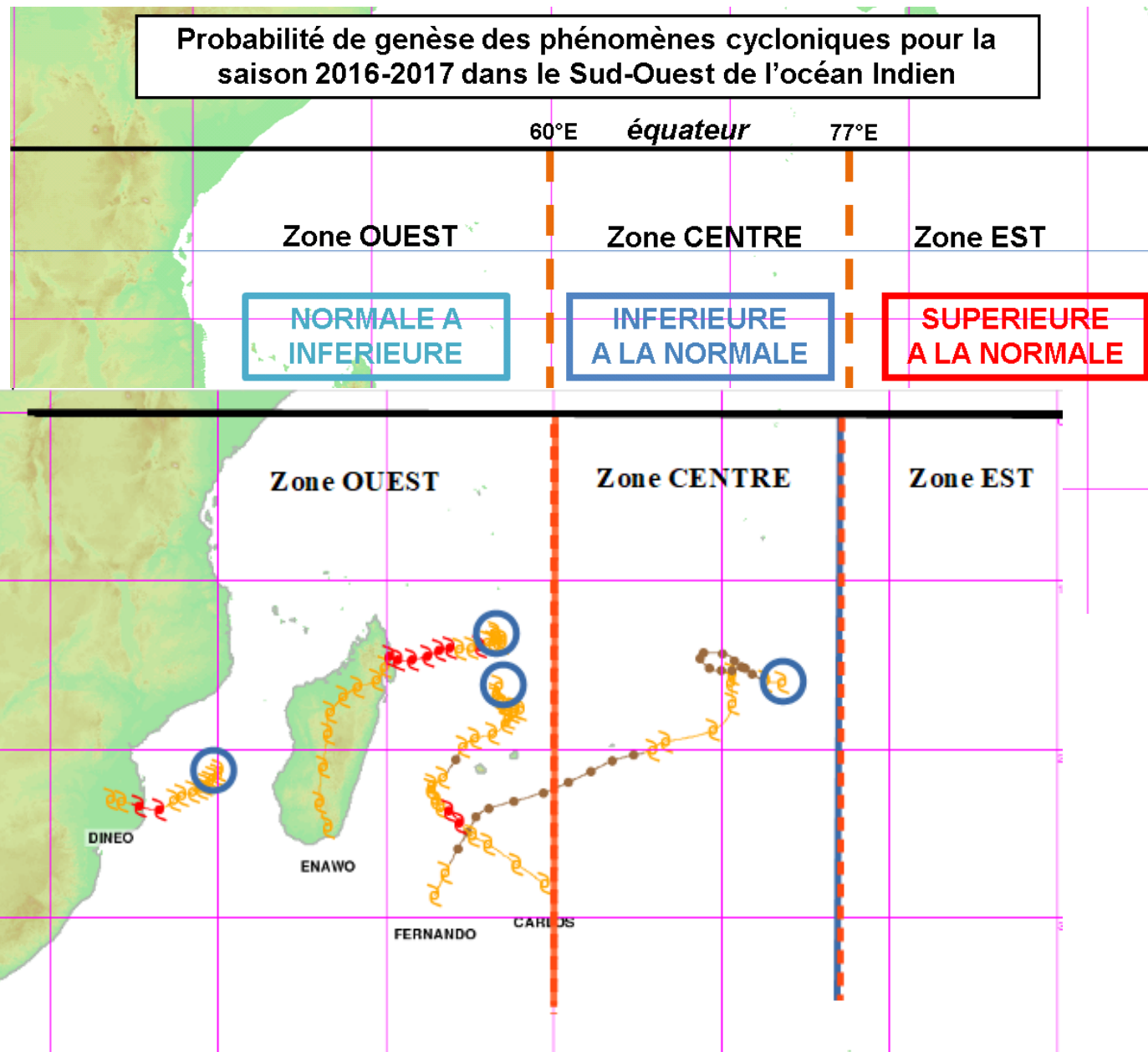
- Track typology prediction: mainly polewards
- Observed: 5 upon 8 tracks polewards

2015/2016 & 2016/2017 evaluation

TC genesis and track typology 2016-2017

Preferred genesis location forecast

Probabilité de genèse des phénomènes cycloniques pour la saison 2016-2017 dans le Sud-Ouest de l'océan Indien



→ Same as previous year: good prediction for central area and wrong tendency for both western and eastern areas.

→ Track typology prediction: climatological (parabolic)

→ Observed: 3 upon 4 parabolic tracks.

Outline

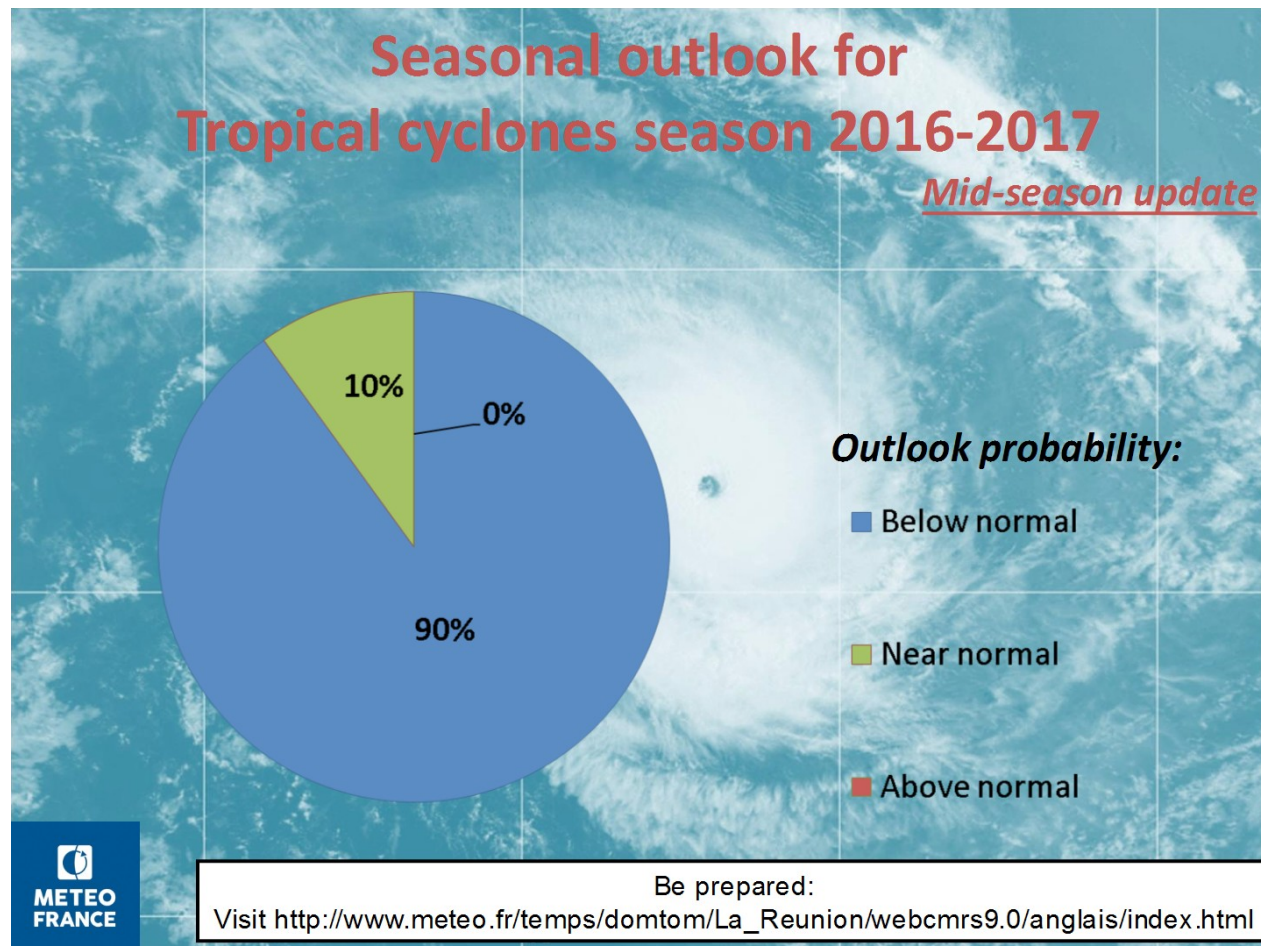
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Conclusion

- A statistical-dynamical model is used for seasonal TC forecasting at RSMC La Reunion to provide probabilistic predictions of various expected features for the forthcoming TC season.
- Assessment of the predictions issued prior seasons 2015-2016 and 2016-2017 shows rather good skill to anticipate the overall TC activity, including TS/TC frequency and main track typology.
- Strong global or regional large scale phenomena were involved (El Nino for 2015-2016 and SIOD+ for 2016-2017) and have likely contributed to this successful prediction.
- So far ... genesis preferred location prediction on 3 different areas over the basin (western, central and eastern) has shown lower skill, mainly over western and eastern areas.

Future work

- Since this year, a mid-season bulletin is issued (end of January) to re-assess the overall activity based on what happened during the first part of the season and what is expected for the second half, and based on the latest seasonal forecast.



Future work

- Improving genesis and main track typology by using a track clustering work (Bessafi, La Réunion University) showing preferred genesis location associated with track clusters.
- Including a range of TS/TC number in the published forecast (associated with 70 % probability as NOAA does)
- Adding the ratio TC number / TS+TC number as a local variable in the statistical model.

Thank you for your attention !
