RSMC La Réunion
Tropical Cyclone Centre
for the South-West Indian

METEO FRANCE

Réunion Island, 12 November 2015

Seasonal forecast of tropical cyclone activity in the South-West Indian Ocean elaborated by RSMC La Réunion for cyclone season 2015-2016

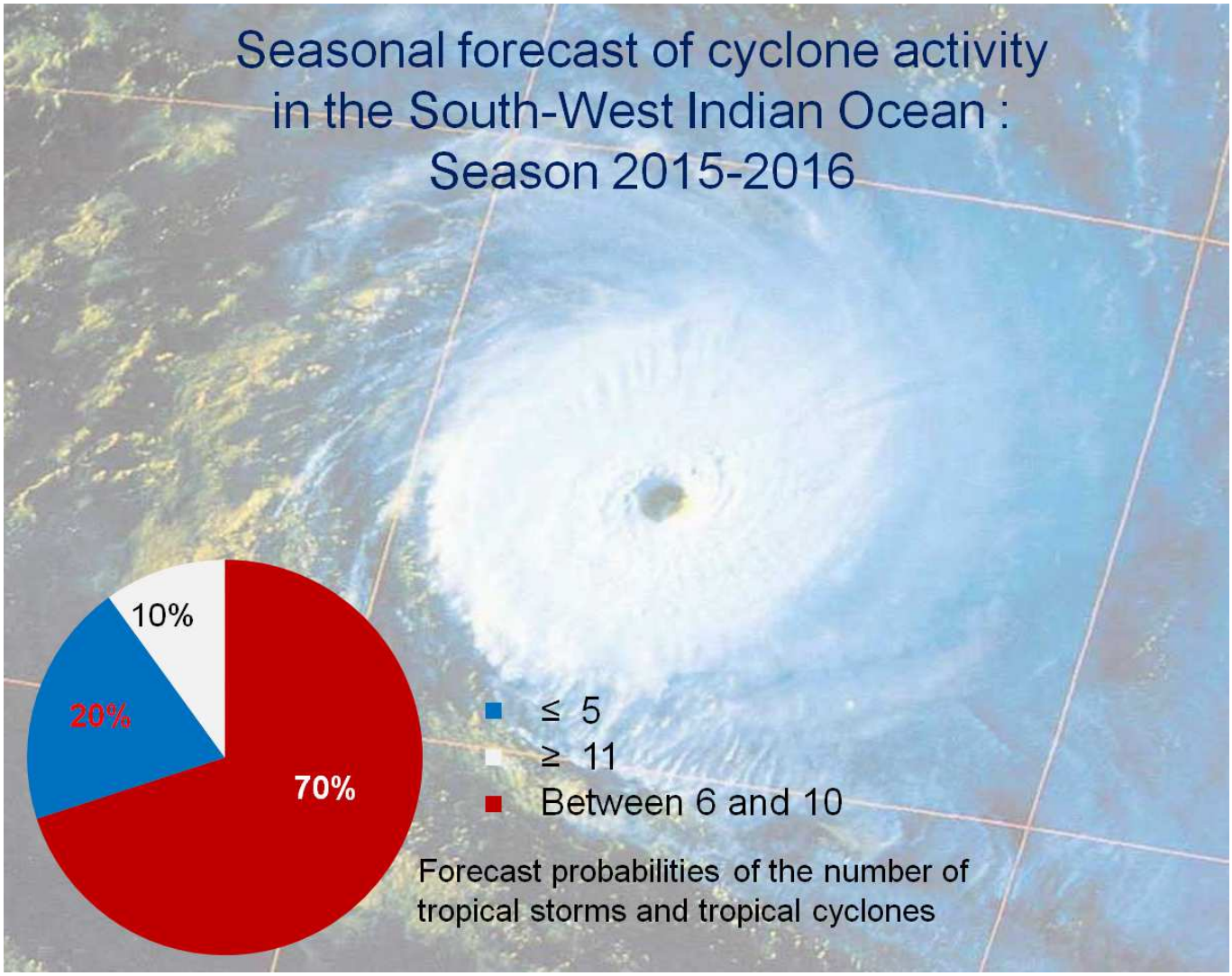
In a global context under the influence of a strong El Niño episode, the most likely scenario for the next cyclone season 2015-2016 tends to call for a cyclone activity that would be lower or close to the norm over the South-West Indian Ocean basin.

We estimate that there is a 70% probability that the number of tropical storms and tropical cyclones will be between 6 and 10 during this 2015-2016 cyclone season. There is also a 20% probability that the next season will be of little activity (number of systems ≤ 5) and a 10% probability that the activity will be close to the norm or higher than it (number of systems ≥ 11). It should be recalled that, on average, ten named phenomena are observed during a cyclone season, of which almost half of them develop into tropical cyclones.

It is also predicted that the privileged genesis area where the majority of storms would form this coming season should take place over the central part of the basin (between longitude 60°East and 77°East), to the detriment of the eastern portion (to the east of longitude 77°East). The number of geneses within the westernmost portion of the basin (to the west of longitude 60°East) is expected to remain close to its climatological norm. As far as the typology of trajectories is concerned, it is likely that it will assume a dominant meridian-like component (that is to say a tendency to head rather rapidly towards the south), or even an atypical component towards the east (a little like what happened during the 2014-2015 season).

One must insist on the fact that these forecasts say nothing about the possible impacts on the inhabited lands of the area. Because a sole system is enough to cause an impact that could be disastrous, even a season of little activity can be associated with major damage (as was the case, for example, with the 1986-1987 season

in La Réunion where Clotilda wreaked havoc, or with season 1982-1983 when Elinah badly affected Mohéli Island in the Comoro Archipelago). Whatever the global forecast, it is therefore necessary to guard against whatever may happen and take the usual precautions and actions of prevention here and now at the beginning of the cyclone season.



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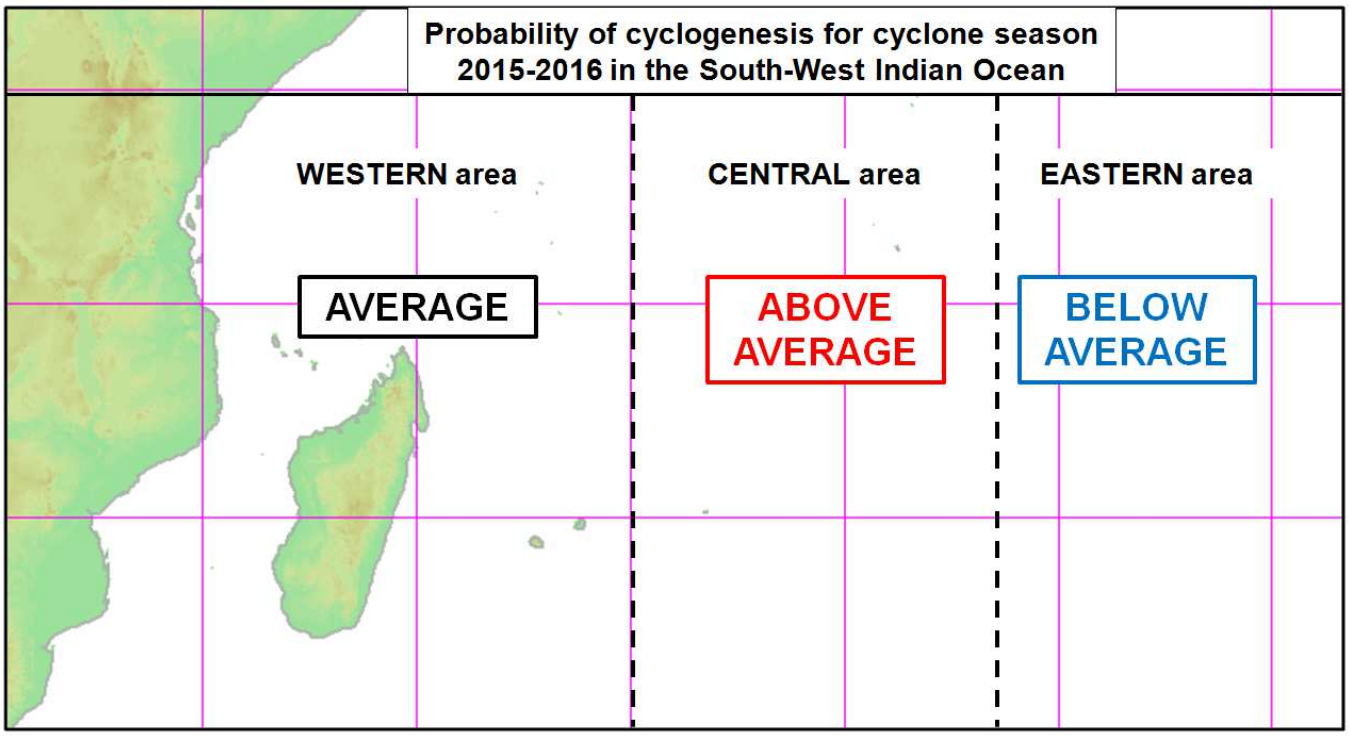


What is a seasonal forecast of cyclone activity?

Seasonal forecasting applied to predictions of cyclone activity, aims at anticipating the main future characteristics of a cyclone season across a basin such as the South-West Indian Ocean basin. Those characteristics can describe various aspects of the season as for example:

- The cyclone activity, a parameter of major importance in seasonal forecasts, which is usually characterized by the number of cumulated days with the presence of a cyclone or by the number of cyclones (although the latter one is considered as a less relevant parameter or metric),
- The privileged areas for the formation of tropical storms,
- Or else, a possible particular typology of tracks (for example a season with a majority of westward zonal tracks)

The development of seasonal forecasts therefore compels us to identify and try to understand the operating processes that regulate or modulate the cyclone activity in our basin on the inter-annual scale (from one season to another). In a way it is a means to better understand the acting processes.

What a seasonal forecast of cyclone activity is not…

One should bear in mind that there is no direct **CONNECTION** whatever between the global cyclone activity of a season and the risk of an impact on a small island such as La Réunion or Mauritius. The season may perfectly be active one particular year without any direct impact on the islands and vice versa.

On the other hand the seasonal forecast will **NEVER** make it possible to anticipate, several months in advance, how close to La Réunion or to any other inhabited land a future cyclone will be.

A 2015-2016 cyclone season dominated by a strong El Niño

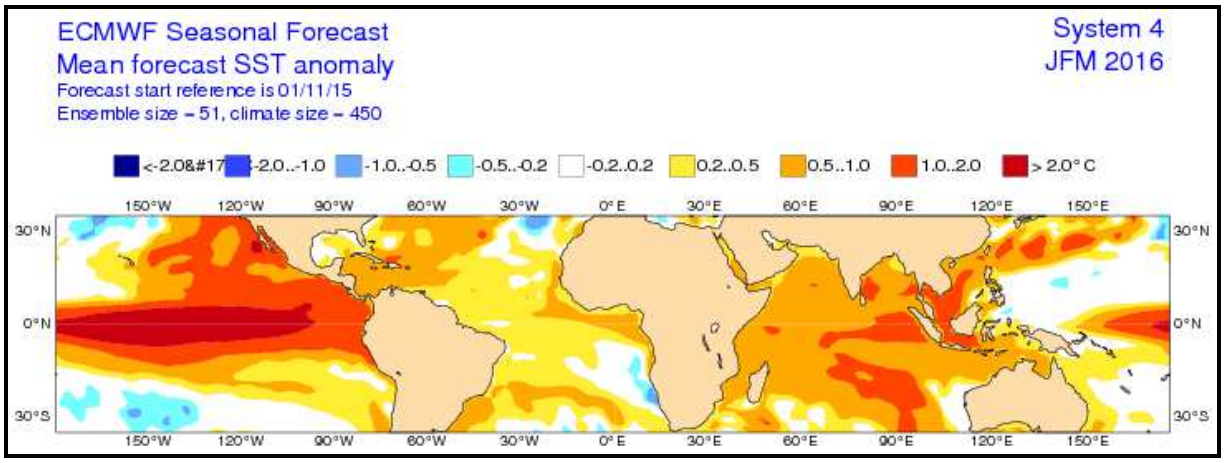
El Niño and its counterpart La Niña are large-scale ocean and atmospheric phenomena in the equatorial Pacific, which affect the wind conditions, the sea temperature and the rainfall. El Niño and La Niña correspond to the two opposite phases of the ocean/atmosphere coupled phenomenon called ENSO (El Niño/ Southern Oscillation). During an El Niño episode the surface warm waters, together with clouds and rains, shift from the western equatorial Pacific towards the central and eastern equatorial Pacific. Owing to its magnitude (with a temperature increase of about 1°C or more of the superficial ocean layers for several months) and the large expanse of the concerned area (at the level of the equator, the Pacific basin stretches over a wide area of more than 10.000 km), El Niño affects the world climate as a whole. That is all the more true this year as the ongoing phenomenon should probably be ranked among the most powerful observed since 1950. It is expected to reach its maximum of intensity during the last two months of the year before beginning to decrease at the start of 2016.

Over the South-West Indian Ocean and over the period between January and March (the heart of the cyclone season), an El Niño episode generates waters warmer than the norm over a large part of the tropical domain. At the atmospheric level, a vast circulation anomaly with an anticyclonic component settles near the surface over an eastern and central large portion of the southern Indian Ocean. In upper levels, the subtropical westerly jet stream, usually situated around latitude 35-40°South, is shifted further north to the level of tropical latitudes.

Unlike in other cyclone basins, such as North Atlantic or North Pacific where El Niño provides a rather clear response in terms of cyclone activity, the signal is far more difficult to interpret in the South-West Indian Ocean. Historically the last two strongest El Niño events resulted in seasons whose cyclone activity was low, even very low (1982/1983 and 1997/1998 seasons), but for a little less strong events, one obtains a rather wide range of responses in terms of cyclone activity (1991/1992 -> normal season, 1986/1987 -> season of very little activity, 1994/1995 -> active season).

Recent studies have shown that that particular response from El Niño in our basin is very likely related to the contradictory evolution of some large-scale parameters as far as cyclone activity is concerned: while sea surface temperatures warmer than the norm (also associated with more available moisture) would tend to favour the development and the intensification of the storms, the northward shift of the subtropical westerly

jet stream is associated with westerly anomalies in the tropical band where the cyclones usually reach their maximum of intensity that can potentially be associated with a crippling strengthening of the westerly vertical windshear, which is very unfavourable to the development and the maintenance of the cyclones.



Forecast of sea surface temperature anomalies for the January-February-March 1st quarter 2016 over the tropical domain by the climate model of the European Centre (forecast produced in November). The areas displayed in yellow to red correspond to areas where sea surface temperatures are higher than the norm contrary to the bluish anomalies that are associated with sea surface temperatures lower than the norm. The abnormally warm waters situated on the equator in the central and eastern Pacific correspond to the signature of the El Niño event. It can be noticed that the waters are also warmer than average over a large part of the Indian ocean (Courtesy ECMWF).

Methodological elements

The present forecast is based on a statistico-dynamical approach which made it possible first, to identify the variability modes of some large-scale parameters (sea surface temperatures, zonal components of the wind at 850 hPa – at about 1500 m – and at 200 hPa – in high altitude) which are the most closely correlated with the descriptive parameters characterizing the activity of a cyclone season (number of phenomena, number of days with presence of storms and cyclones,… genesis longitude anomaly, zonal and meridian-like anomaly of motion).

Then, we have used the ensemble forecast of the climate model of the European Centre for the aforementioned large-scale parameters in order to determine the parameters expected for the next cyclone

season by using the statistical relationships previously established. The assessment of the quality of that model for each of the large-scale parameters provided as an input for the previous seasons, shows that one gets the best results by using the sea surface temperature (the parameter best predicted by the climate models) and the zonal component of the wind at 850 hPa (but to a lesser extent than the sea surface temperature).

That forecast was also compared to the dynamical approach which consists in directly “counting” the number and the geographic distribution of the phenomena simulated by the climate model of the European Centre. For the last prediction made in November, the results of the direct approach are in accordance with the statistico-dynamical approach.