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The PISSARO project: subseasonal impact-based forecasts of the cyclonic activity in the South West Indian Ocean

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[2]*DIROI, Météo-France, Saint-Denis, La Réunion, France*
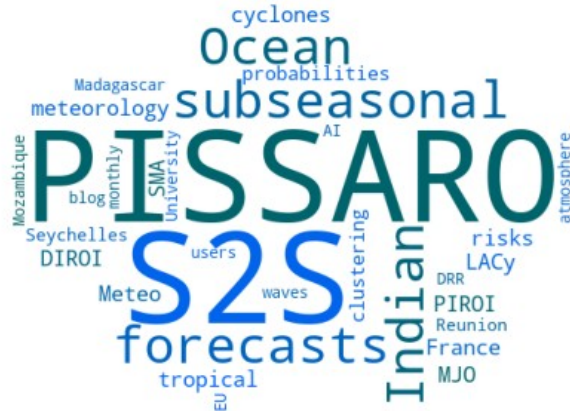[3]*CNRM, Météo-France, CNRS, Toulouse*
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The PISSARO project in brief

Academic research project – 3-year period (2020-2023)

PISSARO: Prévisions Intra-Saisonnières et Saisonnières avec AROme is co-funded by The European Union and Région Réunion

Application of **intra-seasonal atmospheric and oceanic forecasting** over the South West Indian Ocean (SWIO)

Collaborative project for the **valorisation of research data**. Study of past data for the:

→ **evaluation** of the quality of intra-seasonal forecasts

→ **development** of forecast products **adapted to users**

Observation: few warning products for risk management beyond a few days → ambition of the project to enable the development of **early warning tools** **thanks to potential user discussions / S2S experts**

Collaborative project focused on users

Who are we?
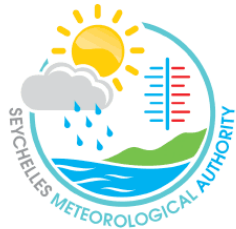
+ *International scientific experts on S2S prediction*

Potential users: forecasters, stakeholders...

Key to the success of the project?
Understand the needs and **propose products adapted** to the users of the intra-seasonal forecasting

How?
- **Communication with regular exchanges**
- **Joint activities**
- Setting up of sharing tools: **web platform**

http://pissaro.re

Intra-seasonal forecasting

Intra-seasonal forecasting = **missing link** to provide users with **a seamless chain of information**

Intra-seasonal forecasting = **missing link** to apply the **"Ready-Set-Go" concept** proposed by the Red Cross Climate Center and IRI (Goddard et al., 2014)

Motivation of the PISSARO project = to evaluate the potential contribution of intra-seasonal forecasting to **support decision making** for various applications including disaster risk reduction
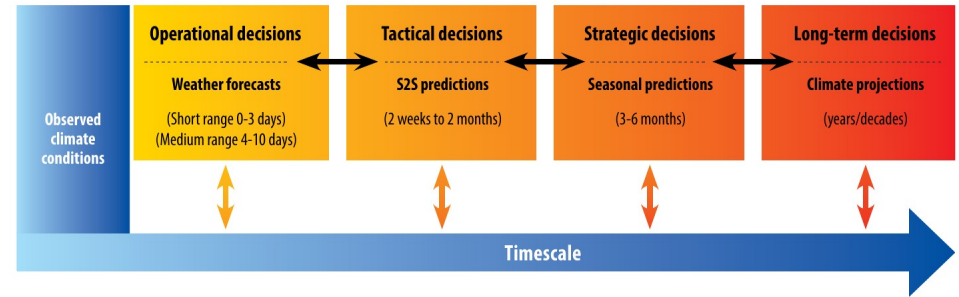
Source: Modified from ESCAP (2017).

Figure. Monthly forecasting at the intersection of predictability sources. Disaster risk management interventions across the continuum of climate information time scales. Figure extracted from the 2019 United Nations report (ST/ESCAP/2867).

How?

By relying on the **large database of the S2S prediction project** i.e. 7 years of intra-seasonal forecasts and 25 years of replay of past forecasts with improved model versions.

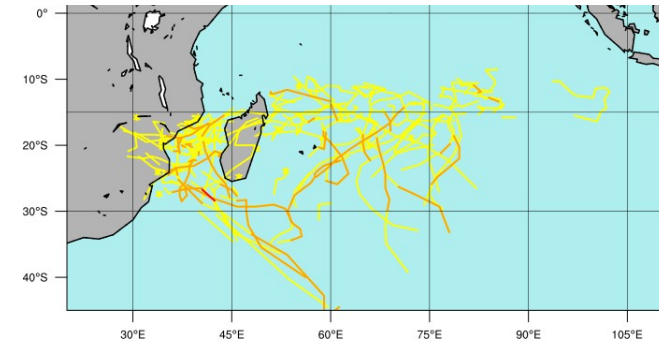**Focus on the ECMWF dataset** (atmospheric parameters + TC tracks)

Figure. Set of potential trajectories (forecast 2 weeks in advance) for the week of 18 January 2021 during which cyclone ELOISE was observed. In orange, systems that have reached the tropical cyclone stage in the forecast. Data : ECMWF Source: DIROI/EC team.

Evaluation of the S2S TC tracks prediction

Challenge: to develop a methodology for evaluating S2S data. How to compare 50 possible scenarios to 1 observation? How to evaluate good predictions and false alarms for TC forecasting?

Our 1st approach: Classifying the observed and predicted trajectories to better compare them

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
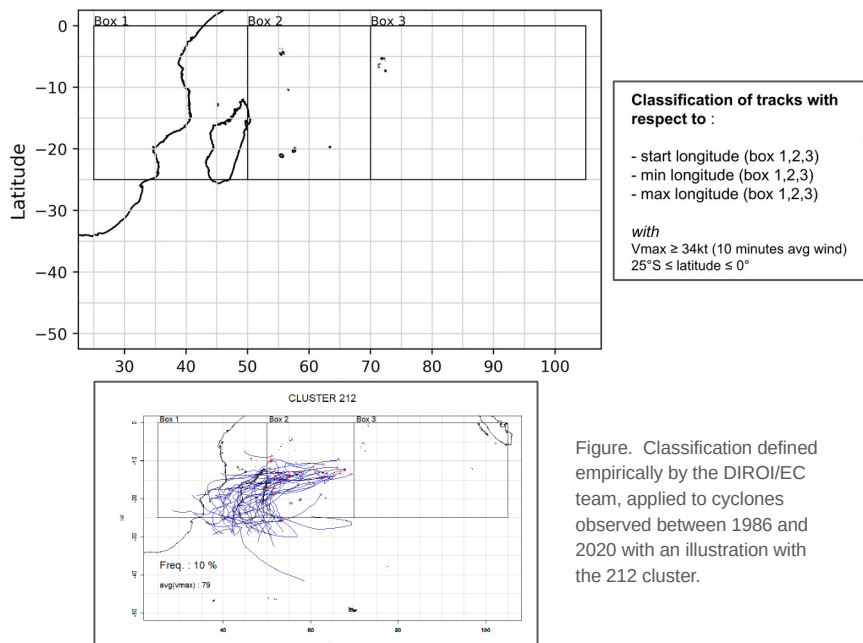Vmax ≥ 34kt (10 minutes avg wind)
25°S ≤ latitude ≤ 0°

Figure. Classification defined empirically by the DIROI/EC team, applied to cyclones observed between 1986 and 2020 with an illustration with the 212 cluster.
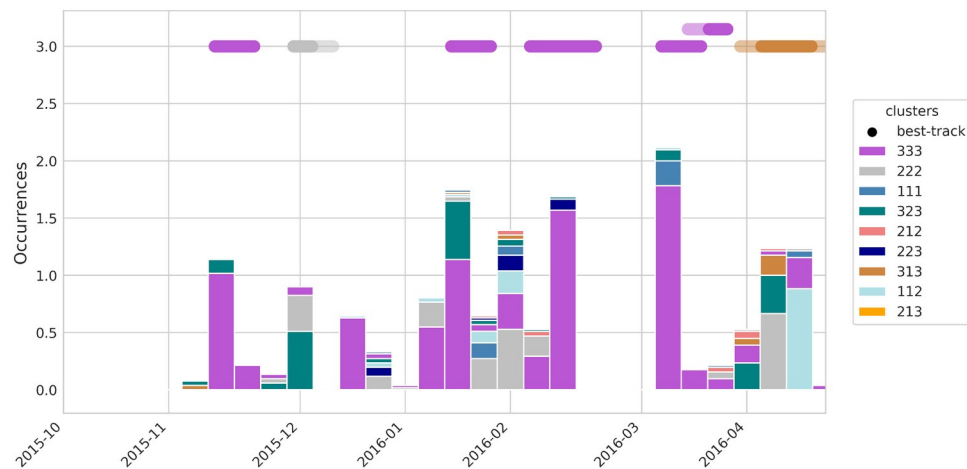

Figure. Application of the classification to the S2S TC tracks for W0 real-time forecasts (vertical bars) compared to the observations (top coloured dots) during the 2015-2016 season with a preliminary pre-processing of the data. Pre-processing of the data is still a work in progress.

Outlook: calculate prediction scores to provide information on the uncertainty associated with the S2S forecast

Experimental activity of monthly briefing for the SWIO with forecasters

Experimentation of a monthly and regional scale forecasting methodology launched in 2018 for the SWIO with a working group (ENM, CNRM and DIROI) based in Reunion Island in the form of monthly briefings

Methodology involves human expertise and the physical concepts of intra-seasonal drivers

PISSARO: **identification of sets of figures for the analysis of the forecast of cyclonic activity and weather patterns in the SWIO.**
Which use? The human expertise of a qualified user will allow to extract the relevant information and to nuance the forecasts from the numerical models to propose an informed forecast of the cyclonic activity and weather patterns for the next 4 weeks.
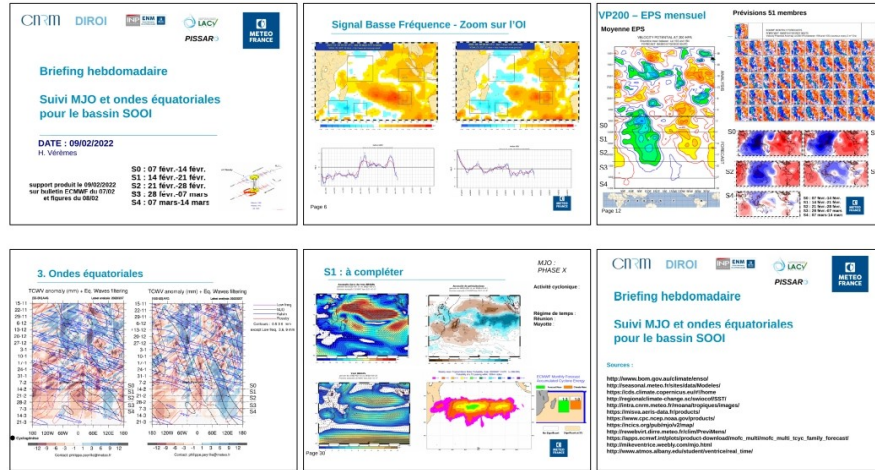
Experimental monthly forecast briefing support (25 – 30 pages) [PRODUCT N°1]
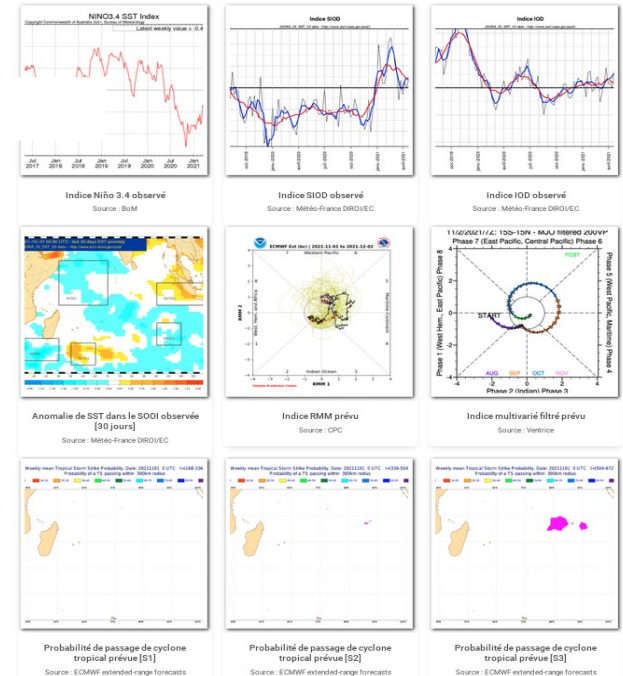
Web page for quick analysis [PRODUCT N°2]

Tropical cyclone occurrence risk products for humanitarian users

Cartographic product for the evaluation of the risk of occurrence of storm or cyclone based on monthly ECMWF forecasts

Example

Definition of the levels:
Thresholds on the probability of max winds for each zone and **adapted according to the forecast timeframe**.

Calibration of the thresholds:
Criteria applied on uncertainty, probability of good detection and false alarm rate

Level of probability of risk occurrence:
3 colors (yellow to red). Definition = **work in progress (based on the following messages : Be aware / Be prepared / Take actions)**

The product [n°3] will be tested by the users during the 2022-2023 cyclonic season.

Tropical Cyclone Risk assessment
based on ECMWF monthly extended forecast

Week 2 starting 2022-01-31 ending 2022-02-07
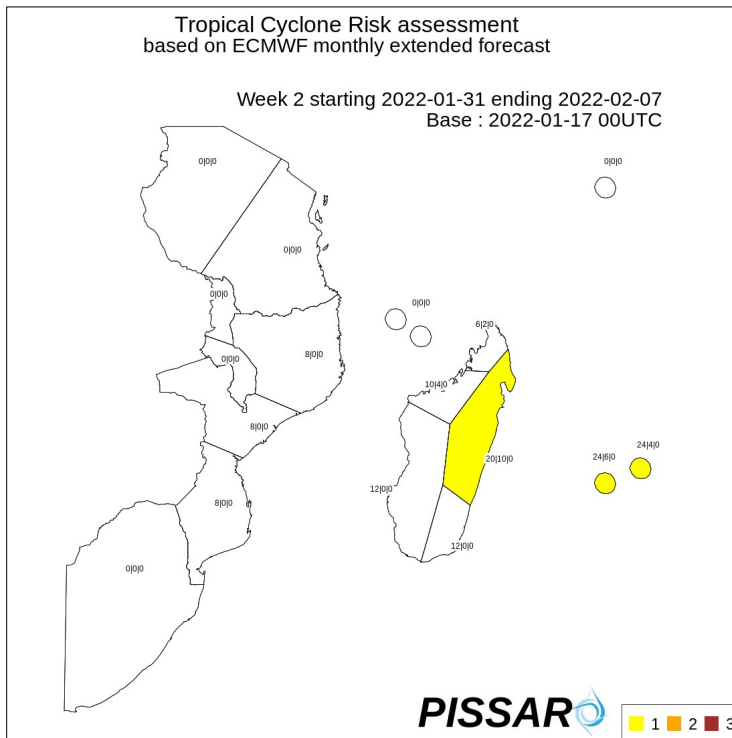Base : 2022-01-17 00UTC

Figure. Forecast map made on January 17, 2022 for the week of January 31 to February 7, 2022 (two weeks ahead). The 3 areas "lit" in yellow mean that a risk of tropical storm or cyclone occurrence is possible for these particular areas, so be informed. These are the 3 areas that were most exposed to tropical cyclone BATSIRAI.

Figure. Tropical cyclone BATSIRAI trajectory. Source: Météo-France
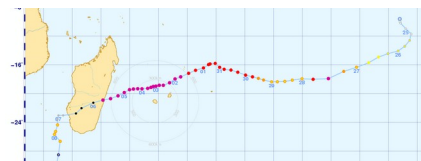
Outlooks

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Evaluation

- TC tracks: new clustering + scores of prediction

Product development

- Adaptation of the monthly briefing and synthesis compilation for Seychelles
- Tropical cyclone experimental test with PIROI for the next cyclonic season
- ITCZ automatic detection product development [work in progress]
- Heavy rainfall occurrence risks product development [work in progress]

Valorisation

- Identification of new potential users
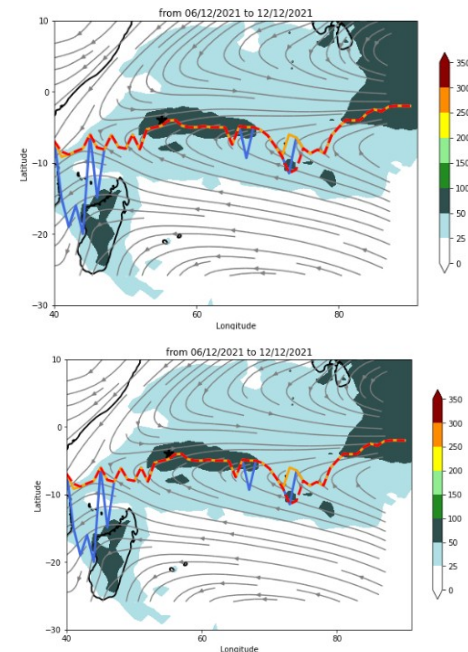- Summer School in Seychelles in 2023

Figure. Diagnosis of the ITCZ applied to the average of the 50 members of the ECMWF ensemble forecast (run of 15/11/2021). Courtesy of Andréa Cachard.

Thank you for your attention!

Follow the news and scientific results of the PISSARO project on the website pissaro.re !!!

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