Introducing ACACIA - Anticipatory Climate Adaptation for Communities in Africa

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ECMWF

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NORCE

ACACIA

Enhancing Sub-Seasonal Early Warnings in Ethiopia and Madagascar

ACACIA (2024 – 2028) aims to improve the accuracy, accessibility, and impact of sub-seasonal early warnings in **Ethiopia** and **Madagascar,** focusing on **extreme rainfall and flooding** (Ethiopia) and **tropical cyclones** (Madagascar).

ECMWF's key contributions to ACACIA include:

(1) Advancing understanding of **sub-seasonal drivers** of high-impact weather.
(2) Developing an **operational framework** to provide national meteorological agencies and the East African regional climate centre (ICPAC) with state-of-the-art sub-seasonal forecasts.
(3) Supporting the **co-production of actionable advisories** for local decision-making.

As part of this EU Horizon-funded initiative, ECMWF plays a crucial role in strengthening early warning capabilities and collaborating with European and African researchers (NCAS, NORCE, ICPAC, and CMI), East African forecast producers (Météo Madagascar, EMI, and ICPAC), and humanitarian organizations (Red Cross).
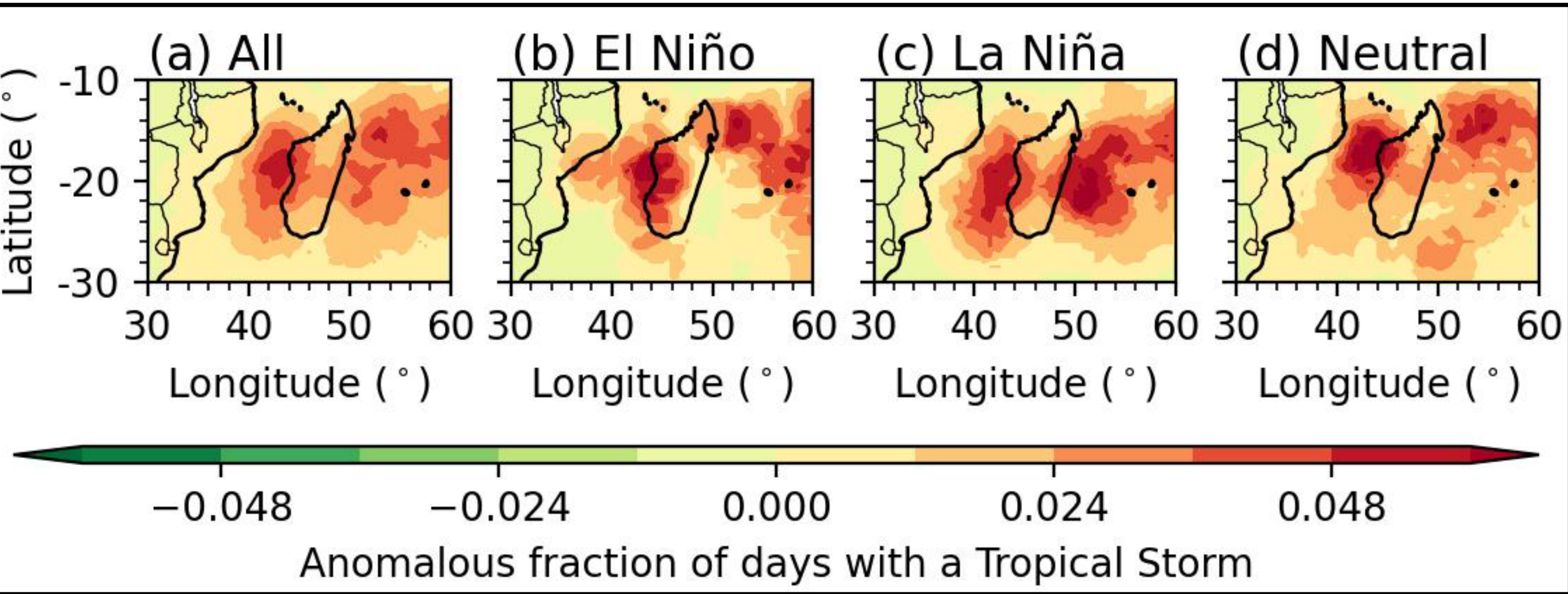

Figure 1: Schematic illustrating ACACIA's work package (WP) structure. ECMWF is leading WP3.

Figure 2: Anomalous fraction of days with a **Tropical Storm** (> 17 m s⁻¹). Composites based on **IBTrACS** (International Best Track Archive for Climate Stewardship) within January to March 1980 to 2024. Panels show composites of active MJO days (> 1.0) in phases 2 and 3 under (a) all conditions, (b) El Niño (> 0.5°C), (c) La Niña (< -0.5°C), and (d) neutral ENSO (anomalous NINO3.4).
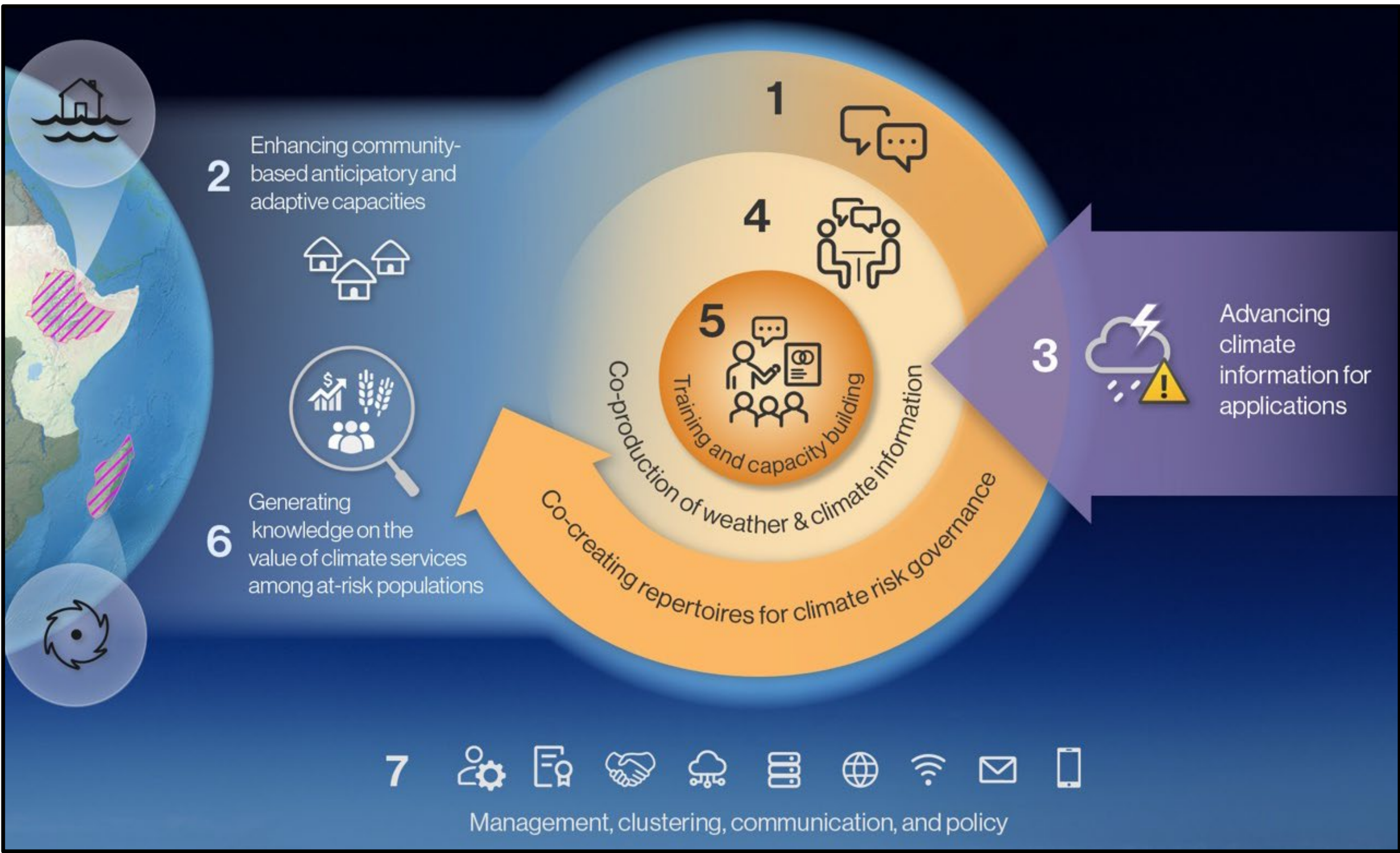
Advancing knowledge of forecast drivers

Initial research examines how **compound environmental drivers** influence **Tropical Storm** (TS) frequency in the **South-West Indian Ocean** (SWIO; Figure 2).

Figure 2a shows **increased TS frequency** when the **Madden-Julian Oscillation (MJO)** is **active in phases 2 and 3**, but this modulation depends on equatorial Pacific sea surface temperatures (SSTs; figures 2b to 2d). Notably, anomalous TS frequency southeast of Madagascar occurs only El Niño and neutral SST conditions.

Currently our analysis has been limited to the **IBTrACS** dataset. We plan to extend this analysis to TSs tracked in **ERA5** and **ECMWF sub-seasonal forecasts/reforecasts** while also investigating the influence of **Indian Ocean SSTs**, the **Mascarene High**, and the **Southern Annular Mode**.

Following this analysis, we will compare TS frequency predictions based on forecasted large-scale drivers to those from operational forecasts.
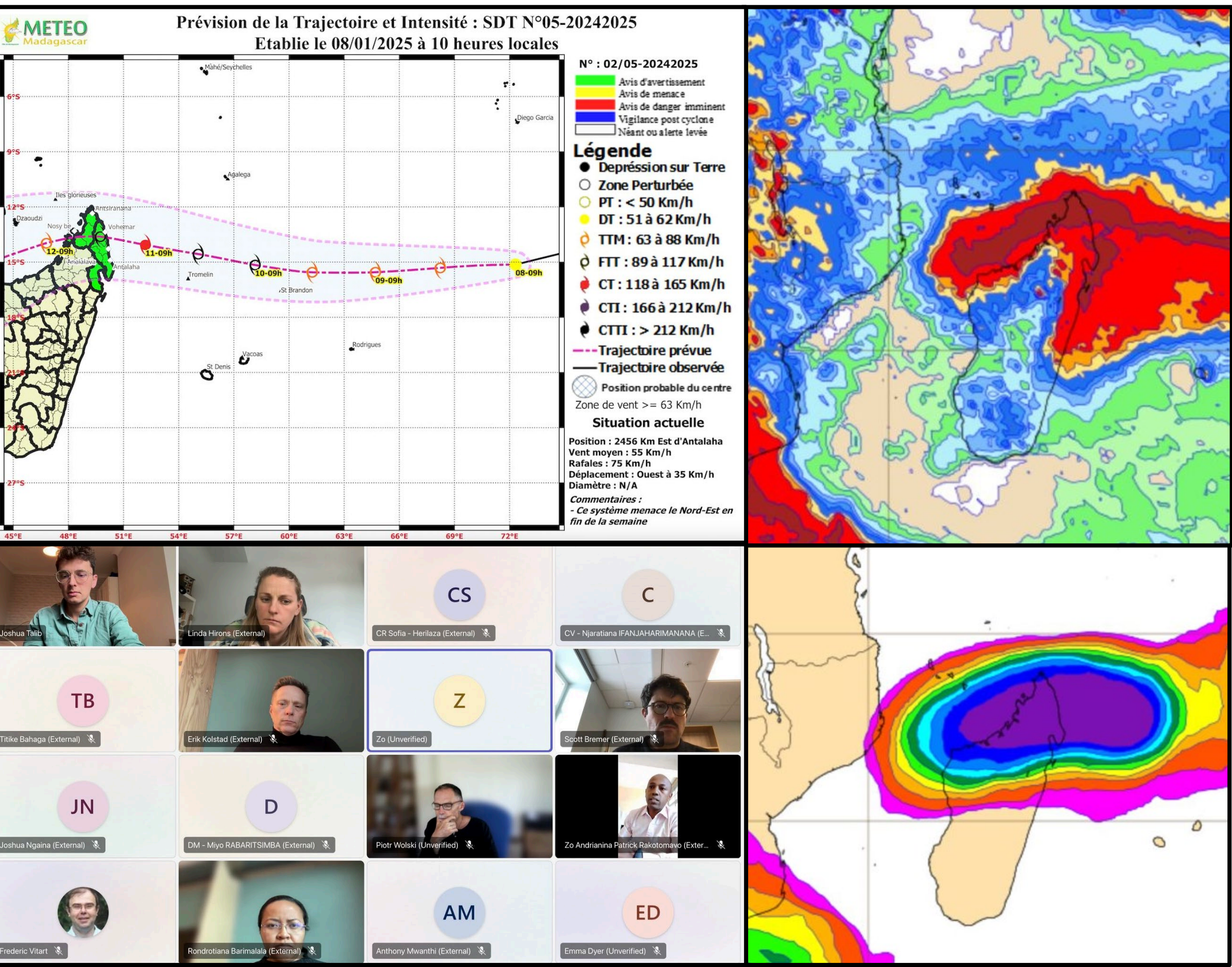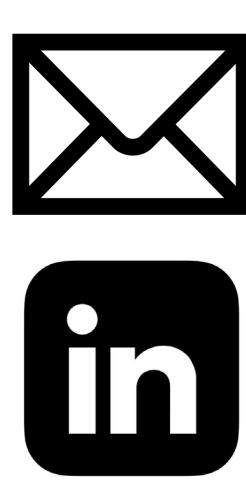
Real-time operational testbeds

ACACIA partners engage in **weekly discussions** on sub-seasonal forecasts of high-impact weather during key seasons (Madagascar: JFM; Ethiopia: JJAS).

During the recent tropical cyclone season, ACACIA evaluated:

- Current forecasting procedures for tropical cyclone warnings in the Southwest Indian Ocean, with a focus on Madagascar.
- How national and district-level humanitarian organizations interpret such forecasts.
- Learning needs for effective use of ACACIA-developed sub-seasonal advisories.

Figure 3 shows a recent online discussion focusing on forecasts of Tropical Cyclone Dikeledi. These operational testbeds will serve as a forum to co-develop effective and actionable sub-seasonal early warnings.

Figure 3: Screenshots from an online testbed discussion ahead of **Tropical Cyclone Dikeledi**. Forecasts, all issued on 8th January 2025, shown include: (top left) MeteoMadagascar tropical cyclone bulletin; (top right) five-day accumulated precipitation; and (bottom right) tropical cyclone strike probability valid for January 13, 2025.

Find out more on our website or get in touch:

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ACACIA Horizon Europe project