

Environmental conditions association with genesis of cyclone "Biparjoy"

Nagalakshmi Katru^{1*}, Sujata K. Mandke¹, Susmitha Joseph¹

¹Indian Institute of Tropical Meteorology, Ministry of Earth Sciences, Pune 411008, India

1. Introduction

The aim of this study is to examine the environmental conditions associated with the formation of Extremely Severe Cyclonic Storm (ESCS) Biparjoy, which developed over the Arabian Sea in June 2023. Cyclone formation is influenced by several key factors, including sea surface temperature (SST), relative vorticity, vertical wind shear, and atmospheric moisture. By analyzing these parameters before the storm's formation, we aim to understand the favorable environmental conditions that contributed to the genesis of "Biparjoy".

2. Data and Methodology

This study uses NCEP/NCAR reanalysis data (Kalnay et al., 1996) with a $2.5^\circ \times 2.5^\circ$ resolution from 1990 to 2020 to analyze key atmospheric and oceanic parameters: Sea Surface Temperature (SST), zonal wind anomalies at 850 hPa, and vorticity computed from u, v wind data. Additionally, Relative Humidity (RH) at 600 hPa is obtained from ERA5 (Hersbach et al., 2020) with a $0.25^\circ \times 0.25^\circ$ resolution. Spatial maps were plotted to visualize the conditions leading to the formation of ESCS "Biparjoy". The analysis was carried out using GrADS and CDO software.

3. Results

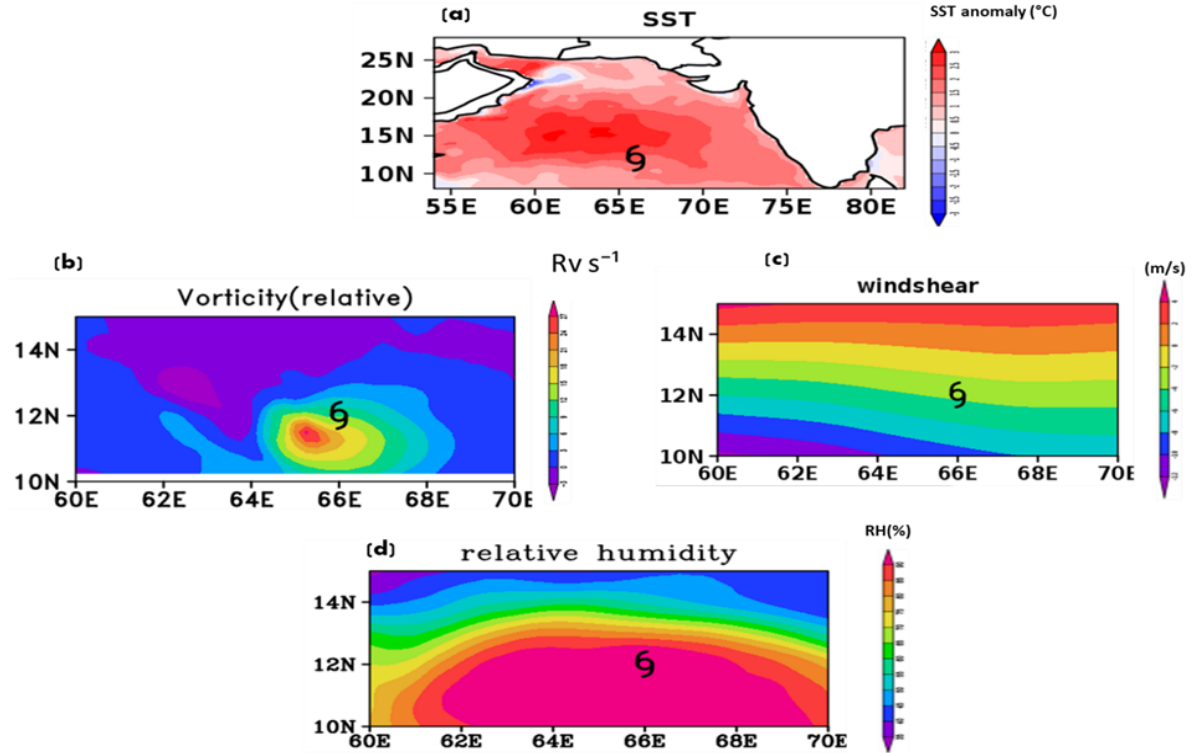


Figure 1: June 1-5, 2023 (a) SST anomalies (°C) (b) Vorticity (s⁻¹) (c) Vertical Shear of the zonal wind (m/s) (200-850 hPa), (d) Relative Humidity (RH) (%) at 600 hPa, over the Arabian Sea.

The formation of “Biparjoy” was influenced by several key environmental factors. Sea Surface Temperatures (SST) in the region were higher, providing the necessary heat for cyclone development. Positive relative vorticity was present, indicating cyclonic rotation, which helped in the formation of a low-pressure system. Low vertical wind shear allowed for a well-structured storm. The easterly winds at 850 hPa promoted air convergence and cyclonic circulation. Finally, high relative humidity at 600 hPa ensured sufficient moisture for convection, fueling storm intensification.

As shown above in Figure 1, the conditions leading to the formation of ESCS “Biparjoy” are visualized.

Conclusions

Favorable environmental conditions, including warm SSTs, positive vorticity, low wind shear, easterlies at 850 hPa, and high humidity, were key factors in the formation of Cyclone Biparjoy. These conditions highlight the importance of monitoring these variables for improved cyclone forecasting and early warning.

References

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