WEATHER PATTERNS CLASSIFICATION ASSOCIATED WITH EXTREME WAVES IN THE CAMPOS AND SANTOS BASINS

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INTRODUCTION

- K-Means clustering method, originally proposed by MacQueen (1967) and later refined by Hartigan & Wong (1979), has become instrumental in investigating atmospheric circulation patterns.
- We are investigating the Weather Patterns associated with Extreme Wave events in two regions of high economic importance for oil production in Brazil.

METHODS
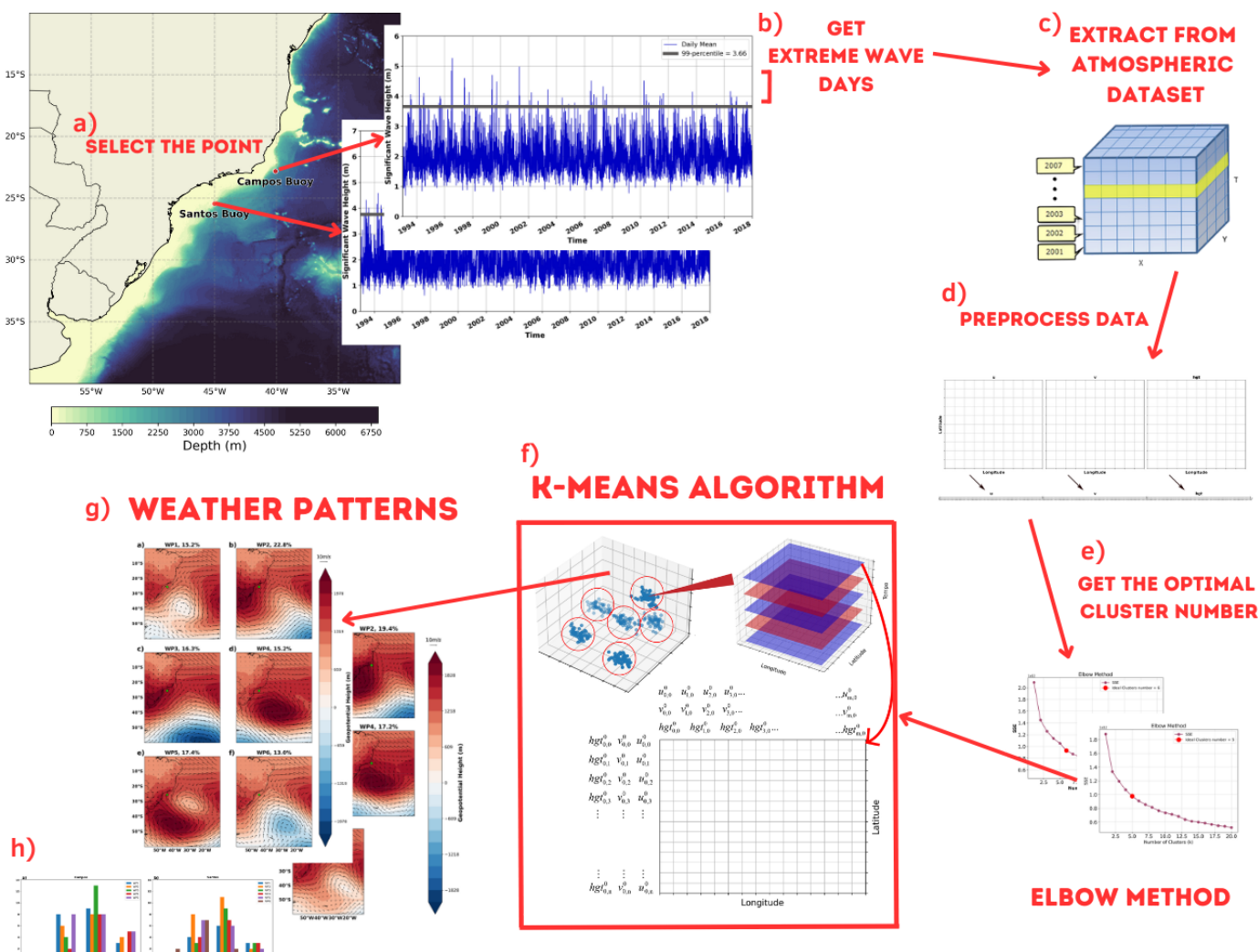
THE DATASET

- **Wave Data:** Significant Wave Height and Peak Direction from WAVERYS
- **Atmospheric Data:** Meridional (v) and Zonal (u) components of Wind and Geopotencial Height (hgt) at 1000 hPa from ERA5 Reanalysis

HOW THE ALGORITHM WORKS

- Input
  - Select desired percentile.
  - Choose a point of interest within specified region (a)
- Data Retrieval
  - Fetch time series of Significant Wave Height.
  - Highlight days exceeding input percentile (b)
- Atmospheric Data Extraction
  - Utilize highlighted days for data extraction (c)
- Preprocess Data
  - Ravel and concatenate u, v, and hgt data (d)
- Cluster Analysis
  - Determine ideal number of clusters using the Elbow Method (e)
- K-Means Deployment (f)
  - Identify weather patterns linked with wave extremes (g) and obtain their frequency distribution (h)
- Get Days associated with each cluster:
  - Averages of days preceding the Weather Pattern (WP) (24 hour and 48 hour before) (see in Results)

RESULTS
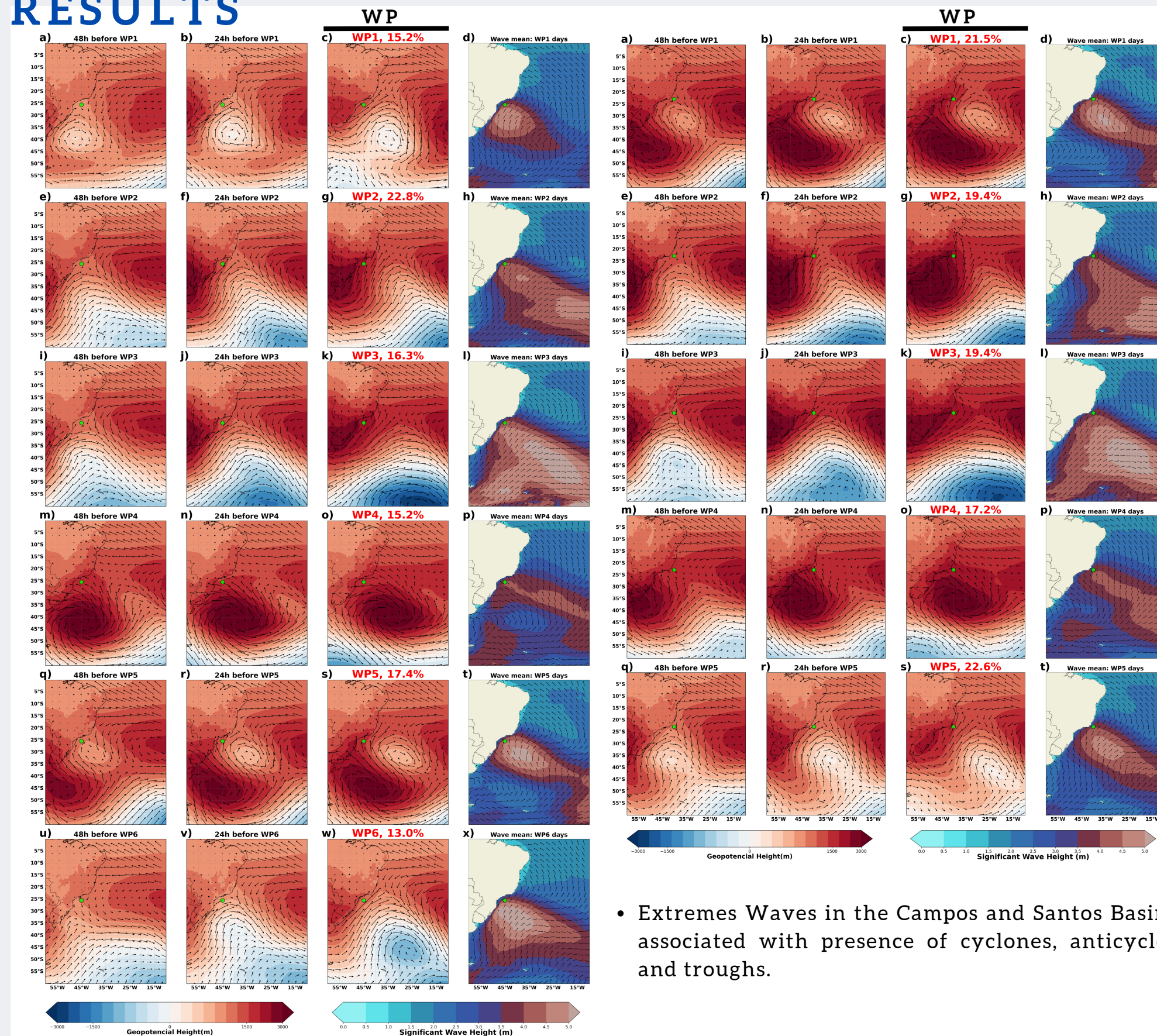
- Several authors, including Sondermann et al. (2023), identified Weather Patterns (WPs) similar to those observed in this study for Campos and Santos.

- Gramcianinov et al.(2020) highlighted that the horizontal pressure gradient amplifies surface wind speed, intensifying fetchs near cyclone regions. The movement speed of the cyclone influences the fetch's position, affecting wave generation.

- The findings are consistent with Pianca et al. (2010), where extremes are not detected in the summer (DJF) and the highest energy is associated with the austral winter (JJA).
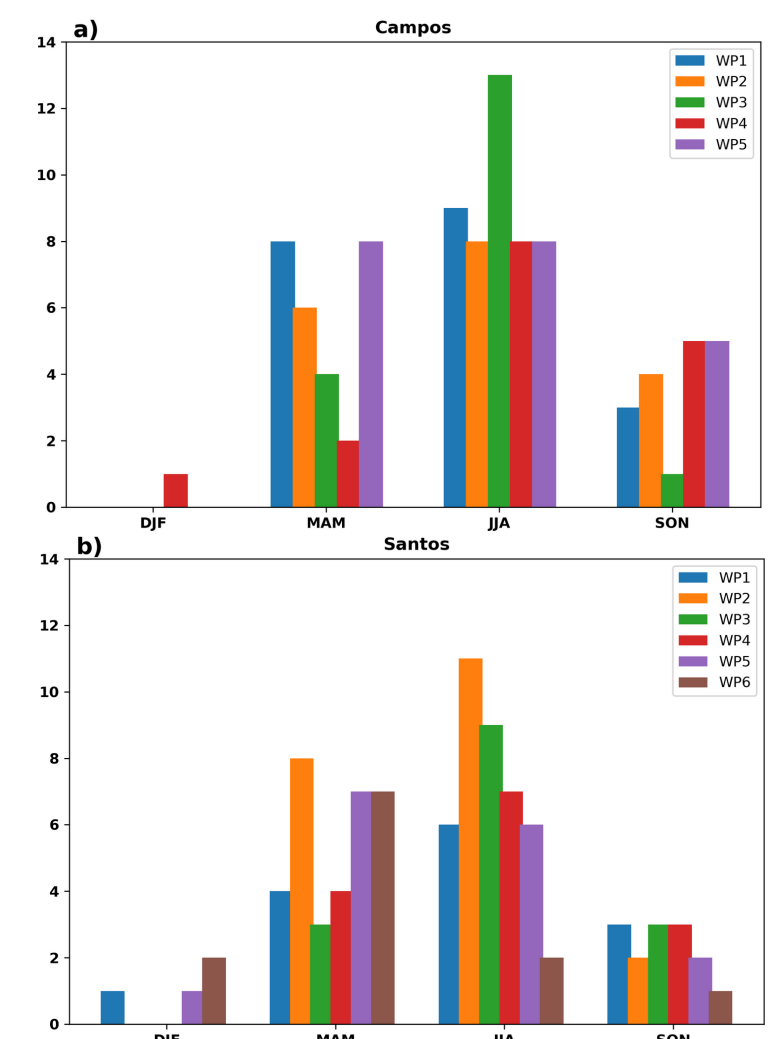
- Extremes Waves in the Campos and Santos Basin are associated with presence of cyclones, anticyclones, and troughs.

ACKNOWLEDGEMENTS

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