

ABSTRAK

ANALISIS VARIABILITAS SUHU PERMUKAAN LAUT DI PERAIRAN INDONESIA PERIODE 1974-2023 MENGGUNAKAN METODE *EMPIRICAL ORTHOGONAL FUNCTION* (EOF)

Oleh

FITRIA TRI ANGGRAINI

Perubahan iklim global yang dipicu oleh peningkatan emisi gas rumah kaca telah menyebabkan kenaikan suhu rata-rata permukaan laut (SPL), termasuk di wilayah perairan Indonesia. Fenomena iklim seperti *El Nino Southern Oscillation* (ENSO) dan *Indian Ocean Dipole* (IOD) secara signifikan memengaruhi variabilitas SPL di wilayah ini. Penelitian ini bertujuan untuk menganalisis pola sebaran serta variabilitas SPL di perairan Indonesia selama periode 1974–2023 dengan menggunakan metode *Empirical Orthogonal Function* (EOF). Metode EOF diterapkan untuk mengekstraksi pola utama dari dataset SPL yang menghasilkan informasi mengenai variabilitas spasial dan perubahan yang dipengaruhi oleh faktor oseanografi. Data yang digunakan mencakup suhu permukaan laut, indeks ENSO dan indeks IOD. Hasil analisis menunjukkan bahwa SPL di wilayah Indonesia mengalami tren peningkatan selama lima dekade terakhir dengan variasi pola sebaran yang berbeda secara regional. Perairan Natuna menunjukkan SPL yang relatif lebih rendah, yang dipengaruhi oleh interaksi monsun dan arus dari Laut Cina Selatan. Sebaliknya, peningkatan SPL yang signifikan terjadi di Laut Jawa, perairan selatan Jawa, Laut Flores, dan Laut Sawu, yang dipengaruhi oleh kombinasi IOD, Arus Lintas Indonesia (Arlindo), dan monsun barat. Analisis EOF mengidentifikasi enam *mode* utama variabilitas SPL, dengan *mode* EOF1 memiliki 62,49% varians yang didominasi oleh pengaruh IOD, monsun, serta ENSO, sedangkan *mode* EOF2 memiliki 22,74% varians yang didominasi oleh ENSO dan IOD. *Mode-mode* selanjutnya merepresentasikan pengaruh fenomena seperti *Madden Julian Oscillation* (MJO), arus laut, dan proses *upwelling*. Secara keseluruhan, distribusi dan variabilitas SPL di perairan Indonesia dipengaruhi oleh interaksi kompleks antara fenomena iklim global seperti ENSO dan IOD, serta faktor regional seperti monsun, Arlindo, dan pemanasan global. Dominasi ENSO dan IOD dalam mengatur variabilitas SPL ditunjukkan oleh kontribusi varians tertinggi pada *mode-mode* EOF utama.

Kata kunci: EOF, Indonesia, Iklim, Suhu Permukaan Laut, Variabilitas

ABSTRACT

EMPIRICAL ORTHOGONAL FUNCTION (EOF) ANALYSIS OF SEA SURFACE TEMPERATURE VARIABILITY IN INDONESIA WATERS (1974-2023)

By

FITRIA TRI ANGGRAINI

Global climate change driven by increased greenhouse gas emissions has caused a rise in the average sea surface temperature (SST), including in Indonesian waters. Climatic phenomena such as the *El Nino Southern Oscillation* (ENSO) and the *Indian Ocean Dipole* (IOD) significantly influence SST variability in this region. This study aimed to analyze the distribution patterns and variability of SST in Indonesian waters during the period 1974–2023 by employing the *Empirical Orthogonal Function* (EOF) method. The EOF method is applied to extract dominant patterns from the SST dataset, providing insights into spatial variability and changes influenced by oceanographic factors. The data utilized include sea surface temperature records alongside ENSO and IOD indices. The analysis reveals that SST in Indonesian waters has exhibited an increasing trend over the past five decades, with regional variations in spatial distribution. The Natuna Sea shows relatively lower SST, which is attributed to the interaction between monsoonal winds and currents from the South China Sea. Conversely, significant SST increases occur in the Java Sea, southern Java waters, Flores Sea, and Sawu Sea, driven by the combined influences of the IOD, the *Indonesian Throughflow* (Arlindo), and the westerly monsoon. EOF analysis identifies six principal modes of SST variability, with EOF1 accounting for 62.49% of the variance and dominated by IOD, monsoon, and ENSO influences, while EOF2 explains 22.74% of the variance and is primarily dominated by ENSO and IOD. Subsequent modes represent the impacts of phenomena such as the *Madden Julian Oscillation* (MJO), ocean currents, and *upwelling* processes. Overall, the distribution and variability of SST in Indonesian waters are governed by the complex interplay of global climate phenomena such as ENSO and IOD, alongside regional factors including monsoons, Arlindo, and global warming. The dominant roles of ENSO and IOD in regulating SST variability are evidenced by their substantial contributions to the leading EOF modes.

Keywords: Climate, EOF, Indonesia, Sea Surface Temperature, Variability