# ABSTRAK

## ANALISIS ARUS GEOSTROPIK BERDASARKAN KETINGGIAN MUKA LAUT DAN KAITANNYA DENGAN KEJADIAN *UPWELLING* DI PERAIRAN SAMUDRA HINDIA BAGIAN TIMUR

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Fenomena oseanografi di Samudra Hindia terjadi akibat interaksi antara atmosfer dan laut. Interaksi ini menyebabkan perubahan kondisi laut, salah satunya perbedaan tinggi muka laut. Perbedaan tinggi muka laut pada dua lokasi di lautan akan menghasilkan gradien tekanan. Arus laut akan bergerak dari tekanan tinggi ke tekanan rendah. Namun, karena pengaruh gaya coriolis, arah arus akan dibelokkan. Arus yang dihasilkan dari keseimbangan antara gradien tekanan dan gaya Coriolis disebut arus geostropik. Tujuan penelitian ini adalah untuk menganalisis arus geostropik yang dihasilkan dari perbedaan tinggi muka laut, menganalisis angkutan Ekman, dan mengidentifikasi hubungannya dengan fenomena *upwelling*, yang diverifikasi menggunakan distribusi suhu permukaan laut dan klorofil-a. Metode penelitian ini menggunakan perhitungan arah dan besarnya arus geostropik berdasarkan perbedaan tinggi muka laut. Arah dan besarnya arus geostropik kemudian dipakai untuk menghitung angkutan Ekman dan mengidentifikasi kejadian *upwelling*. Kejadian *upwelling* diverifikasi menggunakan distribusi suhu permukaan laut dan klorofil-a. Data yang digunakan dalam metodologi penelitian meliputi tinggi muka laut, suhu permukaan laut, dan klorofil-a antara periode 2016-2020. Hasil penelitian menunjukkan bahwa pola arus geostropik tidak berbeda secara signifikan antar tahun. Variabilitas terjadi pada besarnya dan intensitas *eddies* secara musiman. Secara umum, di laut lepas, arus geostropik membentuk pola lingkaran yang disebut *eddies*. Pola arus pada *eddies* bergerak searah jarum jam (siklonik) di zona konvergen dan bergerak berlawanan jarum jam (antisiklonik) di zona divergen. Di daerah pantai, arus geostropik cenderung bergerak ke arah barat di barat Sumatra dan timur di selatan Jawa. Angkutan Ekman cenderung bergerak 90° ke kanan arus geostropik. Oleh karena itu, angkutan Ekman bergerak menuju pantai di barat Sumatra dan menjauhi pantai di selatan Jawa. Kondisi ini menyebabkan *upwelling* hanya terjadi di selatan Jawa dan puncaknya pada musim timur, sehingga disebut *upwelling* musiman. Kejadian *upwelling* di laut lepas jarang terjadi karena angkutan Ekman di zona divergen tidak dapat membawa massa air akibat stratifikasi termoklin yang lebih dalam.



Kata kunci: Arus geostropik, angkutan Ekman, *upwelling*, Samudra Hindia

## ABSTRACT

## THE ANALYSIS OF GEOSTROPIC CURRENTS BASED ON SEA LEVEL AND ITS RELATION TO UPWELLING EVENTS IN THE EASTERN INDIAN OCEAN

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The phenomena oceanography of the Indian Ocean is affected by the interaction between the atmosphere and the ocean. This interaction causes changes in ocean conditions, one of which results in differences in sea level high. The different sea level high between two places in the ocean will cause a pressure gradient. The ocean current will move forward from high pressure to low pressure. Due to the influence of the coriolis force, the direction of the current will be deflected. The current resulting from the balance between the pressure gradient and coriolis force is called the geostrophic current. The aims of this research ware to analyze the geostrophic current resulting from the different of sea level height, analyze the Ekman transport, and identify its relation to upwelling phenomena, which are verified using sea surface temperature and chlorophyll-a distribution. The quantitative method used in this research, by calculating the direction and magnitude of the geostrophic current based on differences in sea level high. The direction and magnitude of the geostrophic current the used to calculate the Ekman's transport and identify upwelling events. The upwelling events verified by the distribution of sea surface temperature and chlorophyll-a. The data used in the research methodology include sea level high, sea surface temperature (SST), and chlorophyll-a between the period of 2016-2020. The results of this research showed that the pattern of the geostrophic current did not differ significantly between years. The variabilities occured in the magnitude and intensity of eddies. These variabilities occured seasonally. In general, at the open ocean, the geostrophic current formed a circular pattern called eddies. These circular patterns moved clockwise (cyclonic) in the convergence zone and moved anticlockwise (anticyclonic) in the divergence zone. In the coastal area, the geostrophic current tend to moved towards to the west in western Sumatra and east in southern Java. The Ekman transport tend to move $90^{o}$ to the right of the geostrophic current. Therefore, it will move towards the coast in western Sumatra and away from the coast in southern Java. This condition caused upwelling to only occured in southern Java and its peak only occured in the east monsoon, so it was called seasonal upwelling. The upwelling event in the open ocean rarely occured because the Ekman transport in the divergence zone was unable to receiver water mass due to the deeper thermocline stratification.



Key words: Geostrophic current, transport Ekman, upwelling, Indian Ocean