



Meteorological Drought and its Relationship with Southern Oscillation Index (SOI)

Donny Harisuseno ^{a*}

^a Water Resources Engineering Department, Faculty of Engineering, University of Brawijaya, MT. Haryono No.167, Malang, 65145, Indonesia.

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Abstract

Drought monitoring, including its severity, spatial, and duration is essential to enhance resilience towards drought, particularly for overcoming drought risk management and mitigation plan. The present study has an objective to examine the suitability of the Standardized Precipitation Index (SPI) and Percent of Normal Index (PN) on assessing drought event by analyzing their relationship with the Southern Oscillation Index (SOI). The monthly rainfall data over twenty years of the observation period were used as a basis for data input in the drought index calculation. The statistical association analyses, included the Pearson Correlation (r), Kendal tau (τ), and Spearman rho (r_s) used to assess the relationship between the monthly drought indexes and SOI. The present study confirmed that the SPI showed a more consistent and regular pattern relationship with SOI basis which was indicated by a moderately high determination coefficient (R^2) of 0.74 and the magnitude of r , τ , and r_s that were of 0.861, 0.736, and 0.896, respectively. Accordingly, the SPI showed better compatibility than the PN for estimating drought characteristics. The study also revealed that the SOI data could be used as a variable to determine the reliability of drought index results.

Keywords: Drought Index; Meteorological Drought; Percent of Normal Index; Southern Oscillation Index; Standardized Precipitation Index.

1. Introduction

In the recent decade, climate change phenomena have been a main issue in the worldwide since its impact on many sectors of economic and social, including water resources sector as the foundation of civilization – agriculture [1]. Information on drought phenomena along with its duration, severity, and areal extent must be well available to be used as a guide for water resource managers to support good planning and management in the water resource field, particularly in mitigation and adaptation planning [2, 3]. Quantitative analysis of drought monitoring commonly deals with an estimation of a drought index, which is normally derived from a comparison between magnitudes of rainfall with mean rainfall in a certain period. Some previous researches had been carried out to obtain drought overview temporally and spatially. Homdee et al. [4] applied the Standardized Precipitation Index (SPI) and the Standardized Evapotranspiration Index (SPEI) methods and confirmed that the SPEI method is more accurate. Harisuseno [5] demonstrated that the SPI showed good reliability in assessing drought characteristics when compared with the RAI, while [6] utilized TRMM satellite data and SPI for monitoring and developing the spatiotemporal map of meteorological drought. Zhang and Li [7] examined the implications of different probability functions and parameter estimation on the SPI index, including drought intensity, duration, and frequency. The Standardized Precipitation Index (SPI) is more frequently applied to drought analysis regarding owing effortless calculation since the method is recommended by the World Meteorological Organization [8, 9]. The application of the Percent of Normal Index (PN)

* Corresponding author: donnyhari@ub.ac.id

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