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Master of Science in Meteorology

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Performance of vegetation index-temperature-based drought indices in detecting agricultural drought in the Philippines

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ABSTRACT

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Agricultural drought is a natural hazard associated with lack of soil moisture content in crops resulting in crop production loss. In monitoring agricultural drought, the Normalized Difference Vegetation Index and Land Surface Temperature (NDVI-LST) triangular relationship is widely employed in deriving drought metrics. In this study, the performance of agricultural drought indices, particularly Vegetation Health Index (VHI), Standardized Vegetation Temperature Ratio (SVTR), and Temperature Vegetation Dryness Index (TVDI) are evaluated in detecting drought phenomenon in the Philippines. Official drought damage reports and crop yield data for rice and corn are used to assess the performance of the indices for each province. The results revealed the variability of each index in drought signal detection. Lowland and upland areas were discriminated by the indices, particularly in TVDI, wherein high frequency of drought events were recorded mostly in lowland areas. Based on the drought hazard index, 19% or 6 M ha of the total land area in the country was under high-hazard zones, which are mainly situated in agricultural production areas of rice and corn crops. More provinces with strong and significant relationship between indices and rice and corn yields were recorded during dry season, especially in SVTR and VHI. The results on correlation analysis also indicated that moisture conditions may have a lesser influence on crop yields during near-normal yielding years. From the ground validation, it revealed that 76% and 71% of the provinces showed high accuracy ($\geq 50\%$) for rice and corn drought detection, respectively. While, 83% and 98% of the provinces recorded higher hit rates than miss rates for rice and corn, accordingly. The performance of NDVI-LST indices showed differences in response of each index for every assessment, which signifies the importance of utilizing multiple indices in investigating and evaluating drought phenomena on a wider perspective.

Keywords: Agricultural Drought Monitoring, Normalized Difference Vegetation Index, Land Surface Temperature