ABSTRACT

Several studies have been conducted in the Philippines regarding drought but most of them focused on how to quantify drought in terms of its three dimensions, namely: severity/intensity, duration, and areal extent. Some focused to monitoring and forecasting the said phenomenon but no attempt has been made to determine which region of the Philippines are sensitive to drought. Hence, there is a lack of information as to which region of the Philippines are sensitive to drought.

This study aimed to assess long-term (annual), intermediate-term (monthly) and short-term (8-day) drought sensitivity in the Philippines using remotely sensed actual evapotranspiration.

Precipitation data from Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) which spans from 2003-2017 were used to select those pixels to be used for drought sensitivity assessment. A certain pixel will be selected if it satisfies the criterion $P_{i+1} - P_i \leq 0$ where P stands for the precipitation data on that pixel at time i and i + 1.

The change detection technique which utilizes the relative evapotranspiration, ET_R [102], which was calculated from MODIS annual, monthly and 8-day 1km evapotranspiration, were then applied to each selected pixel. The whole Philippines was then divided into two distinct classes, drought sensitive and those that are not depending on their responses to changing water availability relative to other regions in the change detection process.

Results showed that 54.12%, 52.49%, and 50.66% of the Philippine area satisfied the condition $P_i - P_{i+1} \leq 0$ for 8-day, monthly, and annual timescales, respectively (Table 5). Out of these percentages, 12.29%, 93.92%, and 92.94% in 8-day, monthly and annual timescales, respectively (Figure 3), are shown to exhibit increasing relative evapotranspiration as their response to decreasing precipitation in the change detection process. Furthermore, this behavior of those certain pixels is detected to last for at least three consecutive months. These regions of the Philippines include the provinces of Isabela, Nueva Ecija, Pampanga, Tarlac, Bulacan, and small portions of Zambales for the Luzon part. In the Visayas area, this study identified the Negros Island, Masbate, and Ormoc, and some parts of Iloilo and Cebu as drought-sensitive regions. This study also detected the southwestern parts of Mindanao and some portions of eastern

Mindanao to be sensitive to drought. These results agree to the results of Perez, et. al., [72]. All these regions were also identified by PAGASA as vulnerable to El Niño events.

The sensitivity of these identified regions was verified further by calculating the change in soil moisture using the formula $\Delta SM = P - ET$ [5]. Results showed that out of 12.29% of the total land area which was detected as drought sensitive in the 8-day timescale, 71.54% of it (Fig. 8a) was also detected to have a continuous decreasing trend in soil moisture content for at least three consecutive months verifying further that those regions were drought sensitive. In the case of the monthly timescale, out of that 93.92% of the total land area which were detected as drought sensitive, 97.94% also showed a continuous decreasing trend in soil moisture content for at least three consecutive months (Fig. 8b) verifying as well that those regions were drought sensitive. On the other hand, in the case of annual timescale, out of that 92.94% of the total land area which were detected as drought sensitive, only 9.75% of it showed a continuous decreasing trend in soil moisture content (Fig. 8c). Upon further investigation, it was found out that there were pixels showing positive net soil moisture in the annual timescale but exhibits a deficit in soil moisture content in three or more consecutive months in the monthly timescale (Figure 9).