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SOIL MOISTURE RESPONSE TO CONVECTIVE RAINFALL

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The climate of Sri Lanka is tropical monsoonal with a marked seasonal rhythm in rainfall. This rhythm is also reflected in the soil moisture because rainfall influences the soil water content. Soil moisture is known to play an important role in our environment and is thus considered an important climatic variable. Therefore, determining the relationship between soil moisture and rainfall are needed to characterize the climate variability. The usual practice is to use long term measurements of rainfall and soil moisture content to derive rainfall-soil moisture relationships. However, results obtained from long-term can obscure the short term behavior of a soil. High temporal resolution rainfall and soil moisture data from first inter monsoon season are used to investigate the response of soil moisture to individual rainfall events.

High temporal resolution data are collected at the weather station of the Department of Geography. The moisture sensor is buried at 30 cm depth to capture the soil moisture in the effective root zone. The soil moisture variations during rainfall were investigated for April 2015. The study focuses on the response of soil moisture to individual rainfall events of different magnitudes and durations. There were 20 major rainfall events during the study period. An individual rainfall event and its corresponding moisture curves were observed. About 45% of rainfall events in April lasted for less than 30 minutes while 30% of the showers lasted for over an hour. In many cases, the peak rainfall occurred about 15 minutes after the beginning of a shower. High rainfall amounts usually triggered a peak in the soil moisture curve. The maximum observed soil moisture level was about 47%. Two types of soil moisture peaks were identified in the time series: sharp-pointed peaks and flat topped-peaks. The latter condition occurred during very long rainfall and/or large rainfall magnitudes. The soil moisture level at the beginning of the month of April was about 2.8%, but thereafter it did not fall below 6% during the rest of the month. This increase in minimum soil moisture level is most likely due to the cumulative effect of rainfall. Although approximately 35% of the showers had total rainfalls of less than 10 mm, the remainder of showers had higher rainfall amounts. These episodes were responsible for maintaining higher soil moisture levels and even driving the soil moisture to the saturation level.

This study reveals that a small rainfall amount with a long duration or large rainfall amount with short duration can lead to soil water saturation. Most of the rainfall events were short (< 2 hours) and a majority of them (60%) occurred in the afternoon suggesting convective rainfall. The study reveals that approximately 15 mm of total rainfall is necessary to get soil moisture to saturation. This implies that rainfall duration is a critical factor in driving the soil moisture to saturation. It is apparent that rainfall duration of less than 30 minutes does not lead soil moisture to saturation. Frequent intermittent rainfall events during the month of April contributed to the overall increase in the soil moisture level compared to the previous month. This elevation in the soil moisture level could also have a significant impact on plants.

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