USE OF DOWNSCALED TROPICAL RAINFALL MEASURING MISSION DATA FOR METEOROLOGICAL DROUGHT MONITORING: CASE STUDY OF NARUMORU CATCHMENT

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ABSTRACT

Remotely sensed satellite rainfall data has gained popularity in the recent past, been especially attractive to ungauged catchments or poorly gauged catchments. Tropical Rainfall Measuring Mission (TRMM) data is considered to be most accurate of the satellite derived rainfall data and with the best spatial resolution at 250 x 250 grid. For purposes of hydrological modelling in small catchments, this data is usually downscaled to 1km x 1km grid to bring it closer to point measurement rain gauge data. This study evaluates whether downscaling of TRMM improves its meteorological drought monitoring capacity. TRMM was downscaled from the original 250 x 250 resolution (Approximately 28km x28km) to 1km x 1km resolution based on the relationship between Normalised Difference Vegetation Index (NDVI) and precipitation. Standardized Precipitation Index (SPI) was computed at 3, 6, 9, 12, and 24 month aggregation periods using the downscaled TRMM data (TRMM1km), TRMM at original resolution (TRMM28km) and observed rain gauge data. Analysis of Variance (ANOVA), t-test and data visualization methods were used to determine the similarity of the SPIs from the three datasets. Similarly, correlation analysis was done to determine dependency and modelling capability of the datasets.TRMM1km derived SPI was found to have lower correlation with the (correlation coefficients ranging from 0.34 to 0.42 for the different aggregation periods) rain gauge derived SPI as compared to TRMM28km derived SPI which had correlation coefficients ranging from 0.57 to 0.66. From analysis of variance, there was no significant difference between the SPI computed from TRMM and from that computed from rain gauge data. Additionally SPI visualization indicated similar drought patterns were identified by both TRMM and rain gauge computed SPIs. Therefore it was concluded that TRMM data, whether downscaled or at original resolution are useful for meteorological drought monitoring in Narumoro catchment.

KEYWORDS – *TRMM, Artificial Neural Networks, Meteorological droughts, remote sensing*

I. INTRODUCTION

Droughts affects more people on earth than any other natural disaster [1]. Droughts are defined as deficit below what is normal in surface water, groundwater, precipitation among others components of the water cycle resulting into hydrological, groundwater and meteorological droughts respectively [2]. Droughts in the meteorological and / or in hydrological sense ultimately results into some economic and / or social loss resulting into social-economic drought. Due to their huge impact on the society, droughts are constantly monitored using various indices including SPI (Standardized Precipitation Index), Palmers Drought Severity Index (PDSI) [3] just to mention a few. To effectively monitor droughts, reliable precipitation records in adequate temporal spatial resolutions are required. In most developing countries, a network of rain gauges that will provide the required coverage is largely missing or inadequate. Remotely sensed rainfall data can provide the required spatial and temporal coverage but