Characterizing Spatial Patterns and Climatology Trends using Monthly Rainfall Rates in Manila, Philippines

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Introduction

The onset of the Asian Summer Monsoon during the typhoon season brings seasonal rainfall to the Philippines causing increased amounts of precipitation throughout the region. Since, Metropolitan Manila is an urbanized location within this region, it is important to monitor precipitation rates to assist in monitoring inland flooding occurrences within the region. In addition, urban metropolitan regions can create their own microclimates which lead to changes in cloud microphysical processes and subsequently precipitation rates to fluctuate within the study region.

Objective

The objective of the study is to determine spatial and temporal characteristics of precipitation rates within Metropolitan Manila, Philippines during the monsoon season.

Methods

84 images acquired from the 3B-43 Tropical Rainfall Measuring Mission (TRMM) from NASA, which provides a monthly best-estimate precipitation rate, were mapped from June to December associated with the onset of the WNPSM from 1998 to 2010 on a 1984 WGS datum. The study matrix comprised of a 3 X 3 matrix at a spatial resolution of 0.25° by 0.25 with a rectangular boundary of 15°N, 14.25°N, 120.5 °E, 121.25°E. With the use of GIS and statistical analysis, variations in monthly precipitation rates were analyzed to depict significant changes in climatology and spatial trends. Data was compared on a monthly and seasonal variation.

Results

Statistical Average Monthly Variation

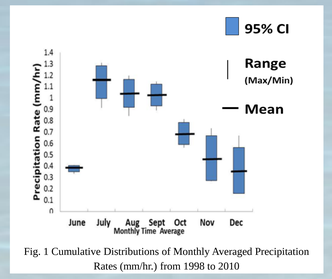

Fig. 1 Cumulative Distributions of Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

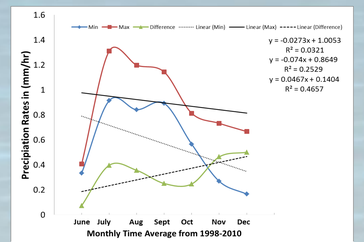

Fig. 2 Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Spatial Average Monthly Variation

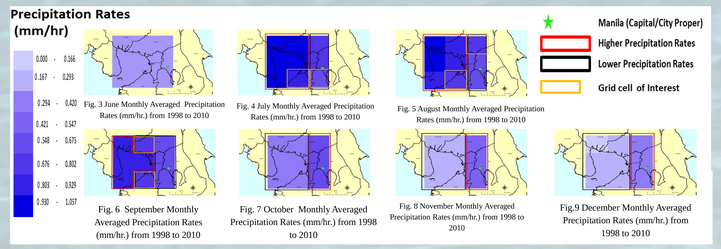

Fig. 3 June Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Fig. 4 July Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Fig. 5 August Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Fig. 6 September Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Fig. 7 October Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Fig. 8 November Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Fig.9 December Monthly Averaged Precipitation Rates (mm/hr.) from 1998 to 2010

Statistical Seasonal Average Variation

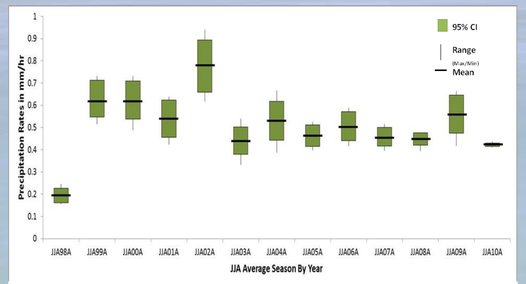

Fig. 10 A JJA Averaged Precipitation Rates (mm/hr.) Over Time

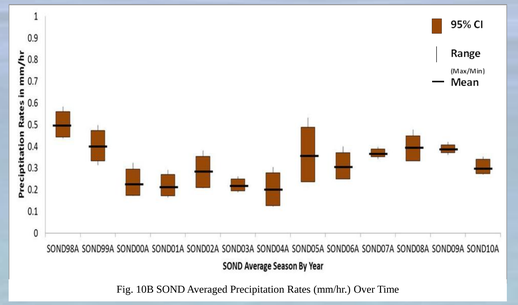

Fig. 10B SOND Averaged Precipitation Rates (mm/hr.) Over Time

Spatial Seasonal Average Variation

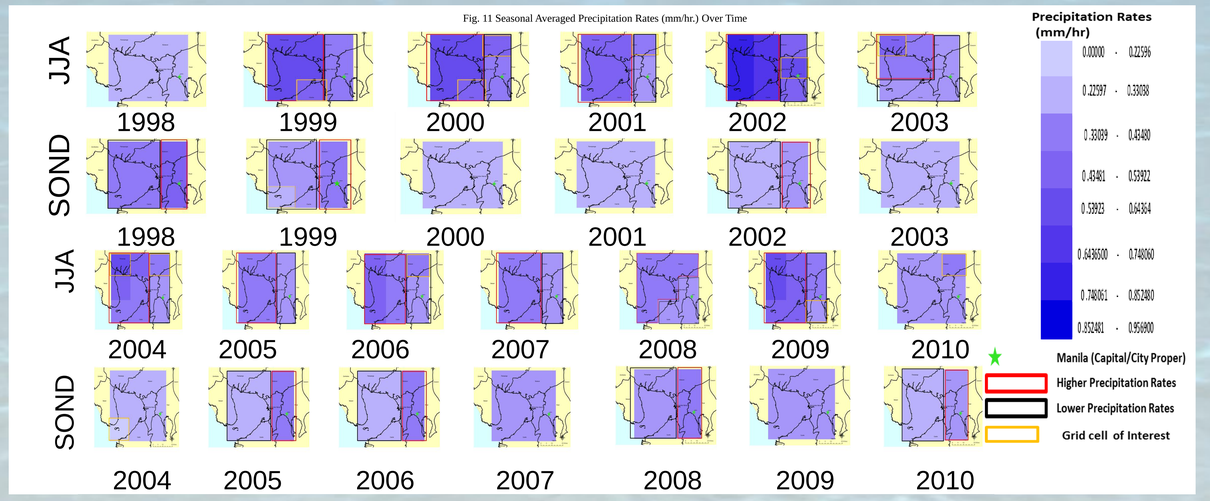

Fig. 11 Seasonal Averaged Precipitation Rates (mm/hr.) Over Time

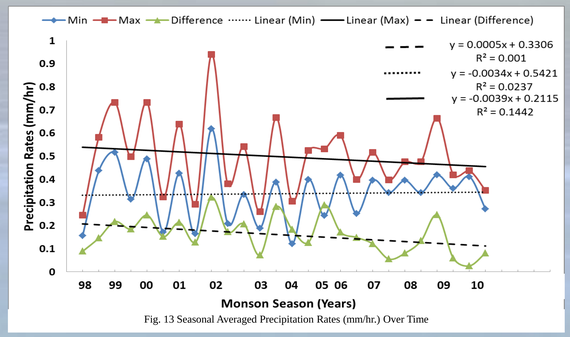

Fig. 13 Seasonal Averaged Precipitation Rates (mm/hr.) Over Time

Conclusions

- Local maximums during July and August with the onset of the WNPSM
- Significant distinction of higher local rainfall rates during JJA and lower rates during SOND
- Distinct patterns between the western two-thirds of the study region and those of the eastern third of the study matrix attributed to oscillation patterns between the ISM and WNPSM from low level winds reverse from winter easterlies to summer westerlies (Wang and Lin, 2002)
- Grid cell of interests display characteristics influenced by meridional temperature gradient creating the margin differences in local changes of precipitation
- The precipitation climatology over time showed a decrease in precipitation rates within the region

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References

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