

# Asian Monsoon Years (2007-2012): Interdecadal rainfall variability associated with typhoon and monsoon over the western North Pacific

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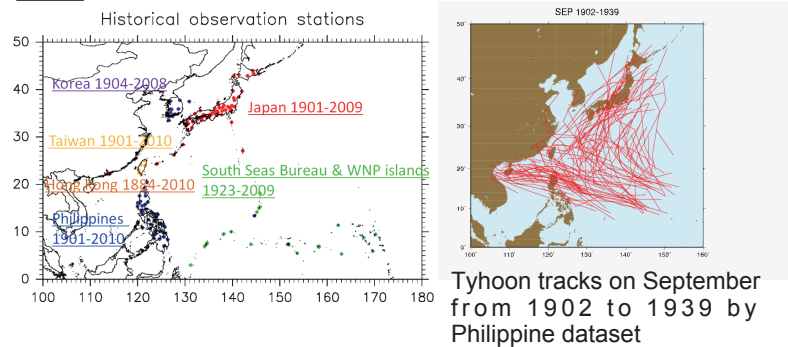
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## Introduction

Over the western north Pacific (WNP) region the main contributor of rainfall is typhoon and monsoon. The variability of typhoon and monsoon directly influences the rainfall variability in this region. Long-term dataset of typhoon and rainfall are necessary to understand the interdecadal variability of the rainfall. In this study typhoon track data and station rainfall data are recovered from paper records during the 20th century. We divided typhoon related rainfall from non-typhoon monsoon related rainfall using station rainfall data and investigated the interdecadal rainfall variability.

## Data

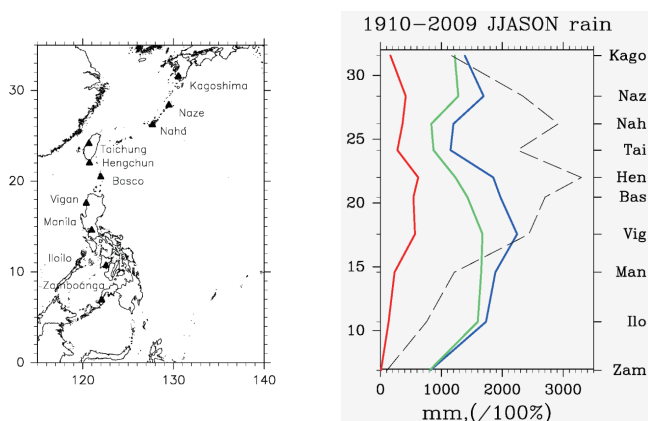


Best track data over the Western North Pacific

	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
USA, Philippines													
Japan													
Taiwan													
Hong Kong													
Shanghai													

Historical typhoon track data are collected from Philippine Weather Bureau, Central Meteorological Observatory of Japan, Hong Kong Observatory, and Zi-Ka-Wei Observatory in Shanghai over the WNP back to 1884. Blue arrows are collected and digitized the typhoon locations. Red arrow is collected the data. Black arrows are available best track data.

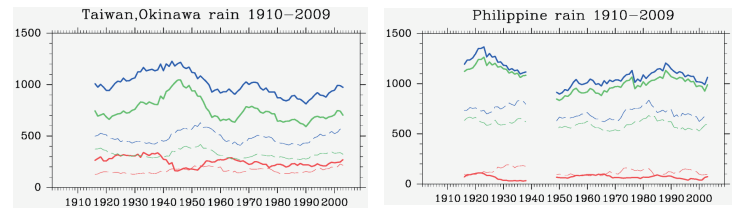
## Climatology of typhoon and non-typhoon rainfall



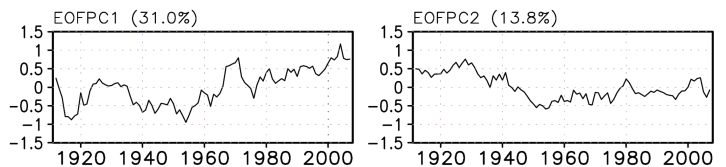
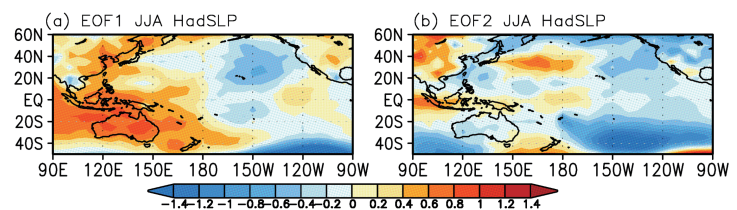
Climatology of typhoon (red), non-typhoon (green), total rainfall (blue), and typhoon rain ratio (black dashed) from June to November during 1910-2009.

Typhoon track dataset is created by connecting present available typhoon best track data from 1910 to 2009. Typhoon rainfall is defined when typhoon is located within 600 km radius from the station. Non-typhoon (monsoon) rainfall is defined as a residual of typhoon rainfall. The north-south islands chain along Philippine, Taiwan and Okinawa are chosen for investigation. In climatology, about 30 % of the annual rainfall comes from typhoon in Taiwan. Other area has 10 to 20%.

## Typhoon and non-typhoon rainfall variability

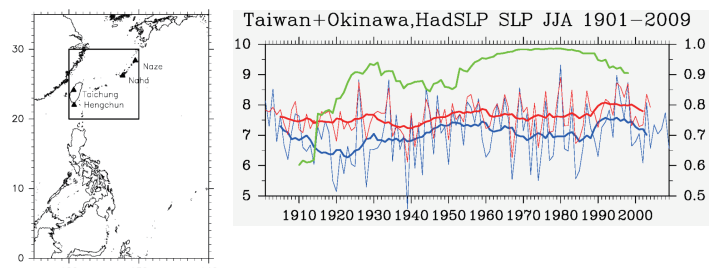


Summer (JJA) (solid) and Autumn (SON) (dashed) rainfall of typhoon (red), non-typhoon (green), and total (blue) from 1910 to 2009 (11 years running mean). 4 stations average in Taiwan and Okinawa (left) and 2 stations average of (Manila and Iloilo) (right).



EOF analysis of JJA HadSLP data from 1910 to 2009 (5 year running mean).

Taiwan and Okinawa have maximum summer non-typhoon (monsoon) rainfall during 1940s and tend to decrease after 1940s. On the other hand Philippine summer monsoon rainfall has two peaks in 1920s and 1990s. North and south stations show different characteristics of monsoon rainfall. EOF analysis of JJA HadSLP shows weakening Walker Circulation mode (EOF1) and decadal PJ pattern mode (EOF2). Correlation of EOF2 and PJ pattern index (difference of Hachijojima and Hengchun SLP) is 0.50. Taiwan and Okinawa monsoon rainfall is negatively correlated to EOF1 (-0.42). On the other hand, Taiwan and Okinawa typhoon rainfall is correlated to EOF2 (0.48). Philippine monsoon rainfall also correlated to EOF2 (0.66).



Taiwan and Okinawa 4 station average sea level pressure (blue), HadSLP (20-30N, 120-130E) (red) JJA mean (+1000hPa), and 21 years running mean correlation (green).

HadSLP and station pressure have high correlation from 1930s to present. However the representation of low pressure during the 1920s is poor in HadSLP. The analysis using HadSLP before 1920s needs caution.

## Acknowledgement

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