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Correlations between PM2.5 and meteorological variables in Chiang Mai, Thailand.

Air pollution is a major concern for the population in Chiang Mai the same as most people in the other large cities in the world. Hazy skies and pollution alert have become normal during late winter and entire summer almost every year. Prolonged expose to PM2.5 can cause acute and chronic effects to the respiratory and cardiovascular systems. This research aims to study the correlations between PM2.5 and meteorological variables (rainfall and temperature) at Chiang Mai during 2017 and 2020. The cross wavelet transform (XWT) and wavelet coherence (WTC) have been used to examine these relations by assessing the presence of common power and the relative phase in the time-frequency space. The XWT between PM2.5 and rainfall shows significant common power in two dominant period bands, one in the period between 10-14 months and the other one between 5-7 months. The first common power occurs during all observed time intervals is obviously related to natural annual periodicities of PM2.5 and rainfall. The second band occurs only in the year 2019 may be connected with the beginning of the monsoon season which starts in May brings a stream of warm moist air to Chiang Mai. Our data shows that PM2.5 typically begins to rise starting in November, and it remains high until March of the next year. The PM2.5 is low in rainy season since rain has a wet scavenging effect on PM2.5. The WTC, which is a measure of the correlation between two time series, indicate that there is a significant correlation between PM2.5 and rainfall at 10-14 month band. The phase difference between these two time series is defined by arrow. The phase arrows pointing to the left indicated the anti-phase relation, when rainfall increases, PM2.5 decrease and vice versa. The correlation coefficient (r) between PM2.5 and rainfall in rainy season is equal to 0.8504. Our studying also finds that there is a proven correlation between PM2.5 and temperature in a day time scale with the correlation coefficient equal to 0.9249. On one day period, PM2.5 is low in day time and high at night. Understanding of how climate variability may impact PM2.5 concentration in Chiang Mai will help the government in better planning and preparation to prevent environmental hazard from PM2.5 pollution.

Keywords: PM2.5, air pollution, wavelet analysis, cross wavelet transform, wavelet coherence.

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