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Air pollution and its impact of tropical heavy rainwater and dew water chemistry in Siem Reap-Angkor region of Cambodia

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Context/Purpose: Angkor monument is a common property of mankind, so restoration and conservation activities are carried out. In recent years, the impact of air pollution is of great concern, but the situation of air pollution in the Angkor region is unknown. In Cambodia, tropical heavy rainfall frequently occurs during the rainy season, while dew is formed early in the morning during the dry season. During the rainy season, air pollutants are scavenged by heavy rainfall, while dry deposition velocities of air pollutants could be accelerated by the presence of dew during the dry seasons. As a result, degradation of Angkor monument may be promoted. This study aims to clarify the actual state of air pollution in Seim Reap-Angkor region of Cambodia and to clarify the impact of air pollutants on heavy rainwater chemistry in the rainy season and dewater chemistry in the dry season.
Methods: Observations of gases (NO_x, O_3, acidic gases, ammonia, gaseous elemental mercury (GEM) and VOCs) and particulate matters (PM2.5, black carbon (BC), water-soluble components, and trace metal elements) were conducted along with collection of tropical heavy rainwater in the rainy season and dew in the dry season.
Results/Interpretation: Preliminary observation of PM 2.5 by AM 520 (TSI) was performed in the dry season from February 27 to March 3, 2018. We observed PM2.5 more than 200 μg/m3 in Siem Reap. We conducted a comprehensive sampling campaign on air pollution during the rainy season from 3 to 8 September 2018. The average concentration of PM2.5 and BC were 10 μg/m3 and 1.34 μg/m3, respectively, and there was no correlation between them. The average concentration of acidic gases such as HNO_3, HCl, and SO_2, in the ambient air in Siem Reap were 1.93 ppbv, 1.43 ppbv, and 0.80 ppbv, respectively, while the average NH3 concentration was 86.2 ppbv during the studied period. In the rainy season, air pollution by PM2.5 and BC was not severe, but the aerosol particles were not neutralized despite the high concentration of NH3. There is a possibility that SOA oxidized from VOCs in the daytime could interfere with the neutralization of sulfuric acid aerosols because of the lower concentration of VOCs in the daytime than in the nighttime. Total VOCs concentrations including BVOCs were 3.12 ppbv on average in the daytime and 6.55 ppbv on average in the nighttime.
Conclusion: High acidity of the particulate matters could cause acidification of tropical heavy rainwater in the rainy season and dew water in the dry season. We will discuss the controlling factors of tropical heavy rainwater and dew water chemistry in the presentation.