

Assessing Future Isoprene Emissions in Southeast Asia: Climate Change Implications

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Abstract : Isoprene emission is known to depend heavily on temperature and radiation. Considering these environmental factors together is crucial for a comprehensive understanding of the impact of climate change on isoprene emissions and atmospheric chemistry. Therefore, the aim of this study is to investigate how isoprene emission responds to changing climate scenarios in Southeast Asia (SEA). Two climate change scenarios, RCP4.5 and RCP8.5, were used to simulate climate change using the Weather Research Forecasting (WRF v3.9.1) model in three different time periods: near-future (2030-2039), mid-century (2050-2059), and far future (2090-2099), with 2010 (2005-2014) as the baseline period. The output from WRF was then used to investigate how isoprene emission changes under a changing climate by using the Model Emission of Gases and Aerosol from Nature (MEGAN v2.1). The results show that the overall isoprene emissions during the baseline period are 1.41 tons hr⁻¹ during DJF and 1.64 tons hr⁻¹ during JJA. The overall emissions for both RCPs slightly increase during DJF, ranging from 0.03 to 0.06 tons hr⁻¹ in the near future, 0.11 to 0.19 tons hr⁻¹ in the mid-century, and 0.24 to 0.52 tons hr⁻¹ in the far future. During JJA season, environmental conditions often favour higher emission rates in MEGAN due to their optimal state. Isoprene emissions also show a strong positive correlation (0.81 - 1.00) with temperature and photosynthetic active radiation (PAR). The future emission rate of isoprene is strongly modulated by both temperature and PAR, as indicated by a strong positive correlation (0.81 - 1.00). This relationship underscores the fact that future warming will not be the sole driver impacting isoprene emissions. Therefore, it is essential to consider the multifaceted effect of climate change in shaping the levels of isoprene in the future.

Keywords : isoprene, climate change, Southeast Asia, WRF, MEGAN.

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