The regional biogenic emissions response to climate changes and ambient CO2 in Southeast Asia

ABSTRACT

The emissions of isoprene from vegetation in the tropics have been regarded as one of the major sources of the global biogenic emission budget. As this emission is highly sensitive to temperature, one may expect significant changes to the emissions due to climate change. In this study, we explore the impact of regional climate change to the emissions of isoprene in Southeast Asia. The potential role of the combination of climate change and future atmospheric CO_2 concentration on isoprene emissions are also investigated. The latest generation of Hadley Centre regional climate modelling system, PRECIS (Providing Regional Climates for Impact Studies) was used to investigate the climate change in the region. The climate output dataset from the model was then used as input for the BVOC Emission Model, which was developed by Sheffield University and Lancaster University to estimate the emissions of biogenic volatile organic compounds. The projected temperature changes under the A_2 emission scenario was 2.5ºC, which accounted an increase of 22% of isoprene emission from 29 to 37 TgC/yr if the CO_2 emission factor was excluded. Incorporation of higher concentration in future CO_2 emissions was found to offset the climate change impact on future emissions of isoprene in the region. With the CO_2 effects, the projected regional isoprene emissions in 2100 dropped from 28 to 25 TgC/yr. These results suggest that future emissions of isoprene in the region is largely buffered by a number of competing factors, which are certainly important to be considered in estimating the isoprene global budget. In a wider perspective, the anticipated high concentration of CO_2 in the future could lead to the disruption of the ozone, organic aerosol and methane formation through the competing influence with warmer climate on isoprene emissions from tropical vegetation.