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Investigating the formation and distribution of surface ozone during dry season over the Northern Thailand

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Surface O_3 has become a common air quality problem due to the continuously increasing level of its precursors, including NO_x, and both biogenic and anthropogenic VOC (Volatile Organic Compound) emissions in the troposphere. Elevated surface O_3 over different regions have been observed over the different parts of the world, with the worst conditions persisting within the Asian countries, which could lead to human health problems (respiratory issues) and affecting local climate in the direct/indirect ways. The formation of surface O_3 is a by-product of reactions between NO_x and VOCs in the presence of sunlight, however in some cases, it may react with CO and biogenic VOCs (e.g. isoprene) in accordance with weather and climatic change (global warming) especially over vegetation, forest and aquatic regions, leading to crop damage due to dry deposition on the plant leaves. Our present study aims to investigate the formation and distribution of surface ozone during the dry season (intense haze event) over northern Thailand.

The Weather Research and Forecasting model coupled with chemistry (WRF-Chem) was utilized for 10 – 20, April 2016 at a horizontal resolution of 10 km with 1 hr temporal resolution. Nine distinct locations (including urban, semi-urban, hill, village, etc.) were selected to compare and study how surface ozone and its precursors vary with respect to its source and environmental change. Simulated surface ozone were compared with observations from the Pollution Control Department (PCD) of Thailand over 9 locations. The correlation coefficient between simulated and observed surface ozone is found to be 0.76 and a root mean square difference of $\sim$38 ppb. Simulations capture the diurnal and daily variations of surface ozone, however overestimates the observations in most stations, which shows the profound contribution of precursors for the formation, and uncertainty in the emission inventories of NO_x, CO, BVOCs and VOCs. During the dry season, the presence of uncontrolled burning of agriculture waste over these regions lead to the enhancement of CO over BVOCs and VOCs and endorse the formation of surface ozone rapidly. Ozone precursors were also simulated and compared whose results will be presented and discussed.