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Variability in ozone and its precursor gases over the Bay of Bengal during post-monsoon

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O_3 and precursor gases were measured during a ship campaign over the Bay of Bengal (BoB) during 28 October -17 November, 2010. The measurements revealed the large spatial heterogeneity in trace gas levels over the BoB during post-monsoon months. The heterogeneity was attributed to unique transport patterns over north and south BoB during this period. Four distinct types of air-masses influenced by heavy pollution from nearby source regions (49% time over North-West Myanmar, East Bangladesh and North-East India), mixed type (25% time over Myanmar, Thailand and Vietnam and 75% time over East BoB), affected by long-range transport of pollutants (59% time over continental South Myanmar, Vietnam and Hong-Kong region of China) and pristine marine (99% time over oceanic regions) were identified. Among these, the continental air masses were fresher compared to marine air masses.

High O_3 and CO levels were observed in air masses coming from South-East Asia. O_3, C4H10 and alkenes were highest in air masses arriving from eastern IGP, Bangladesh, Myanmar via the North BoB. The C2H2 to CO slope of 0.004 and C3H8 to CO slope of 0.003 indicated predominance of biofuel/biomass burning in air masses from South-East Asia. The i-C4H10 to n- C4H10 value of 0.62 indicated contributions of urban/industrial sources in air masses arriving from Bangladesh, India and North-West Myanmar. 'Potential Source Contribution Function' analysis indicated fire impacted South of Myanmar and Thailand regions as potential contributors to high CO levels above 260 ppbv measured on 14 November. Observed enhancements in surface CO during 2-3 November were attributed to the faster transport of continental pollutants associated with cyclonic winds.

The O_3 e-fold time of 2.3 days indicated the higher rate of O_3 destruction over the BoB due to higher precursor levels. Principle component analysis indicated that transport from continental source regions played a major role in determining the chemical composition of the air masses during the campaign and presence of regional sources of NO_x. Diurnal variations of surface O_3 revealed effects of advection, entrainment and photochemistry. Chemical box model simulations of O_3 diurnal variations over the BoB were found to be very sensitive to background O_3 and NO_2 levels as well as dilution.