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Effect of Asian Dust Storms on the Ambient SO_2 Concentration over North-East India: A Case Study

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ABSTRACT

Ambient SO_2 concentration at a high rain fall site, Shillong (25.67^{o}N, 91.91^{o}E, 1064 m ASL), located in North-East India, was measured during March 2009 and January 2010 with the aim to understand the effect of long range transport of pollutants from North-East Asia on the ambient SO_2 levels at this relatively clean site. The concentrations recorded during the former sampling period were very high (Max: 262.3 ppb)—which decayed down gradually towards the end the sampling period—whereas those during the latter sampling period were well within the acceptable limits (Max: 29.7 ppb). This elevated SO_2 concentrations during March 2009 is proposed to have association with a major cold air outbreak and an associated cyclone preceding one of the dust storm events reported in China, and a resultant sudden change in wind trajectory leading to the long range transport of pollutants to the sampling site. The argument is formulated on the basis of the back trajectory analysis performed using HYSPLIT for the month of March 2009—the plots clearly showed a drastic change in wind trajectories between 8th and 15th of March 2009 wherein the winds traveled over some of the highly polluted regions such as the Perm region of Russia—and on the results from model runs performed using the global 3-D model of tropospheric chemistry, GEOS-Chem (v8-03-01)—it clearly showed the tropospheric SO_2 over Perm region in Russia peaking during Nov, Dec, Jan, Feb and Mar every year, possibly due to central heating. The observation of long range transport of SO_2 from the highly industrialized areas of Perm in Russia to North-East India during dust storm events has important implications to the present understanding on its relative contribution to the Asian pollutant outflow to the Pacific during spring as the GEOS-Chem model runs also showed regions in and around Russia with relatively high concentrations of atmospheric NOx, Peroxyacetyl Nitrate, Lumped Peroxypropionyl Nitrate, HNO_3, HNO_4,C_3H_8, C_2H_6, SO_4, NH_4, Inorganic Sulphur Nitrates and Lumped Alkyl Nitrate.

KEYWORDS

SO_2, GEOS-Chem, HYSPLIT, Cold Air Outbreaks, Asian Dust Storms, Asian Pollutant Outflow

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