



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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Programme of Study : Ph.D.

Thesis Title: Transported emissions from the Indo-Gangetic Plain dominate Air pollution and Climatic impacts over North East India during Pre-monsoon season

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SHORT ABSTRACT

Aerosols are suspended particles that can significantly impact air quality as well as weather through their different effects. The westerlies carry emissions from the Indo-Gangetic Plain towards North-East India through atmospheric transport along the southern slope of the Himalayas and contribute to the aerosol burden over North-East India. The pre-monsoon season is a period of high aerosol loading over North-East India, with the highest atmospheric heating and aerosol optical depth with an increasing trend. Moreover, studies have also reported a declining rainfall trend and an increasing rainfall intensity over this region. This study investigated the direct, semi-direct and indirect radiative effect of atmospheric aerosols and black carbon, specifically on the rainfall mechanisms responsible for the pre-monsoon rainfall over North-East India with the WRF-Chem model. Aerosol radiative effects affected rainfall according to the height of the terrain in the North-East India region. Aerosol effects, in general, tended to increase total rainfall over lower-terrain areas, whereas moisture reduced between 2-3 km, which decreased total rainfall over high-terrain areas. The study also differentiated the impacts of aerosols emitted locally within the NE India region and those transported from outside this region to ascertain whether local or transported aerosols were more impactful in influencing this region's rainfall during this season. The role of different aerosol effects on radiative forcing and rainfall was also studied. Results show that aerosols transported primarily from the Indo-Gangetic Plain were responsible for about 94% of the PM₁₀ mass over North-East India's atmosphere and 64% of near-surface PM₁₀ concentration. The indirect aerosol effect was found to be the major effect and more impactful with transported aerosols that dominated both rainfall and radiative forcing and suppressed rainfall significantly than the direct and semi-direct effect. Thus, this study found that emission control policies implemented in Indo-Gangetic Plain will reduce air pollution as well as the climatic impacts of aerosols over the North-East India region. The study also compared the performance of planetary boundary layer parametrization schemes to select a suitable scheme to accurately predict meteorological parameters during the pre-monsoon and monsoon season with the WRF model at an enhanced resolution of 3 km grid size compared to the 10 km used in WRF-Chem.