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Modelling the uptake of air pollutants released from a lignite based power plant in a tropical boundary layer over a forested canopy

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Turbulence characteristics are well quantified for the mid-latitudes, but the same is not so for a tropical boundary layer. The convective boundary layer (CBL) is directly affected by the solar heating of the earth's surface. In this study we have attempted to model Sulphur Dioxide releases from an elevated stack from the Neyveli Lignite Corporation (NLC) located in Tamil Nadu, India. This is among the largest lignite based power plant in the country. To our knowledge a quantitative estimate of the dispersion characteristics from this power plant has not been undertaken before. The location of Neyveli is such that the boundary layer is strongly influenced by (i) the diurnal variation of solar insolation within the tropical belt, (ii) wind flow patterns owing to its proximity to the Bay of Bengal, (iii) the effect of added roughness elements in the surface boundary layer due to the extensive greening of the NLC complex. In this paper we have modeled the dry deposition removal rates over heavily forested terrain within the NLC premises. We find that this is comparable to wet removal rates. Higher values of u*, the friction velocity, corresponds to increased turbulence, decreased resistance of gases to vertical turbulent motion with a concomitant increase in the dry deposition velocities. Time dependent concentration isopleths with and without the dry deposition removal rates amply reveal the efficacy of this removal mechanism.