



Long term PM_{2.5} estimation and its impact on human health in Beijing, China

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Due to the economic growth and urbanization, the emissions of pollutants have increased significantly in the North China Plain (NCP). Beijing, the capital of China, is located at the northern tip of NCP, and it is considered one of the most densely populated cities with the poorest air quality. This is of major concerns, because of the impact of high pollutants concentration on human health. The present study analyses the characteristics of AOD and the particulate matter with diameter $< 2.5 \mu\text{m}$ (PM_{2.5}) and its impact on human health in the central Beijing areas. We acquire AOD from Aerosol Robotic Network (AERONET) in Beijing from 2001 to 2012. The AOD data are fitted with a lognormal distribution, and the 95% of the cumulative probability is used as the threshold for episodes of high AOD. Most episodes occur in summer, mostly in June, though this is combined with high precipitation. Episodes of high AOD caused by coarse pollutants occur only in March and April, and they are mostly caused by dust from the north. According to wind direction, wind speed, boundary layer height (BLH) and pollutant emission distribution, episodes of high AOD are due to the anthropogenic pollutants from the south (Hebei province). Based on ground PM_{2.5} observation from the US embassy in Beijing from 2010 to 2011, we establish a relationship between PM_{2.5} and AERONET AOD, including BLH and relative humidity (RH) correction. Thanks to this method, 12 years of PM_{2.5} are estimated for the Beijing central area, allowing the estimation of long term concentrations of this pollutant. Since there is no obvious difference among the daily PM_{2.5} of six stations lying in Chaoyang, Dongcheng, and Xicheng district, we use the daily PM_{2.5} from US embassy station to represent the PM_{2.5} concentration in these three districts, and calculate yearly premature mortality due to long term exposure to PM_{2.5} among the population with an age of ≥ 30 yr in these three districts.