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Observation of ambient formaldehyde at urban and rural sites in the North China Plain

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Air quality issues in the North China Plain (NCP), including frequently occurred haze and photochemical pollution, has become more and more concerned in recent years. To facilitate a better understanding of the reginal air pollution problem, field campaigns carried out at present not only focus on urban areas but also expanded to surrounding rural areas. Formaldehyde (HCHO) is one of the dominant carbonyl compounds in atmosphere, which closely related to photochemical pollution. As part of several field campaigns study on air pollutions in the NCP, ambient HCHO were measured at an urban site in Beijing from 2013 to 2016, as well as two rural sites Gucheng and Raoyang located in the middle of the NCP in summer of 2013, 2014, and 2016, respectively, using an in-situ HCHO analyzer (AL4021) based on Hantzsch reaction fluorescence method. Mixing ratios of HCHO at the urban and the rural sites of the NCP were at a similar level in summer, which were fairly higher than those reported at other Chinese sites or oversea sites. Different diurnal variation characteristics of HCHO can be seen between urban and rural sites, with two peaks for the former and one peak for the latter. Seasonal variation of HCHO at Beijing was interpreted with relative high concentrations in summer and autumn and low concentrations in winter and spring. In addition, variation of pollutants such as ozone (O_3), peroxyacetyl nitrate (PAN) and carbon monoxide (CO) were discussed together with HCHO. And, photolysis rates of HCHO were calculated using simultaneously observed photolysis rate coefficients, demonstrating that the HCHO photolysis rate for yielding hydrogen and CO was faster than that for yielding H and HCO radicals. The results suggested that photochemical processes played an important role for the HCHO peak during daytime.