The Daily Variation of NH_3 over Agricultural Areas in Asia Using Combined Satellite Measurements

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ABSTRACT

Ammonia (NH_3) is one of the most important pollutants in the lower troposphere and is mostly produced from the use of synthetic fertilisers and manure spreading over agricultural areas[1]. Most NH_3 is emitted in Asia[2], particularly in the Indo-Gangetic Plain in India and the North China Plain. Currently, NH_3 emissions are subjected to limited regulation in Asia and there are few ground monitoring stations taking NH_3 measurements. However, satellite instruments offer global coverage for NH_3 observations where ground stations are sparse.

Observations of NH_3 are essential for establishing environmental regulations for agricultural practices, particularly over Asia, as NH_3 plays an important role in the formation of secondary aerosols[3] and $PM_{2.5}$ over cities, through transport from rural areas[4]. Wet and dry deposition of NH_3 on soils and water bodies is also detrimental to ecosystem biodiversity as it leads to acidification of the environment[5]. The remote sensing of NH_3 presents numerous challenges because NH_3 concentrations rapidly change over time and space due to the short lifetime of the gas, which ranges from a few hours up to a day. Studying the NH_3 diurnal cycle provides valuable information on its sources, surface exchange, deposition and transport processes, and the impact on these by weather and surface conditions; all these are crucial for improving atmospheric models.

The NH_3 daily cycle has been investigated over the Indo-Gangetic Plain and the North China Plain using combined measurements from the IASI and CrIS satellite instruments. The NH_3 total column measurements were obtained by using an optimal-estimation-based retrieval method developed at the University of Leicester, incorporating a fast NH_3 detection method for selecting the a-priori profile. The study also focuses on the impact that thermal contrast and surface temperature have on the retrieval of NH_3 signal. We aim to compare the satellite retrieved NH_3 measurements to ground measurements and modelled NH_3 from the TOMCAT model.

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