The Impact of Agricultural Environments on HONO Emissions during Spring and Autumn in The North China Plain

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Abstract

The unknown daytime source of HONO has been extensively investigated due to unexplained atmospheric oxidation capacity and current modelling bias. Abrupt morning increases in atmospheric HONO were frequently observed during spring and autumn at a rural site in the North China Plain (NCP), which were closely linked to simultaneous rises in atmospheric water vapor content and NH_3 concentrations. Dew and guttation water formation was frequently observed on wheat leaves, from which water samples were taken and chemically analyzed for the first time. Results confirmed that such natural processes likely governed the daily nighttime deposition and daytime release of HONO and NH_3. Trough detailed budget analysis, an unknown production rate in HONO ($P_{unknown}$) was obtained, from which we seperated contributions of dew water and soil emissions. Results revealed that both during spring and autumn, morning $P_{unknown}$ peaks were caused by dew and guttation water evaporation, while afternoon $P_{unknown}$ peaks were explained by soil emissions. During spring, soil emissions resulted in more pronounced $P_{unknown}$ peaks, while in autumn dew emissions were more important. Soil emissions varied from day to day, however, exhibiting a good exponential relationship to soil temperatures. Overall, the daytime relative contribution of dew emissions was higher during autumn, while soil emissions dominated during spring. Nevertheless, dew emission remained to be the most dominant contributor to morning time HONO emissions in both seasons, thus being responsible for the initiation of daytime OH radical formation and activation of photochemical reactions, while soil emissions further maintained HONO and associated OH radials formation rates at a high level, especially during spring. Future studies need to thoroughly investigate the influencing factors of dew and soil emissions and establish their relations to HONO emission rates, to form reasonable parameterizations for regional and global models, improving current underestimations in modelled atmospheric oxidation capacity.

Early Career Scientist

NO, I am not an early career scientist.

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