Geophysical Research Abstracts
Vol. 21, EGU2019-294-1, 2019
EGU General Assembly 2019

Long-term flux observation above a subtropical forest canopy

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The exchange of nitrogen oxides between biosphere and atmosphere plays an important role of global nitrogen cycle, influencing the regional air quality, N deposition, and ecosystem health. The dry deposition of nitrogen is often estimated from inferential method and/or throughfall measurement in forests with certain uncertainty. In this study, a micrometeorological method was applied to directly observe the NO_x flux in 2015 and 2016 above the canopy of a Pinus massoniana-dominant subtropical forest in southeastern China, which was thought to be background sites. Both two years deployed a net NO_x flux downwards, i.e. N dry deposition of 21.2 kgN ha^{-1} yr^{-1} and 7.67 kgN ha^{-1} yr^{-1} in 2015 and 2016, respectively. A larger downward flux was found in winter and autumn, with a small emission in the spring, which reflected the possible bi-way exchange balanced by soil-atmosphere exchange and folia-atmosphere exchange. The NO_x concentration seemed the most important factor controlling the NO_x exchange above canopy, which explained seasonal variation of N deposition and the difference between the two years as the concentration in 2016 was distinctly lower than that in 2015. The dry deposition is underestimated by 73.7% from the throughfall measurement minus the wet-only deposition. The stomatal uptake of NO_x is likely to be responsible for the dry deposition underestimation of throughfall measurement. Furthermore, the dry deposition was simultaneously monitored at another subtropical forest, which has already been observed of nitrogen saturation. The dry deposition dynamics would be compared between these two sites.