



## Multiscale Nitrogen Emission and Its Impacts

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### **Message from the Guest Editors**

Nitrogen is an essential element for plant growth, but it is tightly coupled with other nutrients (e.g., carbon, phosphorous) that influence biological productivity and the structure and functioning of ecosystems in the long run. Since the pre-industrial era, the global nitrogen cycle has been altered due to the expansion of agricultural lands, biomass burning, the combustion of fossil fuel, and the cultivation of leguminous crops that carry out biological nitrogen fixation. “Nitrogen cascade” has been raised as an issue by previous scientists as a substantial amount of reactive nitrogen has been introduced into ecosystems. Anthropogenic perturbation of the global nitrogen cycle contributed approximately two-thirds of the annual flux of reactive nitrogen into the atmosphere in the early 21st century, including oxides of nitrogen ( $\text{NO}_x$ ), nitrous oxide ( $\text{N}_2\text{O}$ ), and ammonia ( $\text{NH}_3$ ). These nitrogen-containing gases remain a matter of great concern to human health and the environment. Thus, in order to sustain human and environmental health, it is essential to have a complete quantification of these N-containing gases and their effects on terrestrial and aquatic ecosystems.

Deadline for manuscript  
submissions:

**31 January 2023**





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