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Simulation and uncertainty identification of atmospheric nitrogen oxides dry deposition velocity for the Dinghushan Forest, Southern China

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Nitrogen oxides (NO_X), as one of the most important atmospheric pollutants, has great adverse effects on human health and ecosystems. Dry deposition is one of the most important NO_X removal processes in the atmosphere. To understand the effects of NO_X on human health and ecosystems, various numerical model systems have been developed to simulate and predict the dry deposition of NO_X. However, the parameterization of dry deposition of NO_X in numerical model is still insufficient which makes it difficult to assess and predict the effect of nitrogen deposition on ecosystems accurately and also limits the understanding of the transportation of nitrogen in the land-atmosphere exchange system. Therefore, a major challenge in accurately simulating nitrogen deposition is to identify the key sources of uncertainty and improve the mechanism of simulation model for NO_X dry deposition process. Based on our previous investigations, the Noah-MP land surface model and the dry deposition module in the WRF-Chem atmospheric chemistry model were coupled to form a dry deposition single-point model, and the model was driven by the micro-meteorological observation of the Dinghushan Forest Ecosystem Location Station. The model captured the observed NO_X deposition velocity (Vd) well, but still underestimated the Vd with the optimal simulation ranges from 0.0075 to 0.10 cm·s^{-1}. Then a series of numerical experiments were carried out to identify the key processes and parameters uncertainty influencing the calculation of Vd. The Brooks-Corey parameter, radiation stress function, leaf reflectance for visible radiation, leaf & stem death rate due to temperature stress, relative changes to Maximum carboxylation at 25°C and Momentum roughness length were identified as the most sensitivity parameters influencing the calculation of NO_X Vd. Such analysis will be used to improve the estimation of deposition resistance terms in order to enhance the dry deposition parameterization.