Attribution of soil acidification in a large-scale region: artificial intelligence approach application

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Attribution of causes of soil acidification is paramount for predicting the responses of terrestrial ecosystems to global change, and for defining mitigation policies. The conventional calculation of the hydrogen ion (H^+) budget considering all the biogeochemical processes is used to make attribution assessments across large-scale regions. However, many gaps in using this process-based calculation remain - particularly concerning indirect and interactive effects of the drivers and processes of acidification in a changing environment. In this study the Random Forest (RF) analysis-based artificial intelligence approach was adopted to estimate the contributions of the drivers and identify the key processes of soil acidification of different land uses (forest and farmland) and parent materials (fluvial deposit, granite and sandstone). The Pearl River Delta, China was considered in a case study. The results indicate that nitrogen (N) fertilizer was the dominant driver of the acidification of farmland due to nitrification of NH_4^+, whereas acid deposition contributed the most to the acidification of forest soil, NO_3^--N deposition played a major role, and small differences in contribution were observed among the parent materials. The direct and indirect drivers and processes of acidification and their interactive effects were considered and identified in the RF analysis-based artificial intelligence approach. This artificial intelligence approach provides a powerful method for untangling the complex causes of soil acidification across large-scale regions over a long time period, and consequently helps to develop fact-based mitigation and adaption strategies.