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How to couple ecological database to geochemical dynamic model to predict the impact of atmospheric nitrogen deposition and climate change on French forest ecosystems at the national scale?

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Abstract: Nitrogen atmospheric deposition is known to severely impact ecosystem functioning by influencing soil biogeochemistry, nutrients balance and, consequently, tree growth, forest health and biodiversity. Because the ongoing global changes affect the ecosystem processes, climate change and atmospheric deposition must be conjointly taken into account to assess the evolution of forest ecosystem status over time. The general purpose of this work was to predict forest vegetation response to the combined impacts of nitrogen atmospheric deposition and climate change by using dynamic modelling approaches. The coupled biogeochemical-ecological model ForSAFE-Veg was first run to simulate this response on three well referenced studied sites after calibration (Rizzetto et al. 2016). The main challenge consists now in a change of scale: (i) first by extending the simulations to a hundred set of sites from the French ICP-forest network, and (ii) second to apply the approach on forest ecosystems defined at the national scale. To reach this goal, we choose to couple the biogeochemical model ForSAFE (Sverdrup et al. 2007) to the ecological model EcoPlant (Gégout et al. 2005) based on measured ecophysiological datas for the French territory. Here we present the results of the statistical analysis and Glm models which were developed to make this coupling possible, particularly by harmonizing the shared parameters of the two models. As an example, pH and C/N parameters were harmonized thanks to links established between soil variables and soil solution characteristics. Other influent parameters such as temperature and available water content were also considered in this coupling process.

Keywords: geochemical and ecological models ; ForSAFE-Veg-EcoPlant ; vegetation ; nitrogen atmospheric deposition ; climate change
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