Impacts of changes in climate, nitrogen deposition, ozone and CO₂ exposure on forest carbon sequestration: a model assessment

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Carbon sequestration in forests and forest soils is influenced by various drivers including changes in climate (temperature and water availability), nutrient (nitrogen, base cations, phosphorous) availability, carbon dioxide (CO_2) exposure and ozone (O_3) exposure. We modelled the combined effects of past and expected future changes in those drivers on carbon sequestration in European forests and forest soils for the period 1900–2050. Forest inventory data around 2005 (EFI database) were used to assess reference forest growth rates, which were then modified for other years by factors accounting for deviations in climate and air quality compared to 2005. The impacts were evaluated using various assumptions with respect to interactions between drivers. Impacts of soil macro-nutrient availability (P, Ca, Mg, K) were also accounted for. The forest growth model was coupled to a soil model predicting nutrient availability and soil carbon sequestration.

Historical meteorological data were taken from a high resolution European data base that contains monthly values of temperature, precipitation and cloudiness for the years 1901–2000. Oxidised and reduced N deposition was calculated with the EMEP model. In addition, the ozone exposure in terms of a phytotoxic ozone dose (POD) was calculated by the EMEP model, incorporating the DO3SE deposition module, which parameterises ozone uptake as a function of phenology, light, temperature, humidity, and soil moisture. Historic NO_x, NH₃ and VOC emissions were taken from Lamarque et al., 2010. For the future (2010-2050) we used two scenarios for deposition (current legislation and maximum technically feasible reductions) and two climate scenarios (no change and SRES A1 scenario). Results of the simulations will be presented during the conference.

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