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Modeling species net primary productivity at local scale with a dynamic vegetation model : the importance of specific functional traits

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Dynamic Vegetation Models (DVMs) are widely used to simulate the net primary productivity (NPP) at global or continental scales using plant functional types or bioclimatic affinity groups. The DVMs are much less used to simulate species at local or regional scales due to limits of their parametrization schemes. Thus, there is an urgent need to validate DVMs considering species particularities. The present study focuses on sessile oak (Quercus petraea [Mattus.] Liebl.) and European oak (Quercus robur L.). We produced validation data based on forest inventories within five oak forests of Eastern Belgium. We estimated growth by combining tree ring widths (from year 2006 to 2017) with biomass estimates of allometric equations. At the same time, we also measured functional traits (specific leaf area, leaf C:N, sapwood C:N) and collected other parameters from literature. First, we clarified differences of specific leaf area, leaf C:N and sapwood C:N between sessile oak and European oak. specific leaf area and leaf C:N showed a similar seasonal evolution for both species while sapwood C:N of European oak was significantly higher than sessile oak during the growing season. Secondly, our results indicated an improvement of the ability of the DVM CARAIB to simulate site NPP of both species when using all the specific parameters together. By contrast, the use of default plant functional type parameters or parameters adjusted one by one did not allow at all to reproduce the NPP differences among sites in the simulations. These results clearly indicated the fine acclimation of the morpho-physiological traits at species level to the environmental conditions and the need to take into account this phenomenon for further simulations of species with DVMs.