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Modelling stomatal behaviour and transpiration in montane Scots pine (Pinus sylvestris L.) and pubescent oak (Quercus pubescens Willd.) canopies from sap flow measurements.

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Stand transpiration in a Scots pine (Pinus sylvestris L.) and a pubescent oak forest (Quercus pubescens Willd.) was obtained for the 2003 growing season from canopy-scaled sap flow measurements with heat dissipation probes. Derivation of canopy stomatal conductance (Gs) was carried out from daily values of transpiration and meteorological variables, assuming perfect coupling between the canopy and the surrounding air. The overall dynamics of Gs was fairly similar between the species during the growing season, but with higher values for Scots pine. A twofold difference was observed for maximum values of Gs in pines and oaks (ca. 4 and 2 mm s-1, respectively). A multiplicative model was parameterised, in which Gs was expressed as the product of a maximum conductance (Gsmax, obtained from boundary-line analysis) with daytime water vapour deficit, and a soil moisture constraint function. The sensitivity parameters of the model did not statistically differ between species, although P.sylvestris was found to be more sensitive to high evaporative demands and soil water deficits. Simulated transpiration of the Scots pine stand from June to September 2004 using the abovementioned stomatal conductance model, was found to be underestimated as a result of the different conditions of calibration (2003) and validation data (2004), the former being characterised by a extremely dry summer period. Changes in the magnitude of Gsmax according to observations during the 2004 period, greatly improved the ability of the model to predict accurately both the dynamics and the actual value of canopy transpiration.