Geophysical Research Abstracts, Vol. 8, 10477, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10477

Hydrological implications of atmospheric CO_2 enrichment in deciduous forests

S. Leuzinger (1) and C. Körner (1)
(1) Institute of Botany, Basel, Switzerland

Whether water savings will occur in tall forest-trees under future CO_2 concentrations is largely unknown but could have significant consequences for climate. We present two years of transpiration, soil moisture and leaf temperature data from a ca. 30m tall forest in NW Switzerland exposed to elevated CO_2 concentration (540 ppm) using free air CO_2 enrichment (FACE) and the Swiss Canopy Crane. Results indicate that water savings under elevated CO_2 are relatively low and highly variable between the three investigated species (oak, beech and hornbeam). Across all species, absolute sap flow was reduced by 15 % in trees subjected to elevated CO_2. In order to exclude effects of sap wood thickness, tree size etc., we also analysed relative transpiration curves by standardising each tree with its own mean maximum. These results confirm overall water savings of at most 15 %. Transpiration of CO_2-treated trees tended to start later in the day and maxima were reached earlier. The effect did not depend on vapour pressure deficit conditions. Generally, hornbeam and beech showed highest water savings while oak responded less. In line with these findings, soil moisture in the high-CO_2 area at 15 cm depth remained consistently higher shortly after soil water saturation. During rainless periods, this difference decreased. In contrast, high resolution thermal scanning of the forest-canopy from the crane tower did not reveal water savings through changed energy balance of the leaf, even during brief discontinuation of CO_2 supply on bright days.