Integrative measurements focusing on carbon, energy and water fluxes at the forest site 'Hohes Holz' and the grassland 'Grosses Bruch'

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The reduction of greenhouse gas (GHG) emissions and the optimization of Carbon sequestration by ecosystems have become priority objectives for current climate change policies. In this context, the long term research project TERENO and the research infrastructure ICOS have been established. The eddy covariance technique allows obtaining an integrative estimate of the ecosystem carbon, water and energy balances at the ecosystem level. The relative contributions of evaporation and transpiration as well as carbon sources and sinks need, however, to be determined separately for thorough process understanding.

Two different ecosystem observatories have recently been established in the Magdeburger Börde: a deciduous forest (Hohes Holz) and a meadow (Grosses Bruch). A comprehensive system of instrumentation provides continuous data for the evaluation of energy, water and carbon fluxes at the 1500 ha large forest site, including a 50 m high eddy covariance (EC) tower for micrometeorological investigations in different heights above and below canopy, throughfall and stem flow sensors, a soil moisture and temperature sensor network, soil respiration chambers, sap flow sensors, and ancillary analysis of trees such a dendrometer and leaf area index measurements. Eddy covariance measurements allow the assessment of the carbon (Net Ecosystem Exchange, NEE) and water balance at the ecosystem scale. To better understand the contributing processes we partition water und carbon fluxes of the forest ecosystem by different methods. Tower-based data of NEE are therefore complemented and validated by continuous automatic and manual campaign measurements of soil effluxes and their drivers. Water fluxes into the ecosystem are partitioned by stem flow and throughfall measurements and a distributed soil moisture network. Gap fraction in the forest has a strong influence on the distribution on the water fluxes and is therefore determined on a regular basis. Since the establishment of the flux sites, two abnormally dry years (2015 and 2016) occurred. Fluxes from these years are evaluated in detail here. These data are additionally used to evaluate the drought assessment of the German Drought Monitor (www.ufz.de/droughtmonitor).