## GENERAL INFORMATION

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| **author(s)** | Claeys K |
| **year** | 1997 |
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| **taxa** | |
| **project** | |
| **supervisor** | Lemeur R |
| **institution** | Faculty of Agricultural and Applied Biological Sciences, Laboratory of Plant Ecology |
| **document** | pdf_short, hardcopy at the Laboratory of Plant Ecology |
| **data** | |

## MATERIALS & METHODS

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| **study area** | 5n (scientific zone) |
| **time period** | September-October 1995 |
| **goal** | - calculation of the evapotranspiration with the formula of Penman-Monteith<br>- estimation of the impact of global change on the evapotranspiration |
| **set-up** | |
| **data collection** | meteorological data<br>- measuring tower<br>- standard: precipitation, air & soil temperature, relative humidity, incident short-wave radiation, wind speed and direction<br>- extra for the present study: air temperature at 35 m, surface temperature of the stand at 28 m, net total radiation (per minute), PAR (per 10 minutes)<br>plant-water relationships<br>- 4 days selected per month: sunny, mainly sunny, mainly cloudy, cloudy (with little precipitation), i.e., 17/09, 19/09, 28/09, 29/29, 7/10, 20/10, 23/10, 29/10<br>- calculation of thermodynamic & atmospheric parameters<br>- calculation of the turbulent boundary layer resistance and the physiological plant resistance<br>- estimation of the surface temperature of the stand based on the energy balance<br>- estimation of the potential and actual evapotranspiration based on Penman, Penman-Monteith, and the energy balance |
| **remarks** | description collection meteorological data from Neirynck&DeKeersmaeker_1995_rep |

## RESULTS

The air temperature, saturation deficit, net radiation, total radiation, and the surface temperature of the stand were higher on (mainly) sunny days than on (mainly) cloudy days. The patterns of net radiation and total radiation were similar. The albedo was 0.3–1.0 for small solar heights while it was ca. 0.14 for larger solar heights. The net radiation showed a sinusoidal pattern with positive values during the day and negative values during night. The surface temperature of the stand was ca. 2°C lower than the air

temperature, which indicates that the forest did not suffer from drought stress. The aerodynamic resistance of the Aelmoeseneie forest lay between 2 and 10 s/m. The physiological plant resistance was calculated with the method of Stewart as the energy balance method did not work well. Plant resistance lay between 30–100 s/m during the day and around 10000 s/m during night. Early summer was characterized by convection (a positive heath flux); there was an almost continuous advection (negative heath flux) from July onwards. The calculated potential evapotranspiration, i.e., 4689 mm per growing season (based on hour data) or 3964 mm (data per day), were high compared to literature data.

The actual evapotranspiration was calculated with Penman Monteith (E1), based on the estimated surface temperature and the energy balance (E2), and based on the measured surface temperature and the energy balance (E3). E1 and E2 were similar (485 mm per growing season, 88 mm for the study period), whereas E3 was much lower (40 mm for the study period), which might be caused by dew formation. The saturation deficit and the net radiation seem to have the largest effect on the evapotranspiration. Both actual and potential evapotranspiration were affected by the relative air humidity. Actual evapotranspiration was correlated with changes in air temperature, LAI and plant resistance. Potential evapotranspiration was correlated with mean wind speed above the forest, displacement height and roughness length, and the aerodynamic resistance.

A doubling of the atmospheric $CO_2$ concentration would result in a temperature increase of 1.5°C and a decrease in stomatal conductance with 23 % (Field et al. 1995). The increase in temperature gave a small increase in evapotranspiration (1.5–6 %); the evapotranspiration decreased strongly (up to 24 %) with a decrease in stomatal conductance.