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The Nocturnal Surface Energy Budget at Cabauw

Fred C. Bosveld
KNMI, De Bilt, Netherlands (Fred.Bosveld@knmi.nl)

Closing the Surface Energy Budget (SEB) is an outstanding problem in micro meteorology. To study the SEB an observational program is running at the Cabauw Experimental Site for Atmospheric Research (CESAR). Here we focus on heat storage fluxes. These can best be studied during stable night time when turbulent fluxes are relatively small and storage heat fluxes dominate.

It is found that the night time imbalance can be explained by assuming an extra heat capacity between the level of turbulent flux observations (3m) and the level of the top soil temperature sensors, which is coupled to the radiation surface temperature of the grass. This heat capacity is typically 30 kJ/m2/K (7 mm water equivalent) when the vegetation-soil system is wet , but is lower under dry conditions. The response time of this heat capacity to changes in the radiative surface temperature is typically 1 hour or less.

Measurements of the water content of the thick grass and sod layer at Cabauw in a winter time wet conditions indeed hint at a significant heat capacity. This extra heat capacity, however is not sufficient to explain the day time imbalance.