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Update on Surface Energy Budget Closure at CESAR, The Netherlands

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Problems in closing the Surface Energy Budget (SEB) with current state of the art observational techniques, including the eddy-correlation technique for atmospheric energy fluxes, have been recognized as being fundamental. The imbalances observed in many field experiments are judged to be significant given the anticipated uncertainties in the observational techniques. The uncertainty associated with the observed imbalance in the energy budget casts doubts on the validity of evaluation studies of land-atmosphere components in weather and climate models. It also casts doubt on observations of land-atmosphere exchange of trace gasses like CO_2 at the eco-system level since currently the eddy-correlation technique is the favourite method to observe these fluxes.

Observations at the Cabauw Experimental Site for Atmospheric Research (CESAR) in the Netherlands also show significant imbalances in the surface energy budget. In this study we will not solve this outstanding problem, but discuss different aspects of the problem. We start with some examples of SEB-imbalance on the local scale both for day and night time and look for correlations of the imbalance with the external conditions. Accuracy and representativity of the measurement techniques of radiation, eddy fluxes and soil heat flux are discussed in relation to SEB-closure. Then we explore closure at larger scales by exploiting the 200 m tower observations including flux observations at three levels in the 200 m tower and an XLAS scintillometer over a path of 10 km.