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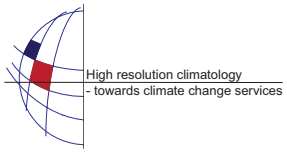

Low Frequency Loss in Regional Scale Flux Observations from a Tall Tower

F. C. Bosveld (1), J. Schalkwijk (2), A. P. Siebesma (1,2)
(1) KNMI, De Bilt, Netherlands (Fred.Bosveld@knmi.nl, 0031-30-2210407), (2) Technical University Delft, The Netherlands

Direct measurements of surface fluxes are nowadays often performed with the eddy-correlation technique. The method is well established for observations in the lowest few meters of the atmosphere which gives flux estimates with a footprint of typically 100 m. Models and satellite products often give results on the kilometer scale or larger and benefit for their evaluation from flux estimates with larger horizontal scales. Until now only a limited number of techniques are available for direct flux observation at larger scale, e.g. airborne eddy correlation, tall tower based observations and scintillometers. Elevated observations "see" a larger footprint.
We focus on tall tower flux observations. Specific problems arise when estimating surface fluxes from these elevated observations related to storage below the observation level and advection. A third concern and the focus of this presentation is the increase of length scale of the transporting turbulent eddies when going to higher levels in the atmospheric boundary layer and the related issue of low frequency loss.

With the Cabauw 200 m meteorological tower in the Netherlands a unique platform is available to perform tall tower flux observations. The tower has been equipped with eddy correlation systems at 5, 60, 100 and 180 m height which measures fluxes of momentum, temperature, humidity and CO2. In addition wind speed, temperature, humidity and CO2 concentration are measured at a number of intermediate levels. This set of instruments has been augmented with an extra large aperture scintillometer which operates at the 60 m level over the 10 km path between a TV-tower and the Cabauw meteorological tower.

Typically turbulence flux data is calculated on a 10 to 30 minute time basis. For atmospheric surface layer observation well established similarity relations exist to estimate low-frequency flux contributions. Low frequency contributions above the surface layer are less well established. We have analysed a large number of days and determined the flux contribution at timescales beyond the averaging time. On the basis of this analysis the surface layer relations for low frequency flux contributions are then generalized to higher levels in the atmospheric boundary layer.