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Filling gaps in the time series of tall tower flux measurements

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The expanding network of tall tower based eddy covariance measurements provides new insight into the biogeochemical cycles of the biosphere over an extended region as compared to the patch scale FLUXNET sites. For tall tower based eddy covariance systems the role of storage flux plays an increasing role with increasing measurement height, which raises new methodological issues. Here we present results based on the tall tower measurements performed at Lutjewad, The Netherlands (6º 21' E, 53º 24' N, 1 m ASL). At Lutjewad the eddy covariance system is installed at 50 m height above the ground, and no storage flux measurements are performed. The basic aim of our study is to provide a methodology to fill the measurement gaps and to provide daily net ecosystem exchange (NEE) sums without correcting for storage. Atmospheric fluxes are generally transformed to surface fluxes before gaps in the data are filled via the estimation of the storage flux. Without accurate storage estimation the transformation becomes less accurate with increasing distance above the surface. Here we propose an alternative method to fill gaps of atmospheric fluxes directly using empirical relations with environmental parameters. We find that atmospheric fluxes were time lagged to variations in radiation. Moreover, we find atmospheric fluxes at elevated height increase almost proportionally with friction velocity. These findings were related to storage between the surface and measurement level. Our results are compared with data taken from the Hungarian tall tower measurements where storage flux is estimated.