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Characterization of potential EC flux underestimation of “sticky” trace gas species

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Eddy covariance (EC) flux measurements of “sticky” trace gas species are affected of damping of high frequency variations of the gas concentration. Several approaches have been developed to correct for this effect (see e.g. Ibrom et al., 2007, Ammann et al., 2006). These approaches have in common that the spectral properties of the scalar are compared with the sonic temperature deduced from the Sonic anemometer data that is only marginally damped. A main difference between the two method is that one uses power spectra, while the other is based on co-spectra of the gas concentration with the vertical wind speed.
NH3 fluxes used in the analysis stem from two field experiments: a) Posieux intercomparison October 2015: NH3 emissions of a grazed pasture measured with Eddy Covariance using an Aerodyne quantum cascade laser and with a horizontal gradient measurement using MiniDOAS systems (Sintermann et al., 2016) in conjunction with a dispersion model. b) Dronten experiment June 2016 in the Netherlands: NH3 emissions from two manured circles within 40m diameters have been determined with four different approaches (Eddy Covariance, Integrated Horizontal Flux approach, horizontal gradients and plume measurements).
Despite correction with standard methods, turbulent NH3 flux measurements with the eddy covariance method seem still be underestimated when, e.g., compared to flux estimated using gradient methods. We discuss possible correction algorithms and how such underestimations can be recognized in the usual case, where no alternative flux estimation methods are available.

References:
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