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EC-Measurements of CO_2, CH4 and N2O over a Maize field

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In order to quantify the full greenhouse gas balance of an agroecosystem, all relevant greenhouse gases (CO_2, CH_4, N_2O), which are exchanged between the land surface and the atmosphere, have to be measured. To achieve this, an eddy covariance system in combination with a Quantum cascade laser was setup at agricultural fields of the TERENO Research Station Scheyern, 40 km north of Munich. The advantages of this approach are that greenhouse gases fluxes are measured i) continuously and at high frequency ii) at the field scale and iii) with minimal disturbance of the ecosystem.
The EC-Station was set up with a 3D-anemometer (CSAT3), an open path infrared gas analysator for CO_2-fluxes (LICOR7500) and a closed path analyser for CH_4- and N_2O-fluxes (QCL-TILDAS, Aerodyne Research Inc., Billerca Massachusetts). Additionally, soil water content, soil water tension, soil temperature, soil surface temperature, air temperature, relative humidity, wind speed and many more parameters were measured.
We present the results for a whole vegetation period for which we recorded fluxes for all three greenhouse gases (2014-1/2015-10). Expected high N_2O emissions due to frost thaw events could not be detected during 2014/2015. However, N_2O-flux up to 38 nmol $m^{-2}s^{-1}$ have been measured after N-fertilization and during wet periods with high water contents of the top soil. Molar CH_4-fluxes exceeded molar N_2O-fluxes regularly, but their greenhouse gas potential was lower than that of the N_2O fluxes.