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# Reactive nitrogen fluxes over peatland and forest ecosystems using micrometeorological measurement techniques

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*Table S1: Overview of literature presenting eddy-covariance measurements of reactive nitrogen compounds. Some additional flux campaigns are listed in the publication of Walker et al. (2020).*

| **Paper** | **Compound** | **Main aim of study** | **Dataset length** | **Flux uncertainty / detection limit** | **Vegetation type** |
|---|---|---|---|---|---|
| Ammann et al. (2012) | $\Sigma N_r$ | Suitability of converter for EC measurements | Few weeks are shown for cross-validation with other techniques | ~5 ng N $m^{-2}$ $s^{-1}$ (upper flux detection limit) | Managed grassland |
| Brümmer et al. (2013) | $\Sigma N_r$ | Temporal dynamics, controlling factors, and seasonal N budget | 11 months | ~6.6 ng N $m^{-2}$ $s^{-1}$ (upper flux detection limit) | Cropland (winter wheat) |
| Eugster and Hesterberg (1996) | $NO_2$ | Deriving transfer resistances | Four different periods with a total of 68 days | Not explicitly given | Rural litter meadow |
| Famulari et al. (2004) | $NH_3$ | Suitability of TDLAS system for EC; cross-validation with AGM | 2 months | Not explicitly given, only standard deviation of fluxes for entire campaign | Managed grassland |
| Farmer and Cohen (2008) | $HNO_3$, $\Sigma AN$, $\Sigma PN$ and $NO_2$ | In-canopy chemical analysis | 12 months | Not explicitly given | Ponderosa pine plantation |
| Farmer et al. (2006) | $HNO_3$, $\Sigma AN$, $\Sigma PN$ and $NO_2$ | Suitability of TD-LIF system for EC | 12 months; shorter periods are shown from different seasons | <1 ng N $m^{-2}$ $s^{-1}$; <20% relative errors at low wind speed (<1 m $s^{-1}$) | Ponderosa pine plantation |
| Farmer et al. (2011) | Aerosols ($NH_4$, $SO_4$, $NO_3$) | Suitability of HR-AMS system for EC | 15 days | ~0.4 to 6.4 ng $m^{-2}$ $s^{-1}$ depending on substance and mode; typical single flux measurement was below DL for $NH_4$ fragments | Ponderosa pine plantation |
| Ferrara et al. (2012) | $NH_3$ | Comparison of high-frequency correction methodologies using QC-TILDAS | 13 days | ~75 ng N $m^{-2}$ $s^{-1}$ (flux detection limit) | Cropland (sorghum) |
| Ferrara et al. (2016) | $NH_3$ | Temporal dynamics of $NH_3$ volatilization after slurry application using QC-TILDAS | ~14 days | Only MAE (4700 ng $NH_3$ $m^{-2}$ $s^{-1}$) and RMSE (12000 ng $NH_3$ $m^{-2}$ $s^{-1}$) given | Maize stubbles and Italian ryegrass |

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| Ferrara et al. (2021) | $NH_3$ | Evaluation of measurement errors using QCL spectrometer | 21 days | 13.6 and 20.7 ng $m^{-2}$ $s^{-1}$ at 95 and 99% CI, respectively | Cropland (faba bean) |
| Horii et al. (2004) | NO, $NO_2$, $O_3$ | Impacts of temporal dynamics on tropospheric chemistry and parameterizations | 7 months, but no time series shown | Not explicitly given | Mixed deciduous forest |
| Horii et al. (2006) | $NO_x$, $NO_y$ | Concentration and flux budgets of $N_r$, inferring $HNO_3$, validation of deposition velocities | 5 months, but only time series of ~2 weeks are shown | Not explicitly given | Mixed deciduous forest |
| Marx et al. (2012) | $\Sigma N_r$ | Suitability of converter for capturing all $N_r$ species at high frequency | 1-week validation, 11 months field campaign | Not explicitly given as aim was on concentrations and fast response | Managed grassland and cropland (winter wheat) |
| Min et al. (2014) | NO, $NO_2$ | Comparison of gradient and direct flux measurements; within-canopy chemistry of $NO_x$ | 6 weeks, no time series shown | <8% for NO flux; <6% for $NO_2$ flux; 0.08 ppt m $s^{-1}$ (NO); 0.14 ppt m $s^{-1}$ ($NO_2$) | Ponderosa pine plantation |
| Moravek et al. (2019) | $NH_3$ | Quantify impact of adsorption on time response of the system | 5 months | Median flux detection limit of 2.15 ng $m^{-2}$ $s^{-1}$ | Corn crop field |
| Munger et al. (1996) | $NO_y$, $O_3$ | Response of $NO_y$ deposition to environmental conditions | 5 years | Only given for concentrations (~50 ppt at the mixed forest site and <10 ppt at the spruce woodland) | Mixed deciduous forest and spruce woodland |
| Rummel et al. (2002) | NO | Flux pattern within the canopy | 3 months | 0.07 ng N $m^{-2}$ $s^{-1}$ | Amazonian rain forest |
| Sintermann et al. (2011) | $NH_3$ | Suitability of a CIMS (chemical ionization mass spectrometry) instrument for EC measurements | Few days | 5 ng N $m^{-2}$ $s^{-1}$ | Crop stubble field and cut grassland |
| Sun et al. (2015) | $NH_3$ | Suitability of the open-path $NH_3$ sensor for EC measurements and comparison to other commercial sensors | 2 weeks | 1.3 +/- 0.5 ng $m^{-2}$ $s^{-1}$ | Cattle feedlot |

| | | | | | |
|---|---|---|---|---|---|
| Wang et al. (2021) | $NH_3$ | Suitability of the open-path $NH_3$ sensor for EC measurements | 1 week | 7.1 ug N $m^{-2}$ $h^{-1}$ | Subtropical rice paddy |
| Whitehead et al. (2008) | $NH_3$ | Suitability and inter-comparison of different analyzers | 2 campaigns, only few days are presented | Not explicitly given | Managed grassland |

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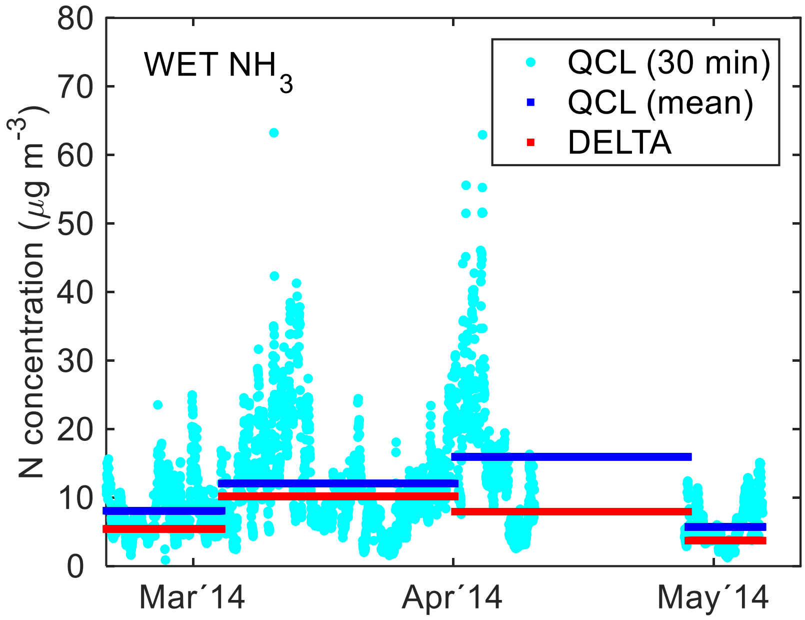


*Fig. S1: Concentration time series of $NH_3$ at the peatland (WET) site. Horizontal red lines correspond to the exposition time of the DELTA denuders. For better comparability, averages of the QCL are shown in blue for the same periods.*

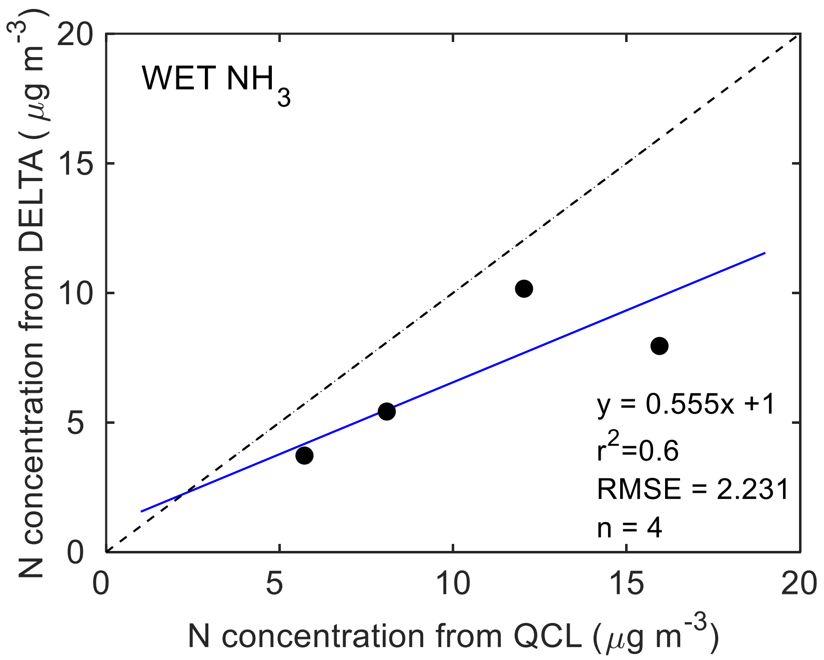


*Fig. S2: Scatter plot of $NH_3$ concentration from QCL and DELTA denuders corresponding to identical periods at the peatland (WET) site.*

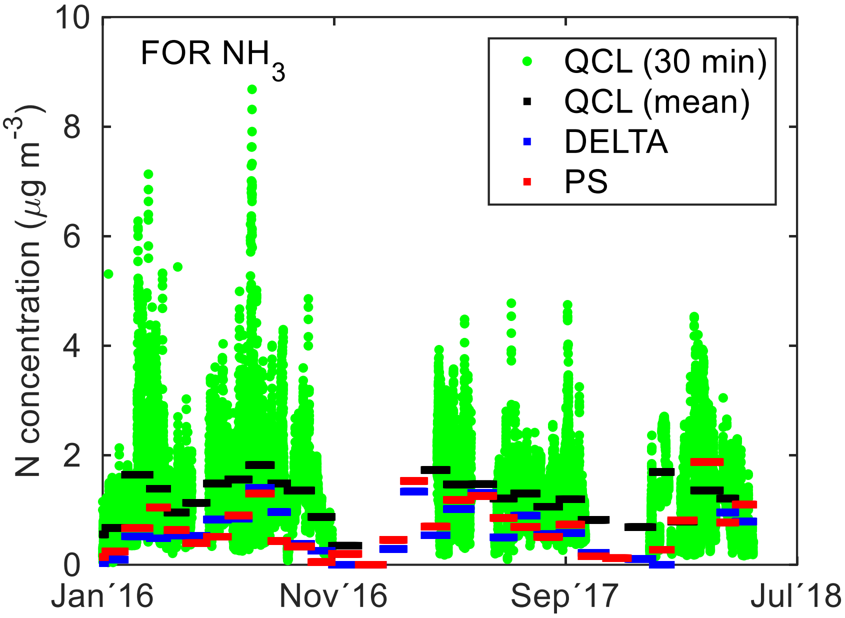


*Fig. S3: Concentration time series of $NH_3$ at the forest (FOR) site. Horizontal blue and red lines correspond to the exposition time of the DELTA denuders and passive samplers (PS), respectively. For better comparability, averages of the QCL are shown in black for the same periods.*

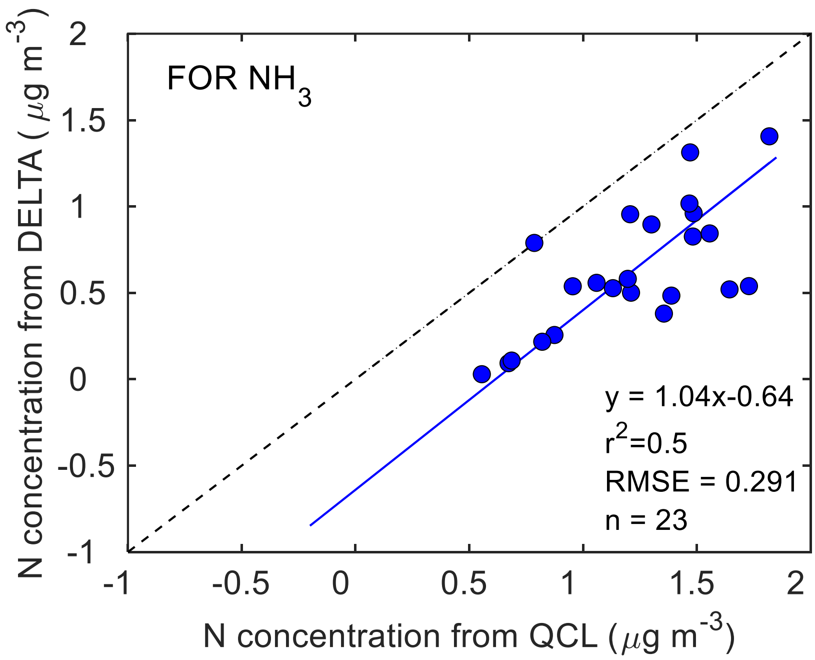


*Fig. S4: Scatter plot of $NH_3$ concentration from QCL and DELTA denuders corresponding to identical periods at the forest (FOR) site.*

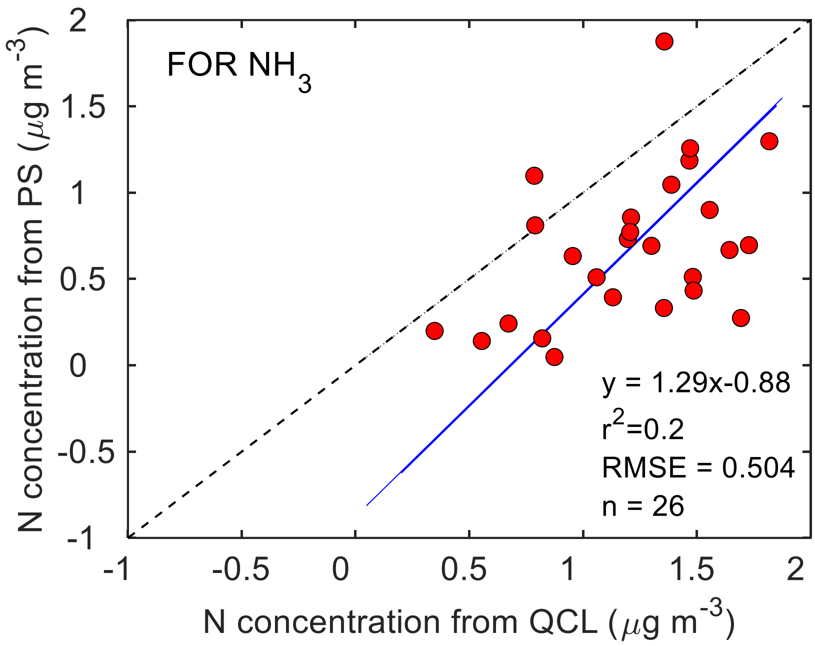


*Fig. S5: Scatter plot of $NH_3$ concentration from QCL and passive samplers (PS) corresponding to the same periods at the forest (FOR) site.*

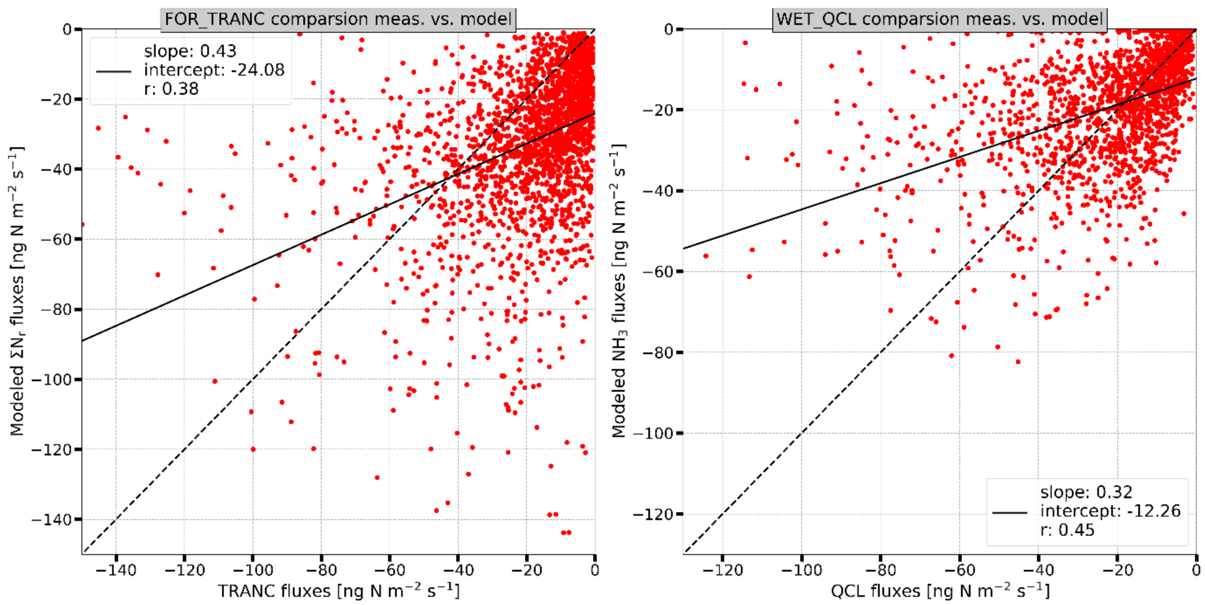


*Fig. S6: Measured vs. modeled deposition data in half-hourly time resolution at the forest (FOR, left panel) and peatland site (WET, right panel). FOR data comprise the period mid-July to end of September 2016. For the WET site the entire campaign from February to May 2014 is shown.*

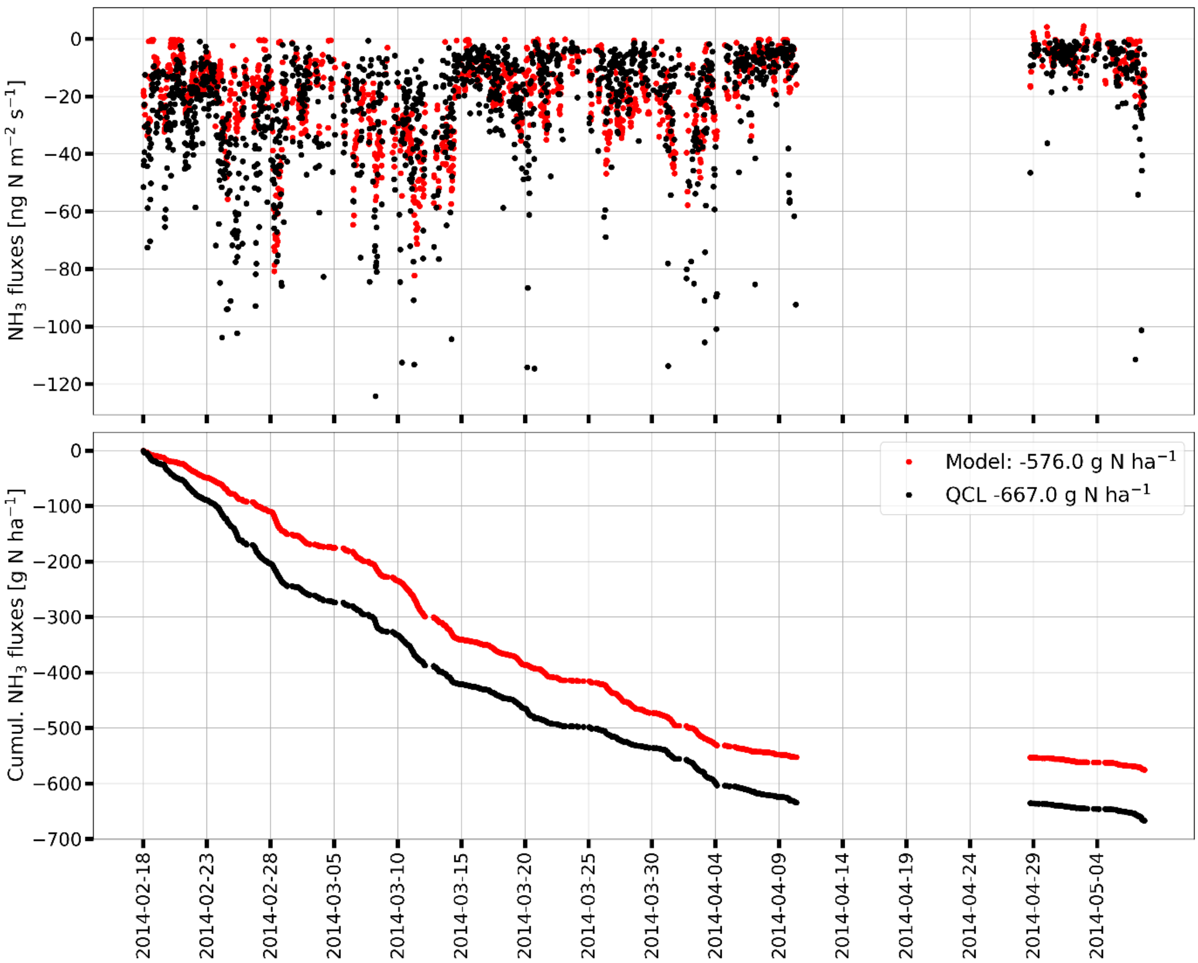


*Fig. S7: Time series (upper panel) and cumulative curves (lower panel) of measured vs. modeled deposition data in half-hourly time resolution at the peatland site (WET) from February to May 2014.*

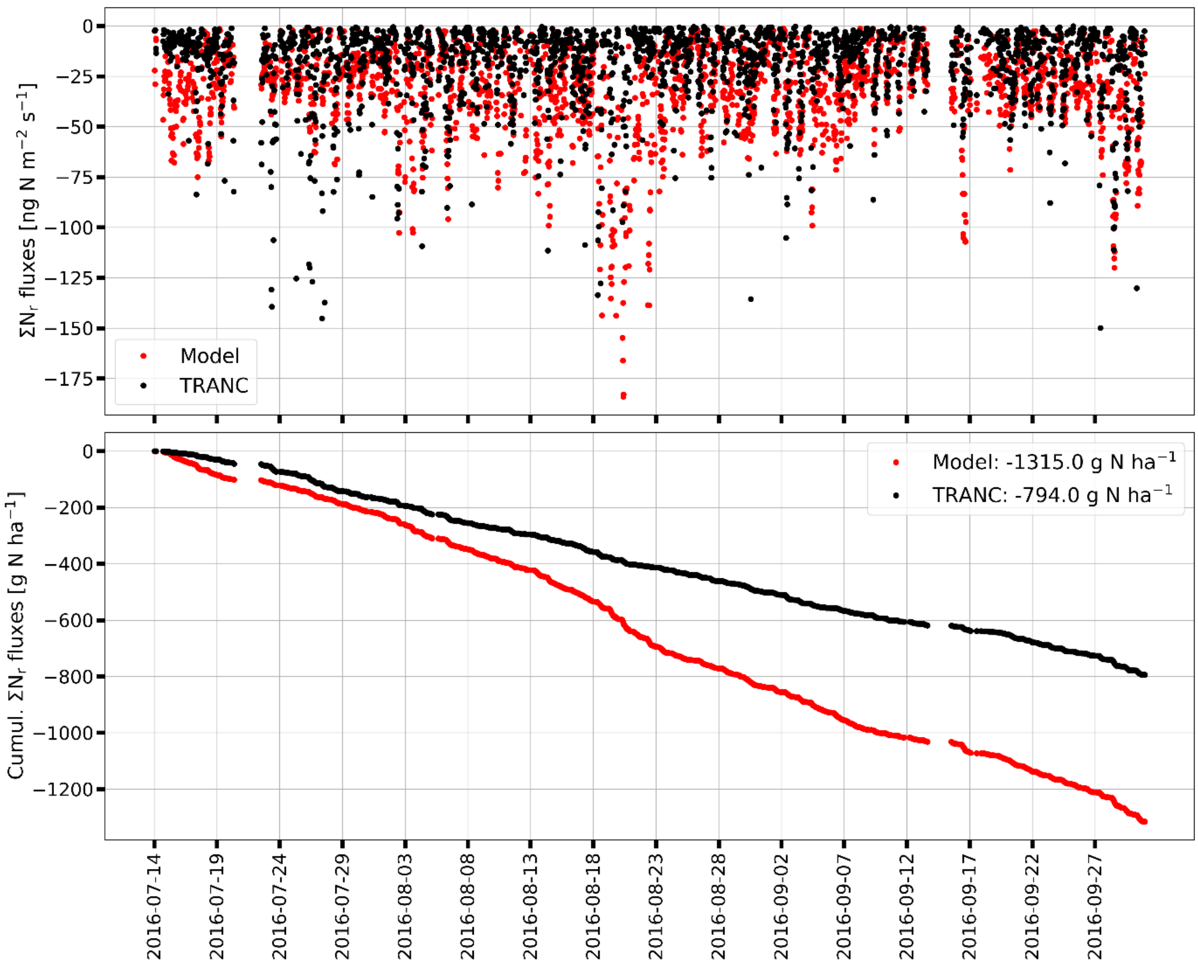


*Fig. S8: Time series (upper panel) and cumulative curves (lower panel) of measured vs. modeled deposition data in half-hourly time resolution at the forest site (FOR) from mid-July to September 2016.*