Spatial distribution of hydroxylamine and its role in aerobic N_2O formation in a Norway spruce forest soil

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➢ Introduction

- N_2O is a crucial greenhouse gas and its concentration has increased about 10% in the last 60 years.

- The estimation of soil N_2O emissions is highly uncertain due to the spatial heterogeneity (e.g. topography and tree species) even in a small region.

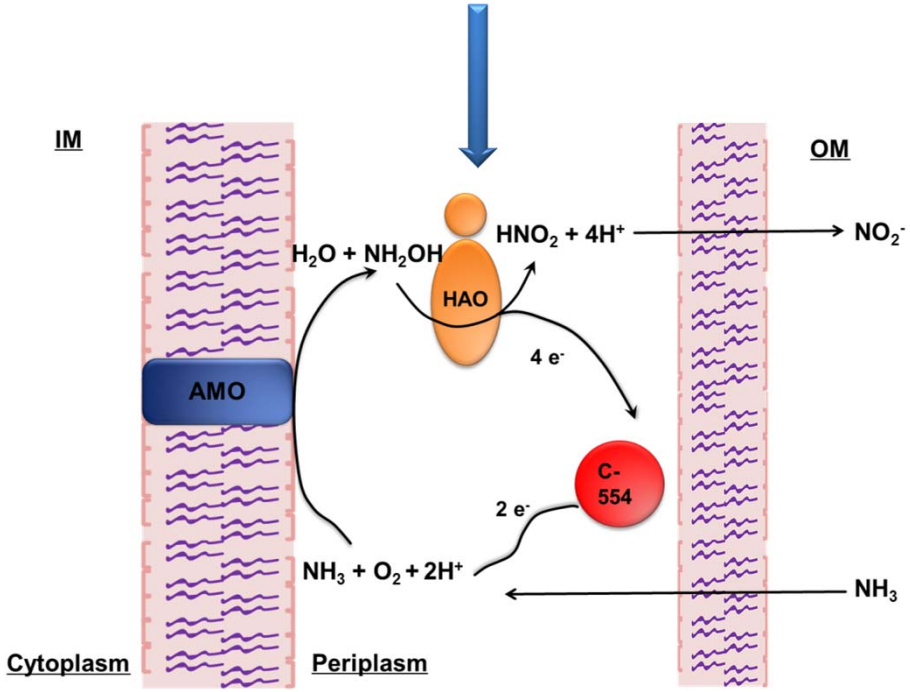
- The mechanisms responsible for N_2O emissions in forest ecosystems are still unclear. Denitrification vs. nitrification?

Denitrification and nitrification

Denitrification process: NO_3^- → NO_2^- → NO → N_2O

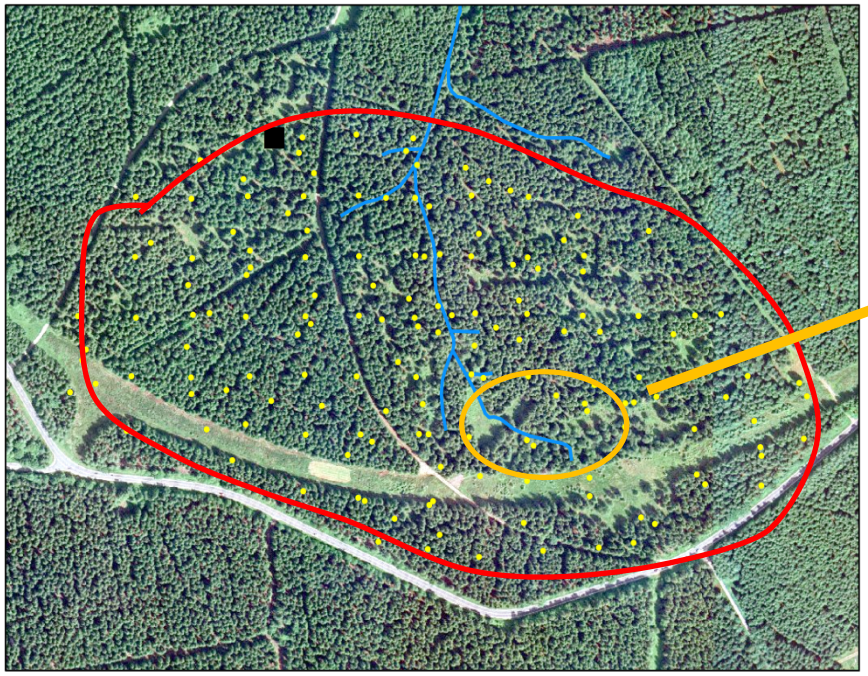
Nitrification process: NH_4^+ → NO_2^- → NO_3^-

NH_2OH(HA) - - - - -> **N_2O**



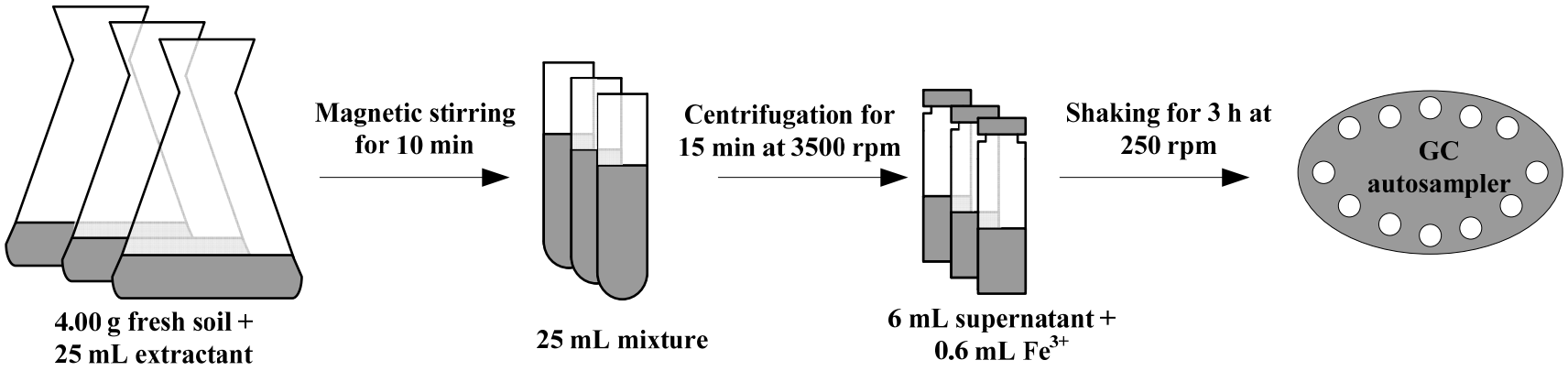
➢ Experimental site

Wüstebach:



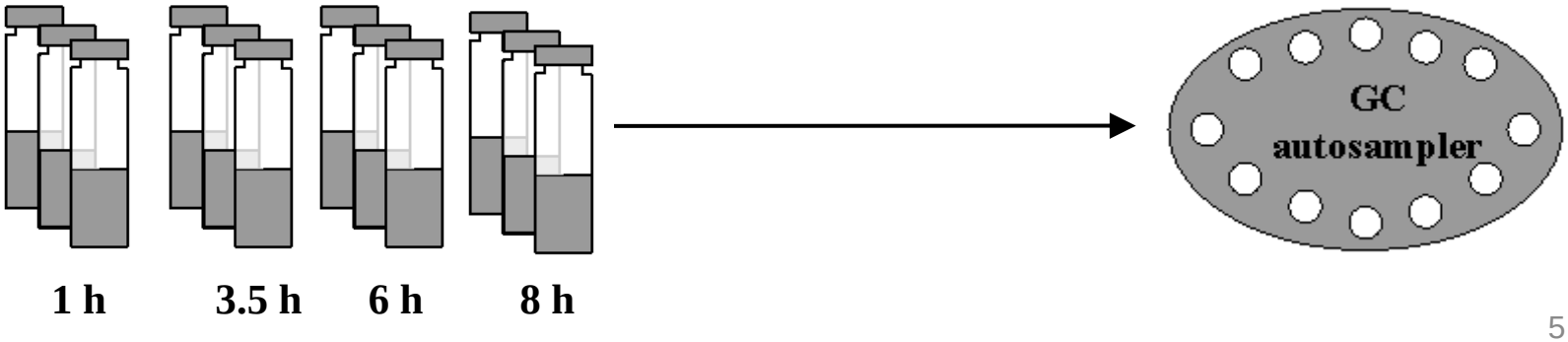
➢ Materials and methods

❖ For hydroxylamine (HA):

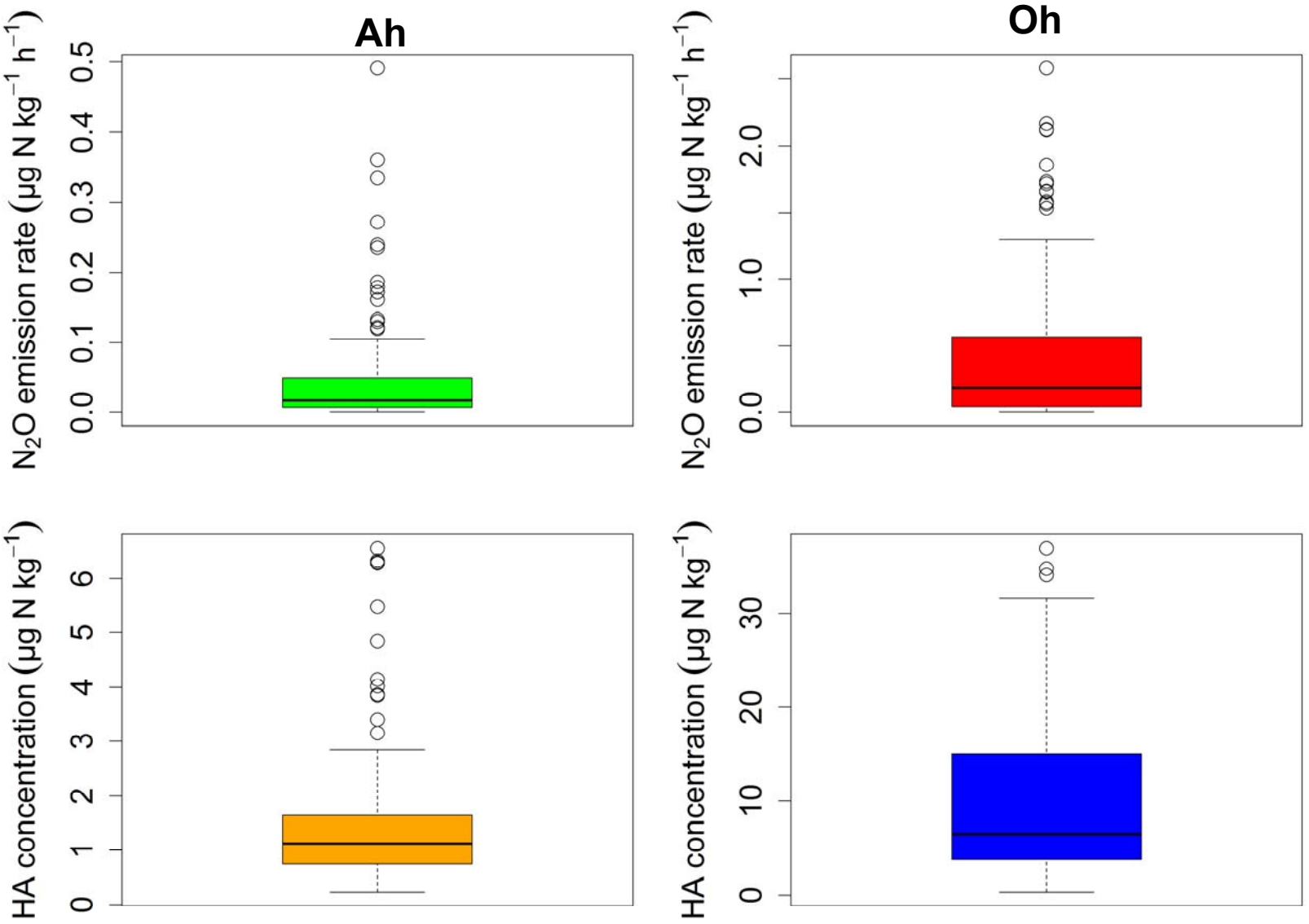


(Liu et al. 2014)

❖ For N_2O emissions:

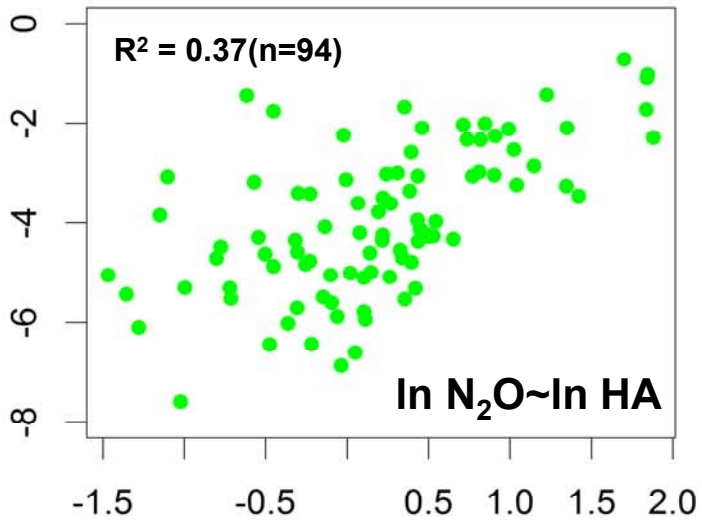


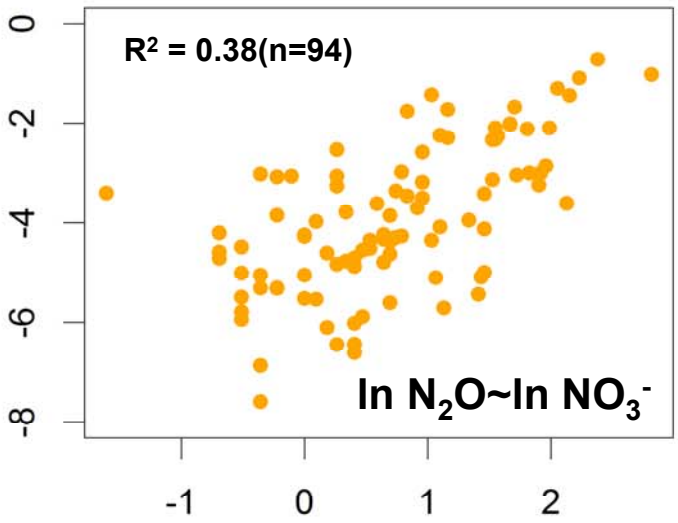
➢ Results and discussion



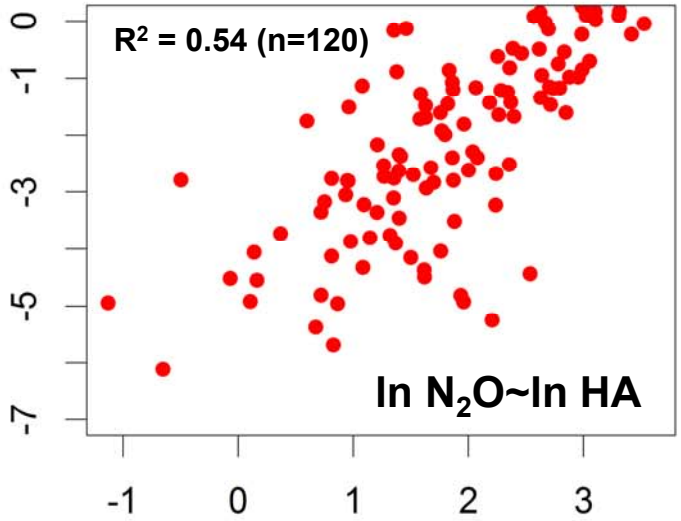
➢ Nitrate or HA?

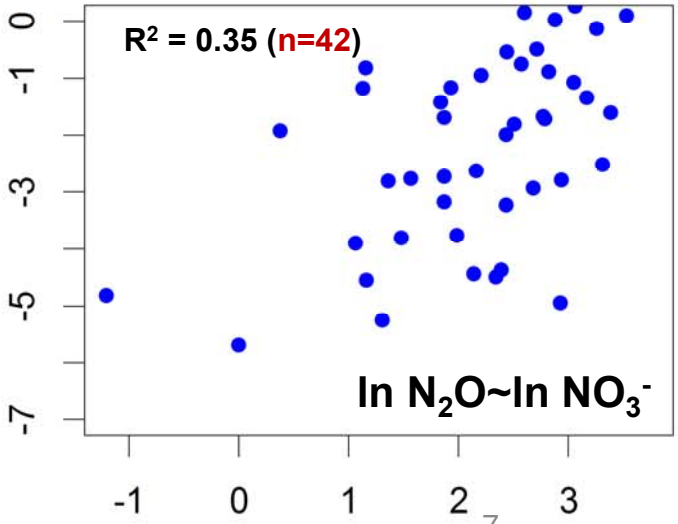
Ah



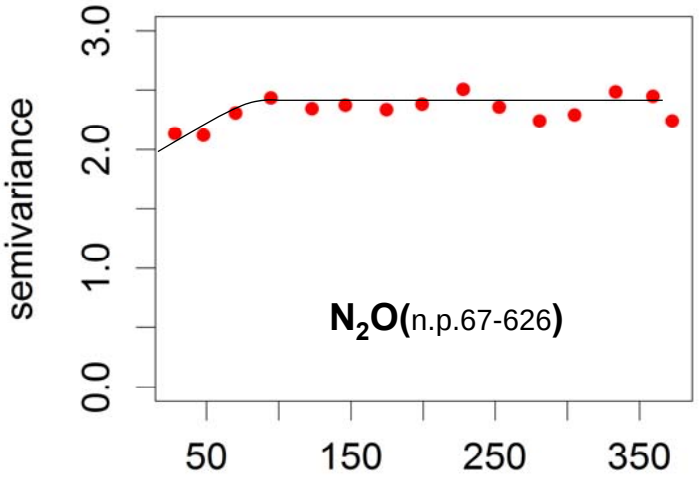


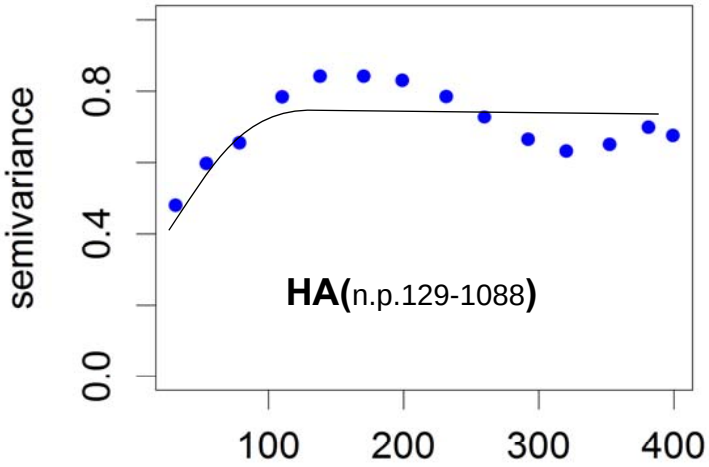
Oh

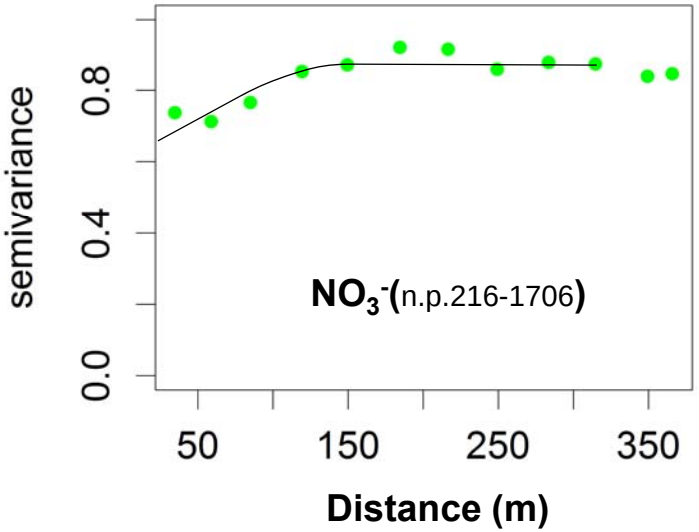


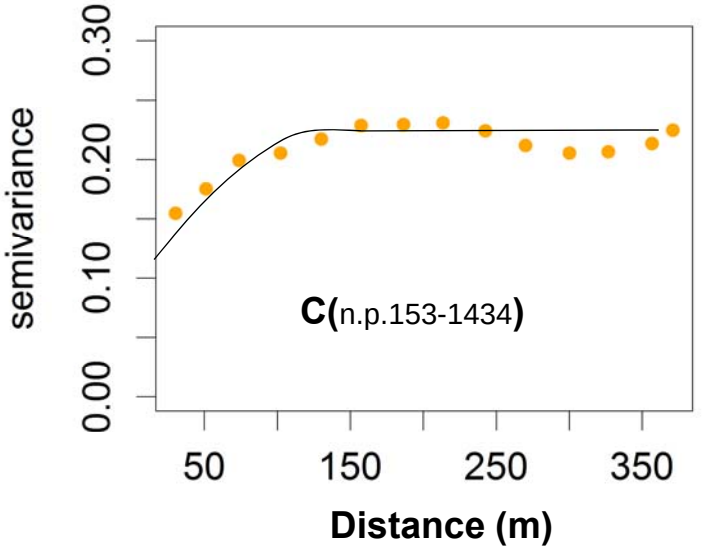


Geostatistics

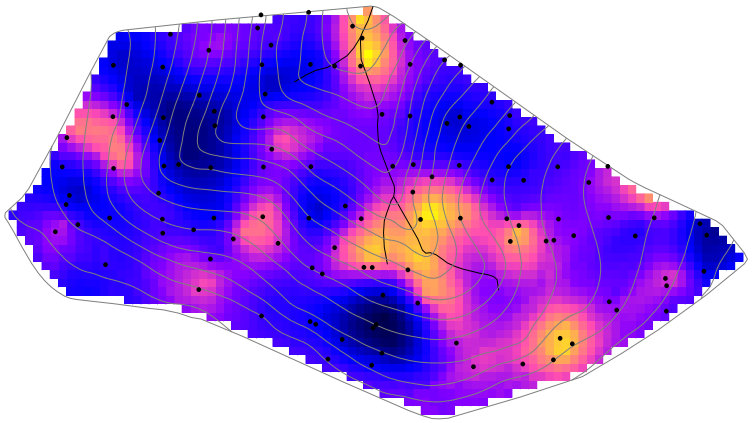




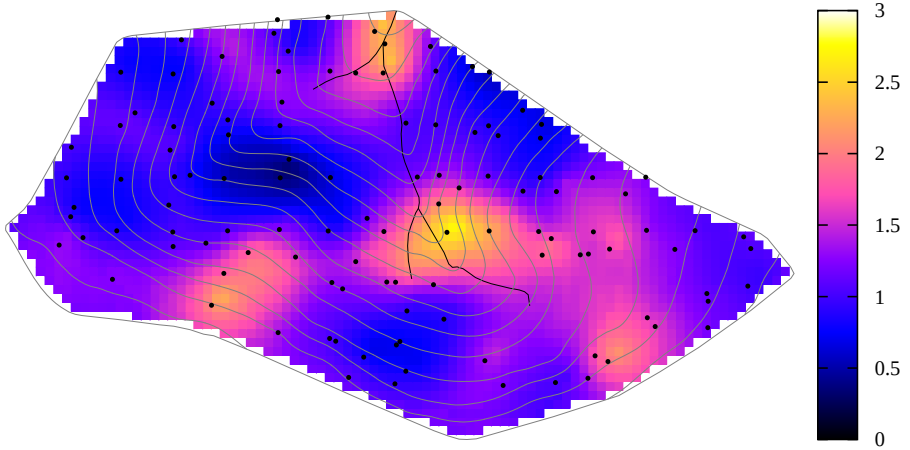




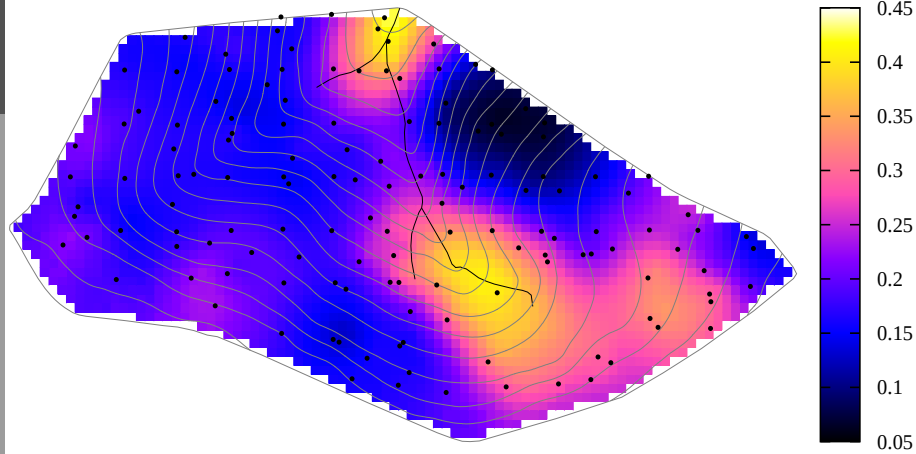
Kriging maps



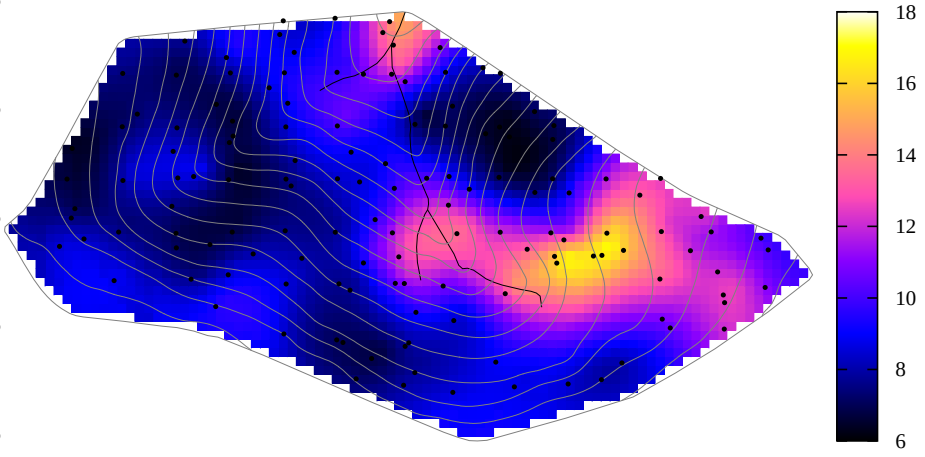
N_2O (µg N kg^{-1} dry soil h^{-1})



HA (µg N kg^{-1} dry soil)



NO_3^- (mg 100 g^{-1} dry soil)



C (%)

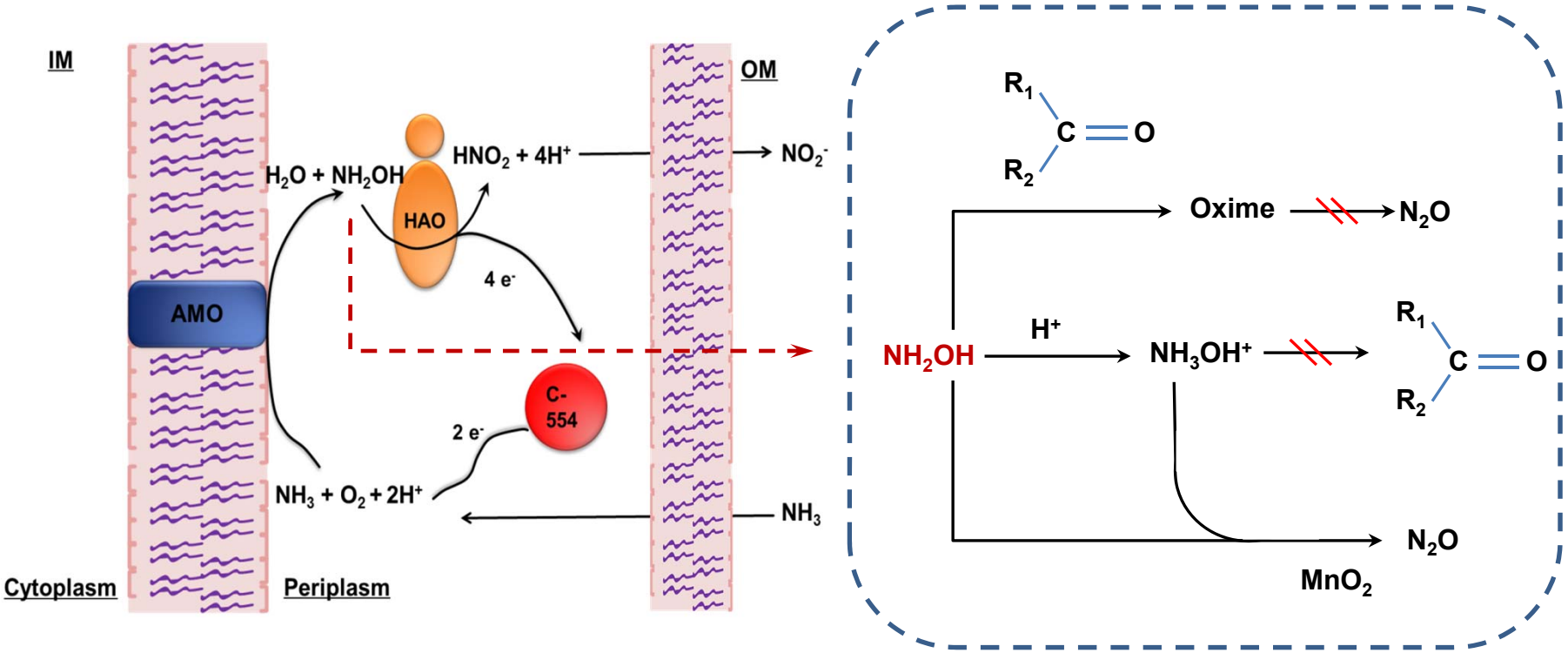
Stepwise multiple regression

N_2O ~ HA + NO_3^- + C + SWC + Mn + pH + P_{in} + Fe

(R^2 = 0.60)

Covariates	Estimates	p value
Intercept	-1.2706	0.5218
HA	1.0351	<0.001***
NO_3^-	0.5080	0.0015**
C	-1.1751	0.0111*
SWC	4.6722	0.0182*
Mn	0.2632	0.0237*
pH	-0.8586	0.0272*
P_{in}	0.8371	0.0546
Fe	-0.0006	0.1073

Conceptual model



➢ Conclusions

- N_2O and hydroxylamine have high spatial heterogenity in the whole area, with high emission rates and concentrations in the source of the wüstebach catchment, despite the high water content.

- Hydroxylamine plays a crucial role for the prediction of soil N_2O emissions in the forest.

- The best model for predicting N_2O emissions in this forest includs HA, NO_3^-, C, SWC, Mn and pH as predicting variables.

Thank you for your attention!