Long-term changes in the inorganic nitrogen output in European ICP Integrated Monitoring catchments – an assessment of the role of internal N-related parameters

Preliminary results

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representatives of focal points…

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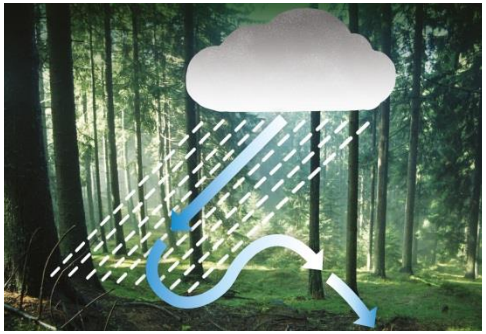

Call for data / data mapping 2019

- Routine monitoring variables do not explain variation/change in TIN output satisfactorily, because not all potential drivers were included in the empirical models

  ➡ Further analysis with specific catchment and soil data is needed: Data mapping on internal catchment N-related parameters at IM sites

- Data collected
  - Soil chemistry (SC): N tot, TOC, pH
  - Soil water chemistry (SW): NO_3, NH_4, N tot, TOC/DOC, pH
  - Litterfall chemistry (LF): N tot, TOC, litterfall amount (d.w.)
  - Foliage chemistry (FC): N tot, TOC, sample weight (d.w.)
- Based on available data (2010-2017) in IM database, the following sites with RW measurements (chemistry and/or runoff volume) were included in to the N assessment: AT01, CZ01, CZ02, DE01, EE02, ES02, FI01, FI03, LT01, LT03, NO01, NO02, PL06, PL10, SE04, SE15, SE16 (17 sites from 10 countries).
- Can these parameters help to explain the variation/trends of TIN in RW at IM sites?

SYKE

Preliminary analysis of data

- Soil water flux (SW_q) was calculated using chloride mass-balance method: SW_q = (Cl bulk + dry deposition / Cl concentration in SW)
- Soil chemistry data from O-horison,
- Soil water data from 30-40 cm depth
- Annual means between 2010 and 2017

- First exploration of data:
    - Update of trends for PC, TF and RW in 1990-2017
    - Correlation analysis
    - Multiple regression
    - Discriminant analysis

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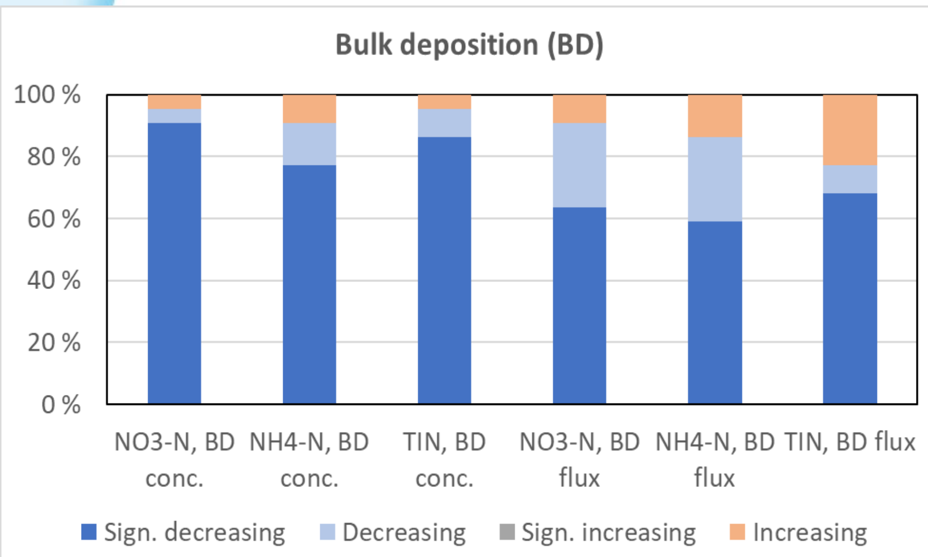
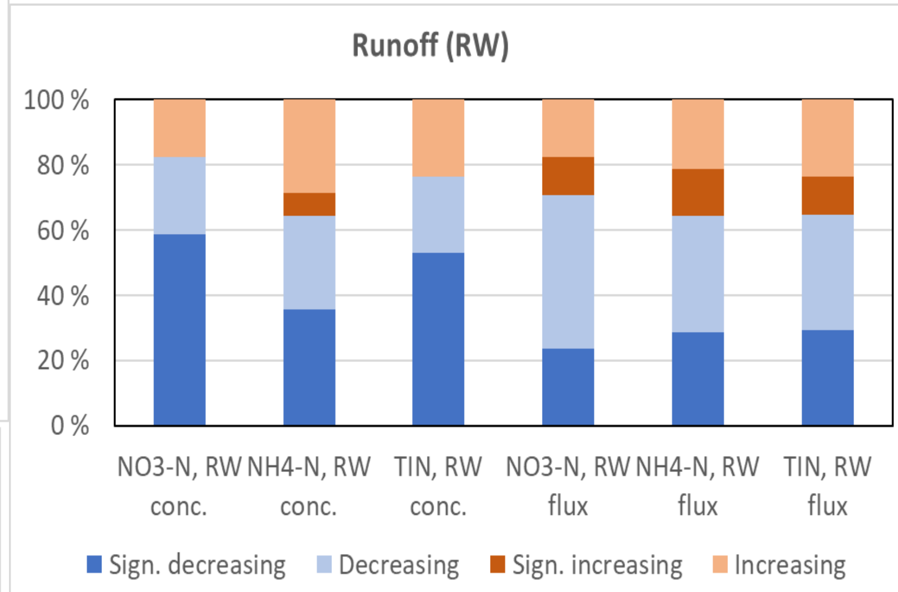
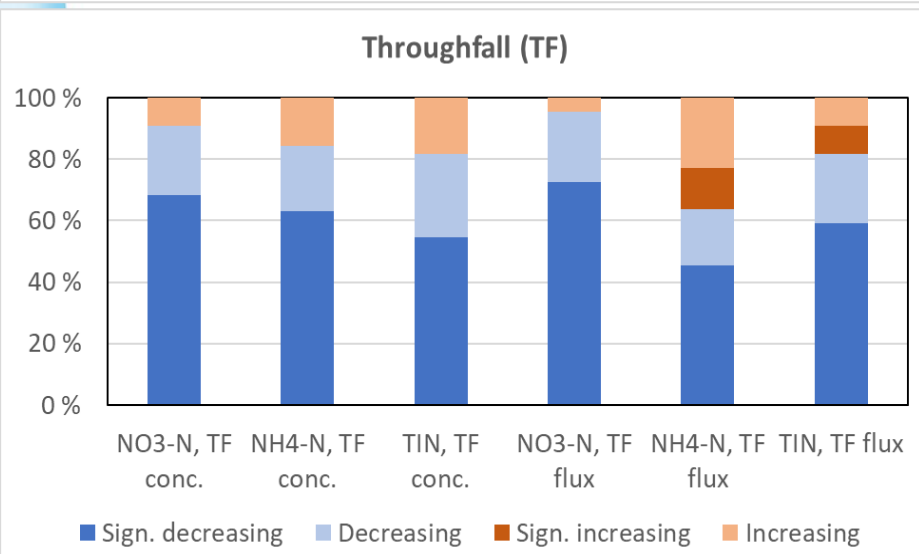
Trend assessment for IM sites: general decrease in N deposition in 1990-2017. Is there a similar decline in TIN output in runoff ?







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Correlation analysis: N in litterfall, foliage, soilwater, and throughfall deposition, and trends in runoff were related to variation of TIN trends in RW

- $p < 0.05$, - negative, + positive; *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Deposition and Runoff	mean TIN, TF	ΔTIN, BD	Δ Runoff
Δ TIN conc. RW	---	+	
Δ TIN flux RW	--	+	++
mean TIN conc. RW	++		
mean TIN flux RW	+		

Foliage and litterfall	mean N tot in FC	mean LF amount	mean N tot in LF
Δ TIN conc. RW	--	--	--
Δ TIN flux RW	--	-	---
mean TIN conc. RW	+	+++	++
mean TIN flux RW	++	+	++

Soil chemistry	mean TOC in soil OH	mean C/N in soil OH
Δ TIN conc. RW	+	(+, p=0.07)

Soil water chemistry	mean TIN conc. in SW	mean N tot conc. in SW	mean TOC conc. in SW	mean TIN flux in SW	mean N tot flux in SW
Δ TIN conc. RW		---	-		---
Δ TIN flux RW	--			--	
mean TIN conc. RW	+				

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Multiple regression and discriminant analysis also higlight the role of N parameters

- Multiple regression:
  - Δ TIN conc. in RW (mg/L/yr) = mean tot N in FC (mg/g) (R^2=0.88)
  - Δ TIN flux in RW (kg/ha/yr) = mean tot N in FC (mg/g) (R^2=0.94)
  - Mean TIN conc. in RW (mg/L) = mean tot N in FC (R^2=0.97)
  - Mean TIN flux in RW = mean N tot in FC (R^2=0.95)

- Discriminant analysis between two groups:

1) sites with sign. decreasing trend in TIN conc. and fluxes in RW, and 2) sites with no sign. trends

  - Δ TIN conc. In RW (mg/L/yr) = mean N tot in LF
    - Mean N tot in LF (group 1) > mean N tot in LF (group 2)
  - Δ TIN flux in RW (mg/L/yr) = mean TIN in TF; mean TIN conc. in SW
    - Mean TIN in TF and TIN conc. in SW (group 1) > Mean TIN in TF and TIN conc. in SW (group 2)

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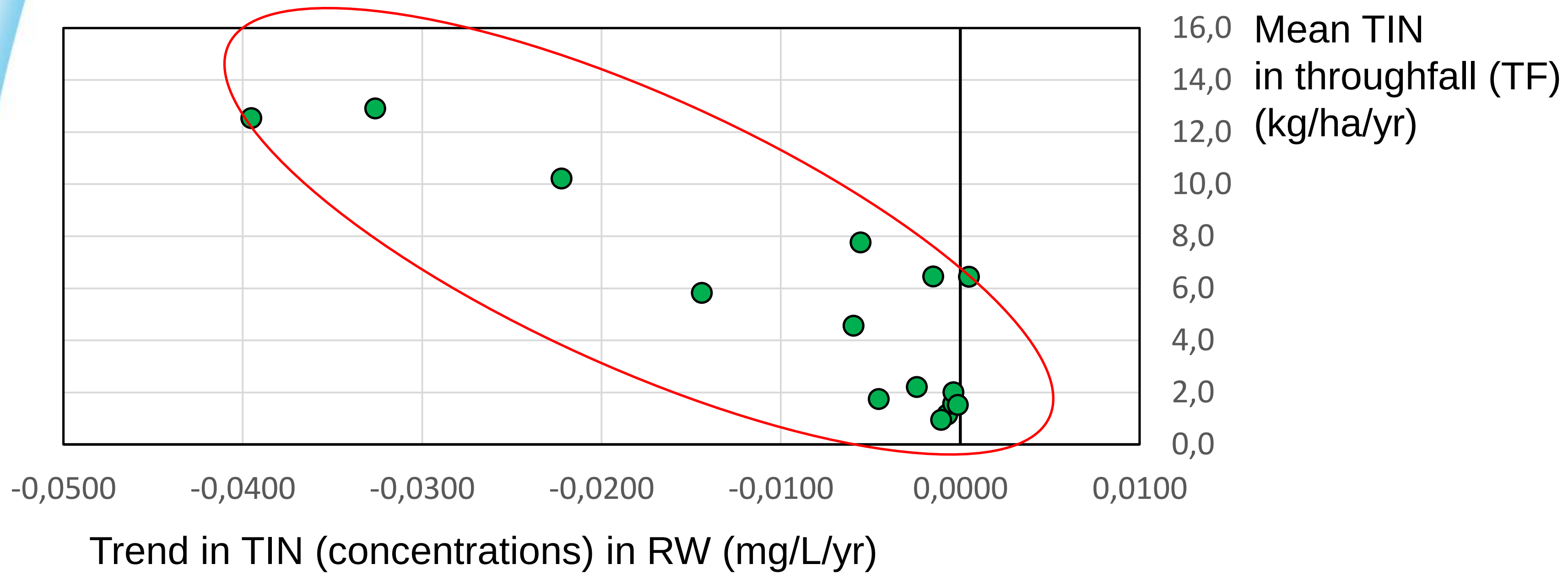
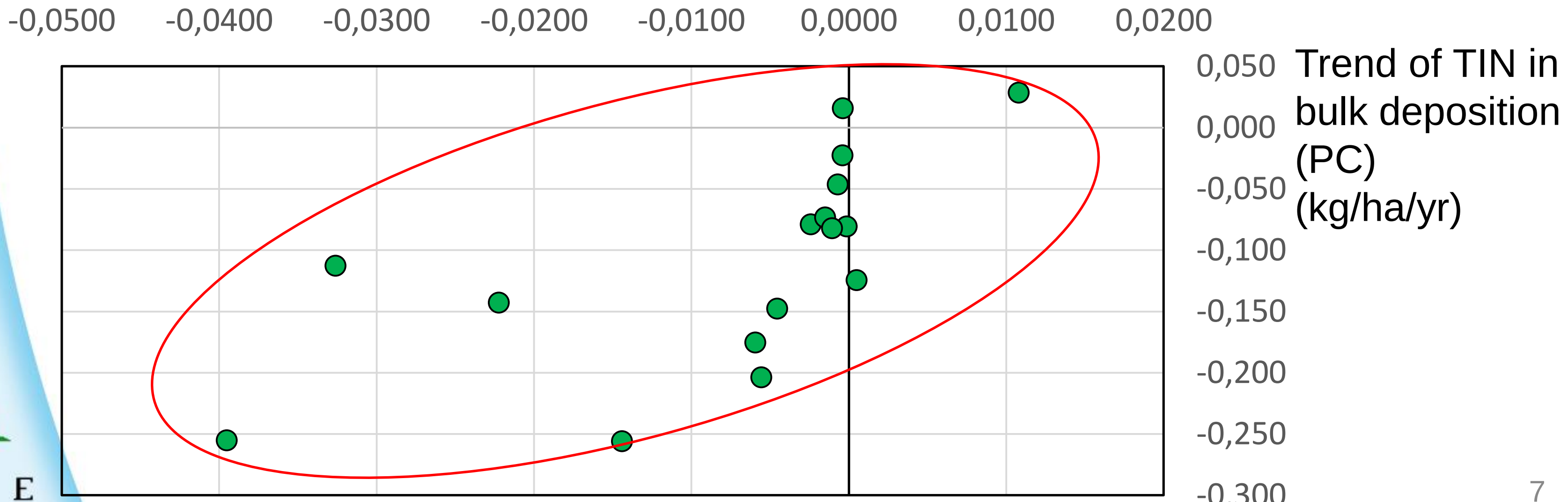
Largest declines in TIN at sites with high N in TF and largest decrease of N in PC





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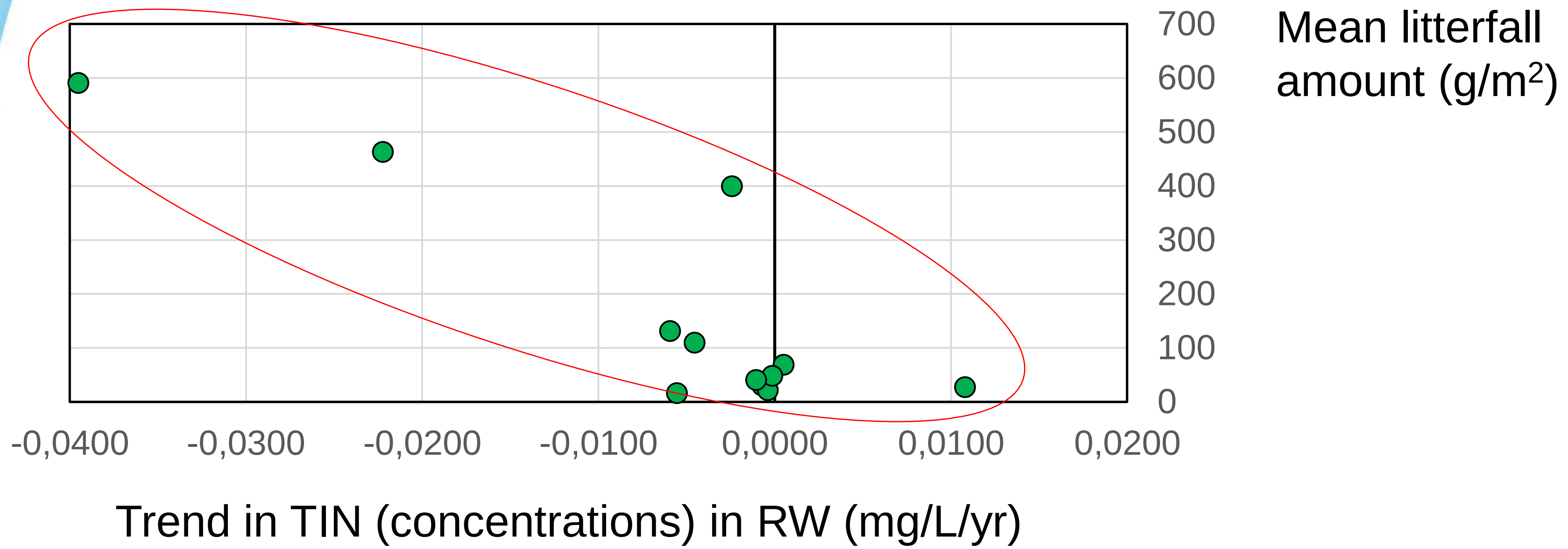
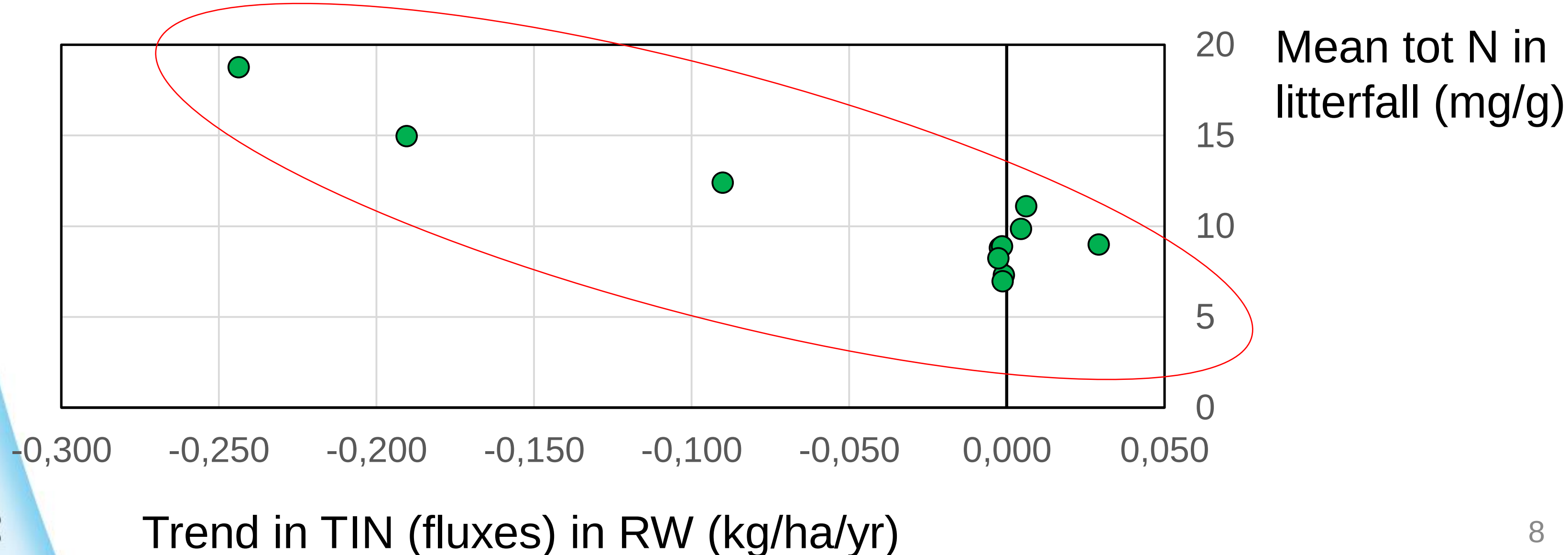
LF amount and N amount in LF affect to TIN trends in RW





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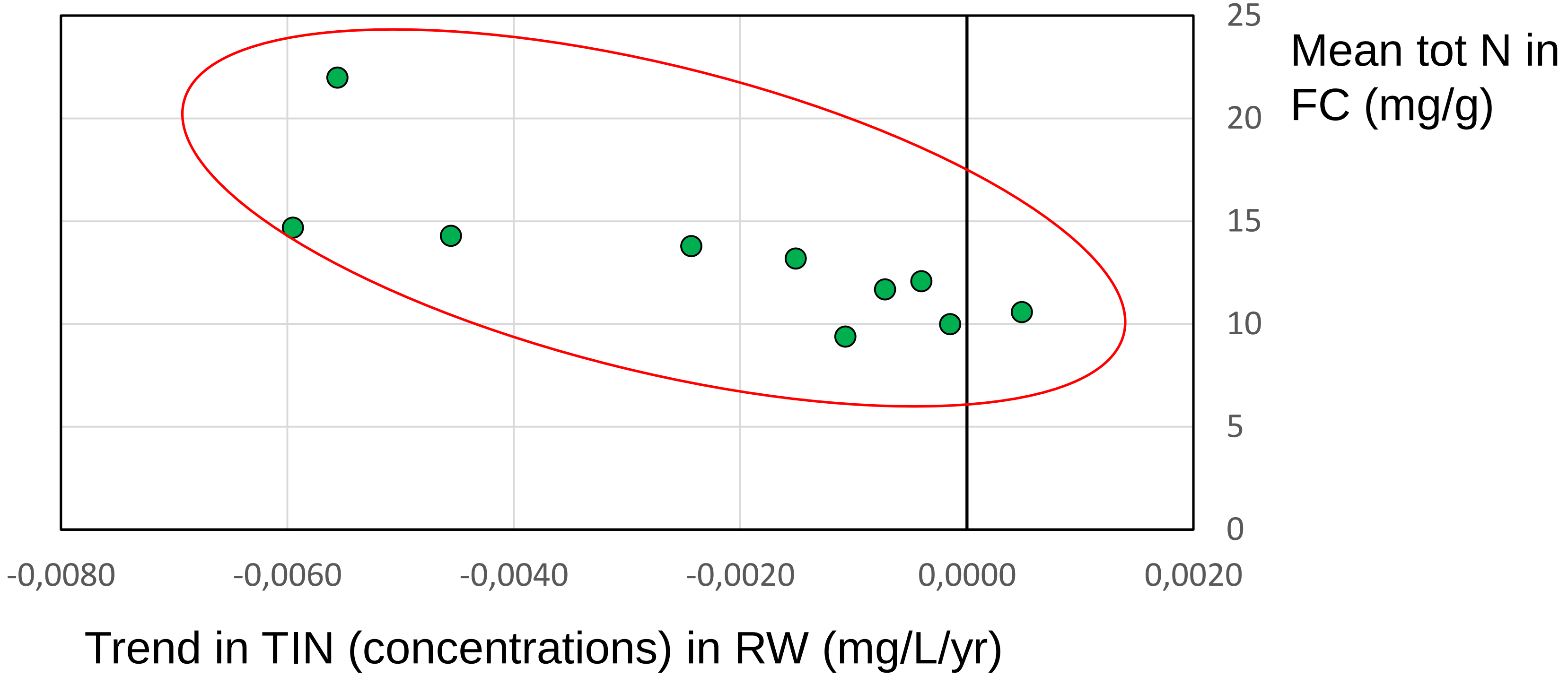
Also tot N in FC affects



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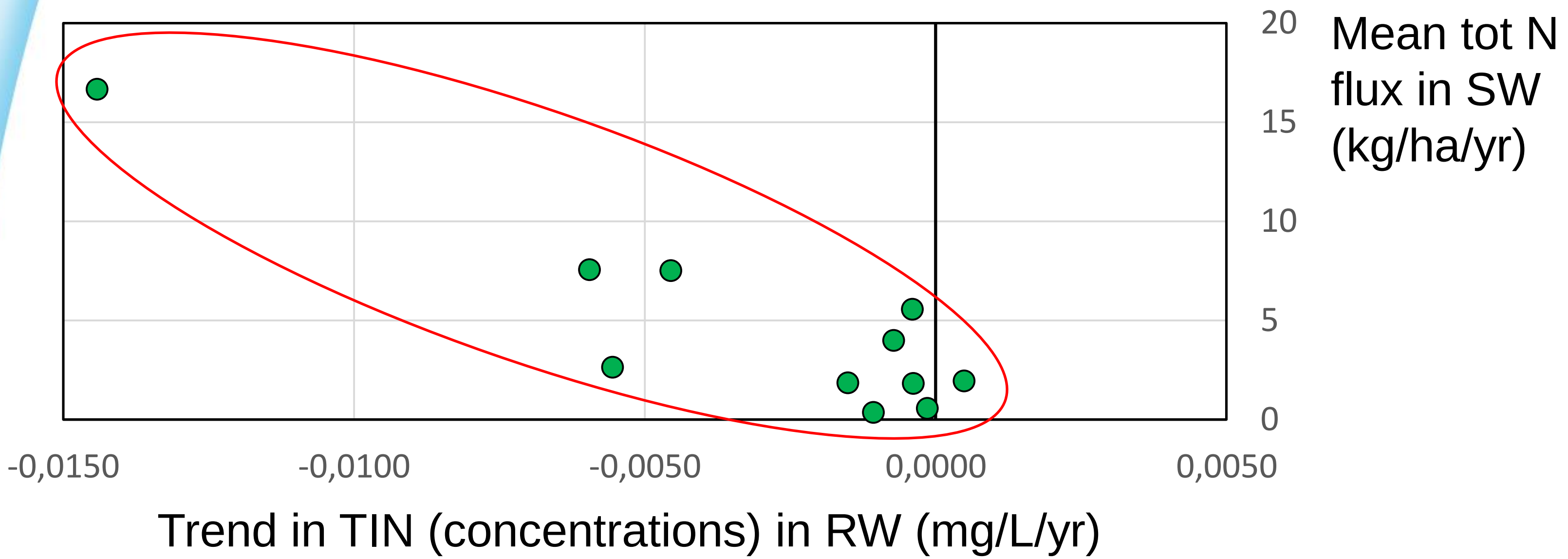
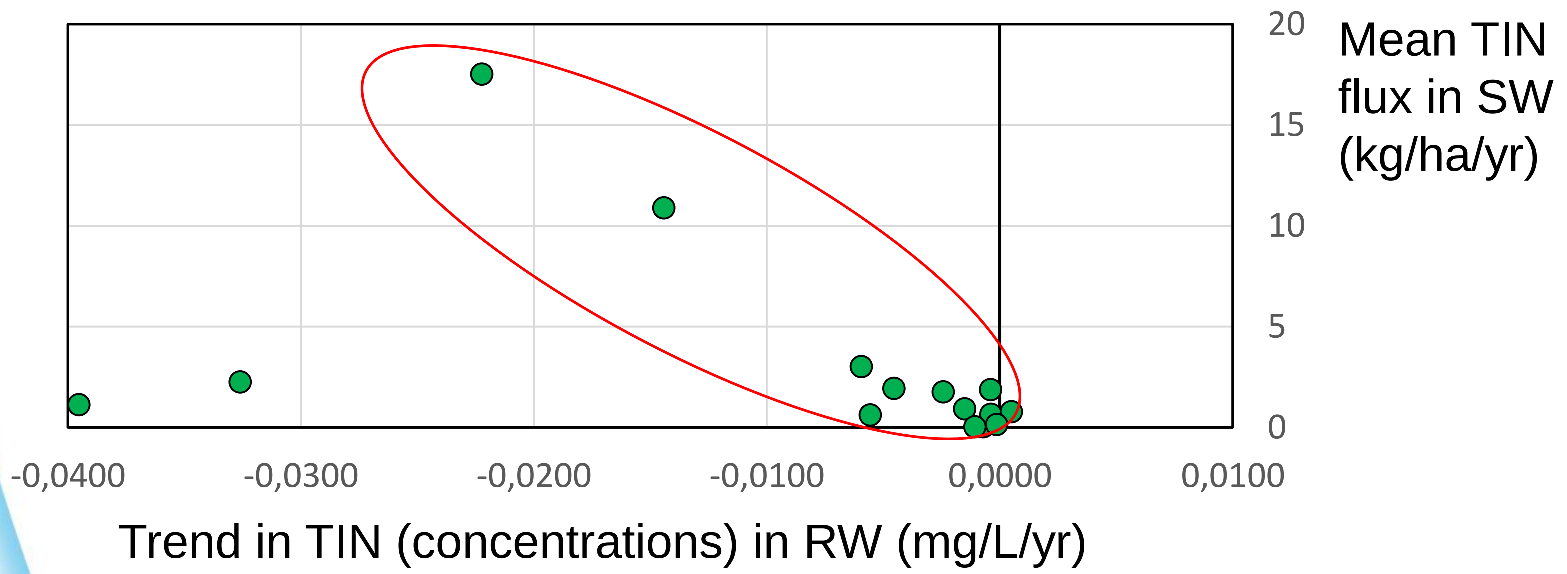
TIN trends in RW are deepening with increasing N in SW





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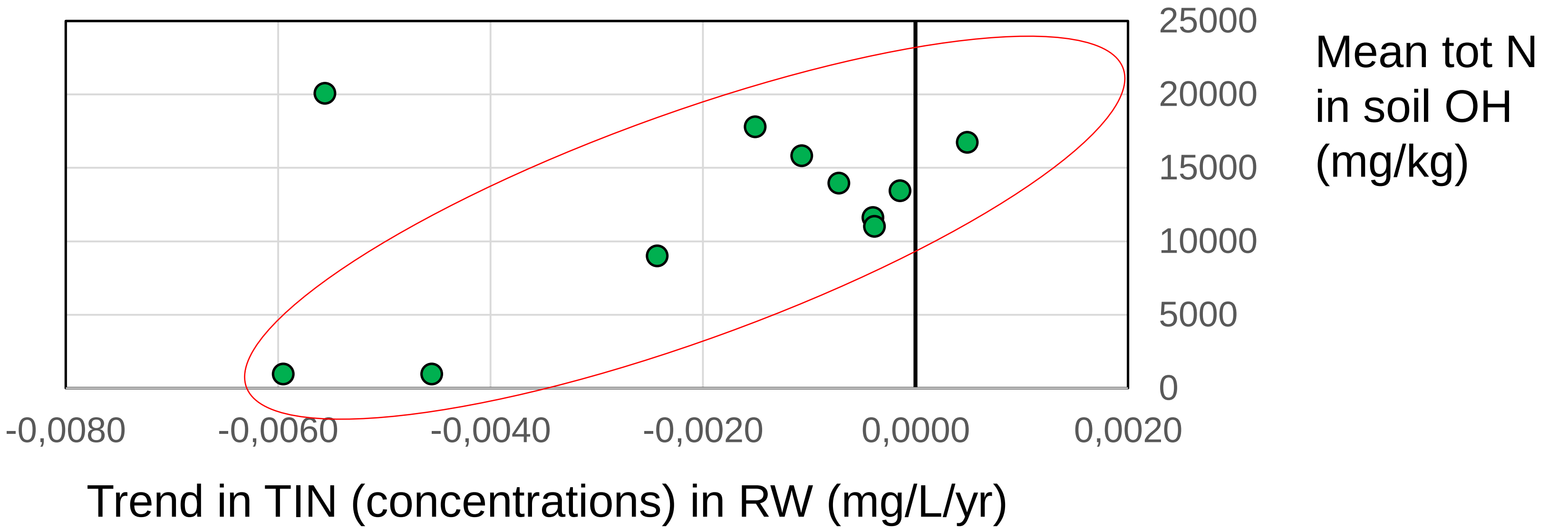
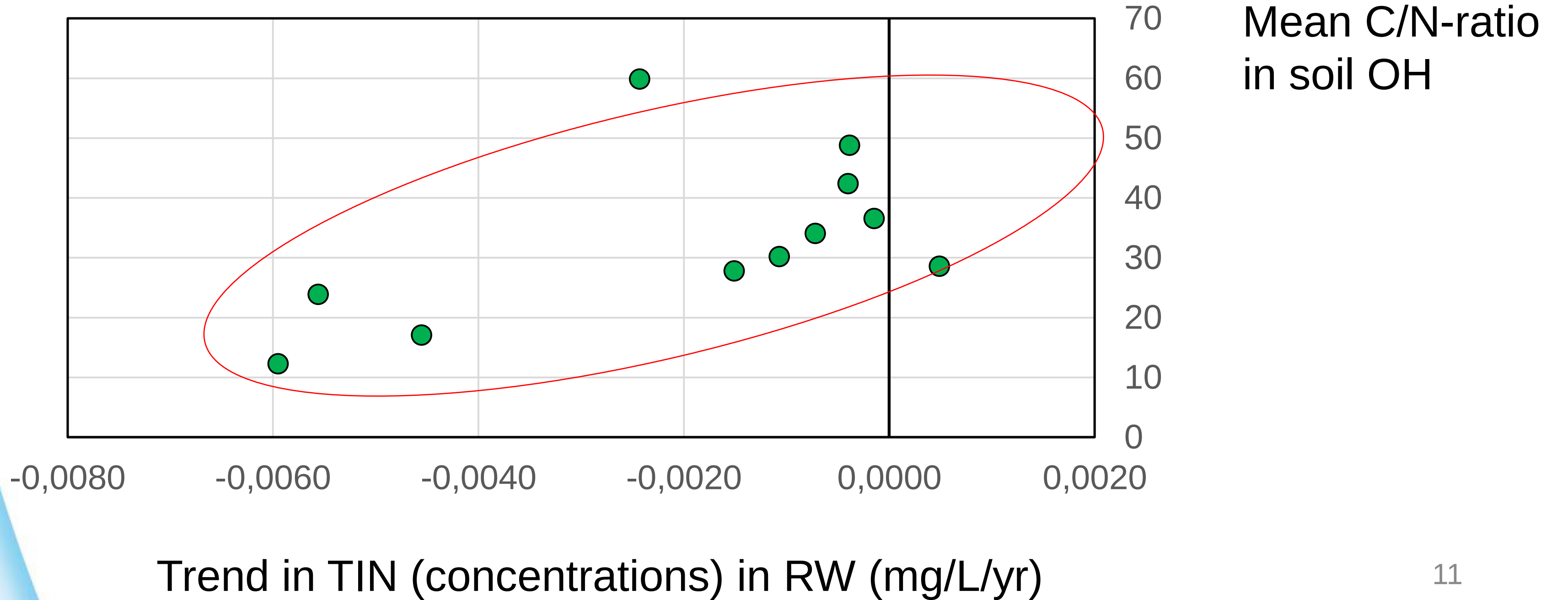
Trends of TIN in RW are weaker at sites with higher soil N organic pool





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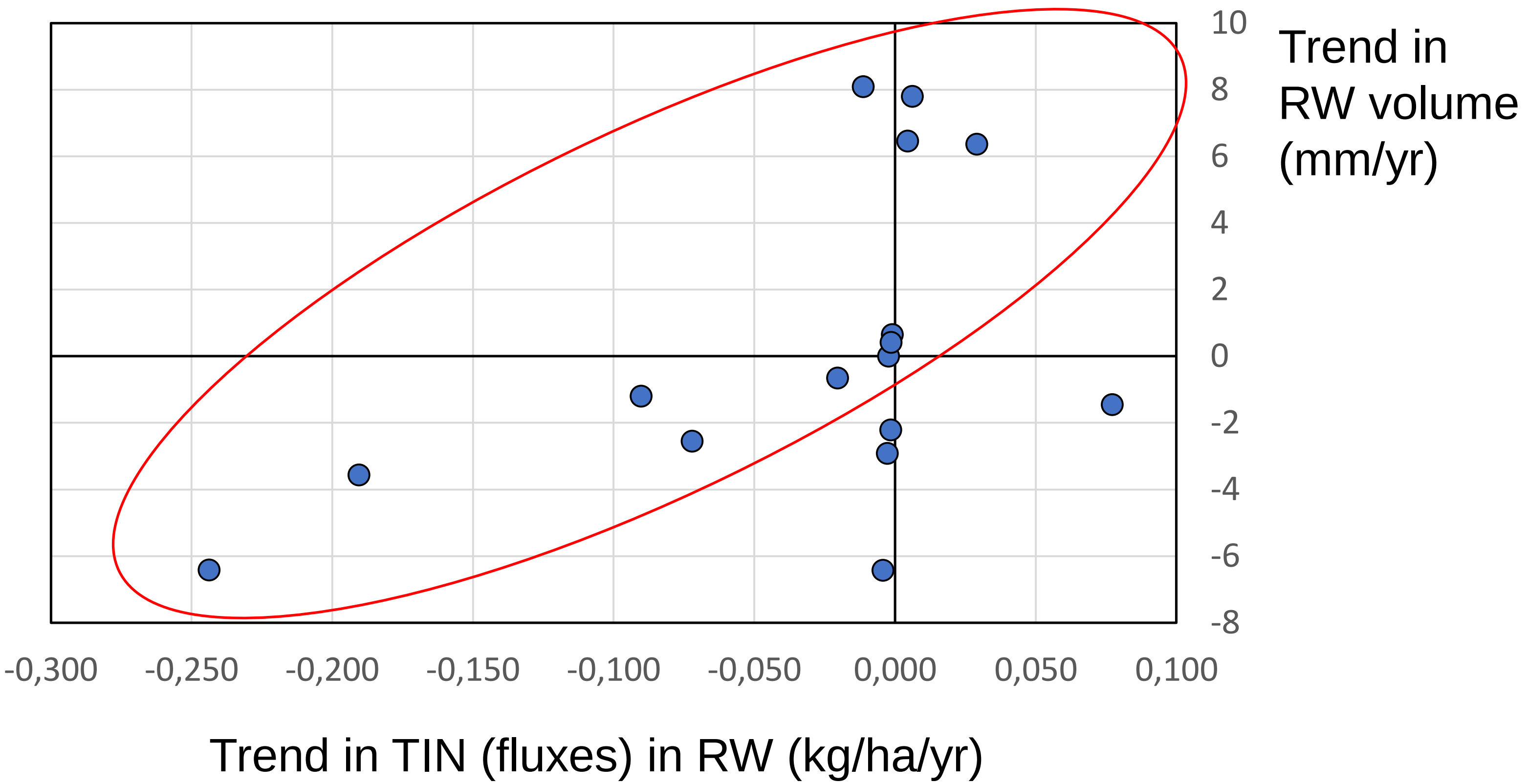
Variation in RW volume trends, but correlation exists between RW volume and TIN flux trends in RW



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First conclusions

- TIN concentrations and fluxes in deposition have generally decreased at IM sites in 1990-2017 (70-90% of the sites)
- NO_3 concentrations in RW have significantly decreased at 60% of the sites. More variation in trends in fluxes. Downward trend of TIN in RW is dominant (70-80 % of the sites)
- N in LF, FC, SW, and TF deposition, and trend in RW volume can explain some variation of TIN trends in RW:
  - Most affected sites with highest N in LF, FC and SW showed the most pronounced TIN decreases in RW
  - A lower C/N-ratio in the soil (a proxy for enrichment of soil with N), the most pronounced TIN decreases in RW
  - In agreement with extensive ICP Waters data
- N is complex, and making this N-puzzle will continue with NFPs
- Additional statistics and parameters probably needed

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Thank you

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