

Introduction

Atmospheric nitrogen (N) deposition is known to influence plant diversity in natural and semi-natural ecosystems. The natural nitrogen cycle is, however, complicated and many nitrogen containing compounds are not measured in many regions of Africa. Total N deposition values are thus not available. The results presented here give the best available estimates.

Methodology

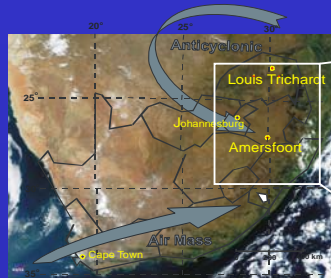
Data from three different studies are combined in this poster. The studies made use of passive samplers for measuring gaseous concentrations of NH_3 , NO_2 and HNO_3 , wet only rain collectors for sampling rain water and analysis of NH_4^+ and NO_3^- by Ion Chromatographic (IC) techniques.

Since no good quality data on the chemical composition of rain water is available for the period 2000-2005, and only two sites were operated between 1998-2005, the preceding ten-year (1886-1996) volume weighted mean precipitation ion concentrations were used together with rainfall depth reported for the corresponding periods.

Aerosol samples were collected using portable Mini-Volume samplers during 3x14 day campaigns in 2005-2007. Samples were collected on PTFE filters (diameter: 47 mm; pore-size: 0.5 μm). The inorganic fraction of aerosols were analysed using IC.



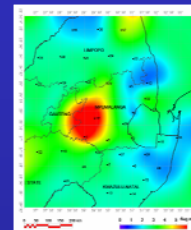
Sites



Deposition velocities ($\text{cm}\cdot\text{s}^{-1}$) used in calculations

	LT	AF	CP	NA
NO_2 (W)	0.34	0.11	0.21	0.13
NO_2 (S)	0.40	0.16	0.14	0.20
HNO_3 (W)	1.84	0.45	0.77	0.13
HNO_3 (S)	2.15	0.68	0.51	0.20
NH_3 (W)	0.47	0.19	0.35	0.07
NH_3 (S)	0.55	0.29	0.23	0.10

NO_2 Concentrations (Sept 2005 – Aug 2007)



W = Winter; S = Summer; AF = Amersfoort; LT = Louis Trichardt; CP = Cape Point; NA = Okaukuejo

Gas



Average gaseous concentrations for the period 1995 – 2005 in ppb. (The number of duplicate samples (pairs) used is given in brackets)

Site	NO_2	HNO_3	NH_3
Amersfoort	2.5 (71)	0.9 (27)	1.2 (65)
Louis Trichardt	0.7 (105)	0.2 (26)	1.2 (85)
Cape Point	1.2 (114)	0.5 (29)	1.5 (120)
Okaukuejo	0.3 (121)	0.3 (25)	1.5 (124)

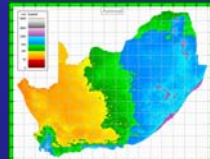
Total estimated annual dry deposition values of N from NO_2 , NH_3 and HNO_3 in $\text{kg}\cdot\text{ha}^{-1}\cdot\text{y}^{-1}$

Site	NO_2	HNO_3	NH_3
Amersfoort	0.6 ± 0.2	0.9 ± 0.5	0.5 ± 0.3
Louis Trichardt	0.5 ± 0.2	1.0 ± 0.3	1.0 ± 0.6
Cape Point	0.4 ± 0.2	0.7 ± 0.4	1.0 ± 0.4
Okaukuejo	0.1 ± 0.1	0.1 ± 0.1	0.2 ± 0.1

Rain



Mean rainfall*



Standard deviation*



*SA weather Service, <http://134.76.173.220/rainfall/index.html>

Annual volume weighted mean concentrations in $\mu\text{eq}\cdot\text{l}^{-1}$ and wet deposition in $\text{kg}\cdot\text{ha}^{-2}\cdot\text{yr}^{-1}$ (in parenthesis)

Site	Yearly rainfall*	NH_4^+	NO_3^-
Louis Trichardt ¹	462.5 (86-99)	9.7 (0.62)	8.0 (0.52)
Skukuza ¹	749.5 (99-02)	9.0 (0.94)	8.1 (0.85)
Amersfoort ¹	563.2 (86-99)	22.3 (1.7)	25.0 (2.0)
Warden ²	589.0 (86-96)	23.1 (1.9)	23.1 (1.9)
Vryheid ²	715.1 (86-96)	21.1 (2.1)	18.4 (1.8)

from ¹Mphepya et al 2004, 2006, ²Turner and de Beer, Eskom report 1996

Aerosol



Deposition velocities* ($\text{cm}\cdot\text{s}^{-1}$) used for deposition at Amersfoort (AF) and Louis Trichardt (LT)

Aerosol size	AF Winter	AF Summer	LT Winter	LT Summer
$\text{PM}_{2.5}$	0.90	0.57	1.17	0.78
PM_{10}	0.49	0.33	0.36	0.21

* from Zunckel, 1999

Averaged calculated winter and summer particulate deposition values ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$) for 05-07

	AF & LT winter				AF & LT summer			
	AF _{2.5}	AF ₁₀	LT _{2.5}	LT ₁₀	AF _{2.5}	AF ₁₀	LT _{2.5}	LT ₁₀
NH_4^+	1.44	0.96	1.17	0.34	1.23	0.74	1.60	0.39
NO_3^-	0.83	0.94	0.69	0.46	0.22	0.17	0.07	0.12

Total dry deposition of particulate N in $\text{kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$

	Amersfoort	Louis Trichardt
NH_4^+	2.67	2.77
NO_3^-	1.11	0.76

Conclusions

- Uncertainties in dry deposition velocities may have a large influence on the calculated deposition values and the reported values most probably represent maximum values.
- Large variations in inter annual rainfall result in large variations in wet deposition values.
- Dry N deposition values shows a strong seasonal cycle (not shown in the data on this poster) with a maximum during spring.
- Estimated total N deposition varies from $9.5 \text{ kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$ at Amersfoort to $7.2 \text{ kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$ at Louis Trichardt.

References

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- Zunckel M., *Atmos. Environ.*, 1999, 33, 3515-3529.
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