



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

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FMI Results

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Tasks of FMI in 2009

- **WP1 Task T1.1 Forcing data 1850-2007**
- airborne nutrient loads
- deliverable 1
- scattered data from literature
- months 1-12
- **WP1 Task T1.2 Nutrient load forcing data 1960-2100**
- airborne nutrient loads
- deliverable 4
- literature survey for future NO_x, SO_x, H⁺ load
- months 1-12
- **WP 5 work**



Resources for ECOSUPPORT

- **3 months from BONUS + 1 from FMI in 2009**



Literature covering 1850-2007

- **much data in open databases available since circa 1980 (e.g. EMEP), so we concentrated in older published data**
- **over 40 articles with old data found until now**
- **many articles discuss monitoring results 1850-1900**
- **tables in articles have been transformed in electronic form**
- **checking of the converted data and text is going on**
- **first examples of different types of tables sent to SMHI**
- **goal is to send all the tables to the ECOSUPPORT home page during 2009**
- **short summary about the results**

author	publ.	article	decades	country area
(anonymous)	1955	Current Data on the Chemical Composition of Air and Precipitation. Note. <i>Tellus</i> , vol. 7, 1, 266–271. 1955.	1950	Scandinavia, UK
(anonymous)	1955	Current Data on the Chemical Composition of Air and Precipitation III. Notes. <i>Tellus</i> , vol. 7, 3, 395–400. 1955.	1950	Scandinavia, UK, Ger
(anonymous)	1955	Current Data on the Chemical Composition of Air and Precipitation IV. Notes. <i>Tellus</i> , vol. 7, 4, 522–527. 1955.	1950	Scandinavia, UK, Ger
(anonymous)	1956	Current Data on the Chemical Composition of Air and Precipitation V. Notes. <i>Tellus</i> , vol. 8, 1, 112–113. 1956.	1950	Scandinavia, UK, Ger
Barrett, Earl & Brodin, Gunnar	1955	Barrett, Earl & Brodin, Gunnar, 1955. The Acidity of Scandinavian Precipitation. <i>Tellus</i> , vol. 7, 2, 251–257.	1950	Scandinavia
Buch, Kurt	1960	Buch, Kurt, 1960. Zusammensetzung des atmosphärischen Niederschlages in Finnland. <i>Soc. Sci. Fennica Commentations Physica-Math.</i> , 14 nr 10, 3–26.	1950	Finland
Egnér, Hans & Eriksson, Erik	1955	Egnér, Hans & Eriksson, Erik, 1955. Current Data on the Chemical Composition of Air and Precipitation. Note. <i>Tellus</i> , vol. 7, 1, 134–139.	1950	Scandinavia, UK
Eriksson, Erik	1952	Eriksson, Erik, 1952. Composition of Atmospheric Precipitation: I. Nitrogen compounds. <i>Tellus</i> , vol. 4, no 3, pp. 215–232.	1860–1940	Europe etc.
Eriksson, Erik	1952	Eriksson, Erik, 1952. Composition of Atmospheric Precipitation: II. Sulfur, chloride, iodine compounds. Bibliography. <i>Tellus</i> , vol. 4, no 4, pp. 280–303.	1850–1950	Europe etc.
Finnberg, F. V.	1923	Finnberg, F. V., 1923. Einige Bestimmungen des Gehaltes der atmosphärischen Niedersläge an Stickstoffverbindungen, ausgeführt in Storkyrö (Finnland), 1921–22. <i>Soc. Sci. Fennica Commentations Physica-Math.</i> , 1 nr 28, 1–9.	1920	Finland
Feilitzen von, H. & Lugner, I.	1910	von Feilitzen, H. & Lugner, I., 1910. Undersökningar över de mängder bundet kväve, som tillföres jorden med nederbörden. <i>Kgl. Lantbr. Akad. handl. o. Tidskrifter</i> , 1910, 151.	1860–1900	Europe etc.
Granat, L.	1978	Granat, L., 1978. Sulfate in precipitation as observed by the european atmospheric chemistry network. <i>Atm. Env.</i> , vol. 12, 413–424.	1960–1970	Europe West
Granat, Lennart, Söderlund, Rolf & E	1977	Granat, Lennart, Söderlund, Rolf & Bäcklin, Leif, 1977. The IMI Network in Sweden – Present Equipment, Methods and Plans for Improvement. Department of meteorology, University of Stockholm (MISU) & International meteorological institute in Stockholm (IMI). Report, AC-40.		
Granat, Lennart	1972	Granat, Lennart, 1972. Deposition of sulfate and acid precipitation over Northern Europe. Department of meteorology, University of Stockholm (MISU) & International meteorological institute in Stockholm (IMI). Report, AC-20.		
Hansen, Frode	1926	Hansen, Frode, 1926. Om Bestemmelse af Nitratkvælstof i Regnvand, Drænvand og Jord. <i>Tidsrk. f. Plante-avl.</i> , 32, 69–120.	1920	Denmark
Hansen, Frode	1931	Hansen, Frode, 1931. Undersøgelser av regnvand. <i>Tidsrk. f. Plante-avl.</i> , 37, 123–150.	1920	
Järvinen, Olli & Haapala, Kirsti	1980	Järvinen, Olli & Haapala, Kirsti, 1980. Sadeveden laatu Suomessa. Vesihallitus - National board of water, Finland. Tiedotus - Report, 198. ISBN 951-46-5055-7 ISSN 0355-0745.	1970	Finland
Mylona, Sophia	1996	Mylona, Sophia, 1996. Sulphur dioxide emissions in Europe 1880–1991 and their effect on sulphur concentrations and depositions. <i>Tellus</i> , 46B, 5, 662–689.	1880-1991	
Miller, N. H. J.	1905	Miller, N. H. J., 1905. The amounts of nitrogen as ammonia and as nitric acid and chlorine in the rainwater collected at Rothamsted. <i>J. Agr. Sci.</i> , 1, 280–303.	1850–1900	Europe etc.
Rodhe, H. & Granat, L.	1984	Rodhe, H. & Granat, L., 1984. An Evaluation of Sulfate in European Precipitation 1955–1982. <i>Atm. Env.</i> , vol. 18, no 12, 2627–2639.	1950–1980	Europe West
Rodhe, Henning, Granat, Lennart & S	1984	Rodhe, Henning, Granat, Lennart & Söderlund Rolf, 1984. Sulfate in precipitation. A presentation of data from the European Air Chemistry Network. Department of meteorology, University of Stockholm (MISU) & International meteorological institute in Stockholm (IMI). Report, CM-64. ISSN 0280-445X.		
Russel, E. & Richards E. H.	1919	Russel, E. & Richards E. H., 1919. The amounts and composition of rain and snow falling at Rothamsted. <i>J. Agr. Sci.</i> , 9, 309-337.	1850–1910	UK
Scharrer, K. & Schropp, W.	1940	Scharrer, K. & Schropp, W., 1940. Ueber den Stickstoffgehalt der Niederschläge. <i>Forschungsdienst</i> , 5, 469–472.	1920–1930	Germany (?)
Söderlund, Rolf & Granat, Lennart	1982	Söderlund, Rolf & Granat, Lennart, 1982. Ammonium (NH ₄ ⁺) in precipitation – A presentation of data from the European air chemistry network. Department of meteorology, University of Stockholm (MISU) & International meteorological institute in Stockholm (IMI). Report, CM-59. ISSN 0280-445X.	1950–1970	SWE ICL NOR FIN D
Söderlund, Rolf & Granat, Lennart	1982	Söderlund, Rolf & Granat, Lennart, 1982. Chloride (Cl) in precipitation – A presentation of data from the European Air Chemistry Network. Department of meteorology, University of Stockholm (MISU) & International meteorological institute in Stockholm (IMI). Report, CM-60. ISSN 0280-445X.		

Example EX-a.tx

For source of data and explanations see EX-a-readme.txt

Table 1. Ammonia and nitrate nitrogen in precipitation in Europe.

Ref.	Place	Period	Precip. mm	as H3N mg N/l	as NO3 mg N/l	as tot. N mg N/l	as H3N kg N/ha	as NO3 kg N/ha	as tot. N kg N/ha
	103 Feldkirch	Austria	1876 -	2.79	1.76	4.55 -	-	-	-
	194 S:t Michael	Austria	1885-1887	1114	1.17	0.67	13.03	7.44	20.47
235, 236	Gembloux	Belgium	1889-1893	693	1.14	0.35	7.92	2.39	10.31
	146 Bulgaria		-	-	-	-	11.86	0.96	12.82
	291 Copenhagen	Denmark	1880/81-1884/85	577	1.91	0.45	11	2.62	12.62
	131 Askov	Denmark	1922/23-1926/27	740	0.71	0.35	5.25	2.63	7.88
	131 Blangsted	Denmark	1925/26	600	1.07	0.57	6.44	3.41	9.85
	131 Spangsbjerg	Denmark	1925/26	730	0.88	0.6	6.42	4.39	10.81
	131 Hornum	Denmark	1925/26	495	0.74	0.54	3.66	2.65	6.31
	112 Storkyrö	Finland	1921-22	-	-	-	1.8 -	-	-
	176 Methroy	France	1877	760	0.41 -	-	3.1 -	-	-
179-181	Montsouris	France	1876-1900	545	2.13	0.66	11.6	3.6	15.2
	213 Liebwerd, Bohemia	Germany	1877/78	620	1.3	0.61	8.05	3.78	11.83
	213 Pešek, Bohemia	Germany	1883/84, 1885/86	490	1.26	0.5	6.17	2.45	8.62
	53 Ida-Marienhütte	Germany	1865-1870	580 -	-	1.88 -	-	-	11.1
	314 Kushen	Germany	1864/65-1865/66	369	0.48	0.16	1.77	0.59	2.34
	314 Insterburg	Germany	1864/65-1865/66	642	0.65	0.39	4.15	2.49	6.64
	314 Dahme	Germany	1865	427	1.42	0.3	6.07	1.28	7.35
	314 Regenwalde	Germany	1864/65-1865/66	568	2.08	0.62	11.82	3.52	15.34
	314 Proskau	Germany	1864/65	445	3.21	1.73	14.29	7.7	21.99
	255 Weihenstephan	Germany	1928-1935	750 -	-	1.97 -	-	-	14.8
	254 Rothamsted	Great Britain	1888-1916	730	0.41	0.2	2.98	1.48	4.46
	81 Garforth, Leeds	Great Britain	1906-1909	685	1.04	0.32	7.09	2.16	9.25

EX-a-readme.tx

- Source of data in EX-a.txt:
- Eriksson, Erik, 1952. Composition of Atmospheric Precipitation: I. Nitrogen compounds. *Tellus*, vol. 4, no 3, pp. 215–232. (Tables 1, 4 and 5)
- Eriksson, Erik, 1952. Composition of Atmospheric Precipitation: II. Sulfur, chloride, iodine compounds. *Bibliography. Tellus*, vol. 4, no 4, pp. 280–303. (Tables 7 and 8)
- Table 5:
- ug H3N/m3 = microg H3N/m3

- Ref = Litterature
- 21 BASILE, G., 1895: Analisi delle acqua meteoriche cadute a Catania du tutto giugna 1888 a tutto setembre 1889. *Staz. Sper. Agrar. Ital.*, 28, 545 574.
- 24 BECHI, E., 1876: Saggi di esperienze agrarie. Florence 1870 76.
- 27 BERTRAND, G., 1935: A propos des apports atmosphériques de soufre combiné aux terres arables. *Compt. Rend, Acad. Agr. France.*, 21, 1015 1018.
- 28 BERTRAND, G., 1935: Observations à propos des apports atmosphériques de soufre aux terres arables. *Compt. Rend.*, 201, 309 312.
- 51 BRAADLIE, O., 1930: Innholdet av ammoniak og nitratkvelstoff i nedbøren ved Trondhjem. *Kgl. Norske Vids. Selskaps Forhandl.*, 3, no. 20.
- 53 BRETSCHEIDER, P., 1872: Ueber den Regenfall zu Ida-Marienhütte in den Jahren 1865–1872 und der Gehalt des meteorischen Wassers an Stickstoff ir Salpetersäure. Breslau 1872.
- 58 BUENOS AIRES, 1906: The climate of Buenos Aires. *Statis. Ann. City Buenos Aires*, 16, 3 8.
- 81 CROWTHER, CH, & RUSTON, H. G., 1911: The nature, distribution and effects upon vegetation of atmospheric impurities in and near an industrial town.
- 103 EUGLING, W., 1877: Ueber den Gehalt an Ammoniak und Salpetersäure in den atmosphärischen Niederschlägen. *Ber. über die Tätigkeit d. lantw. chem. Voralberg*, 1876 1877.
- 106 VON FEILITZEN, H., & LUGNER, I, 1910: Undersökningar över de mängder bundet kväve, som tillföres jorden med nederbörden. *Kgl. Lantbr. Akad. hanc*
- 112 FINNBERG, F. V., 1923: Einige Bestimmungen des Gehaltes der atmosphärischen Niedersläge an Stickstoffverbindungen, ausgeführt in Storkyrö (Finnl *Commentations Physica-Math.* 1 nr 28, 1–9.
- 113 FODOR, J., 1881: Hygienische Untersuchungen über Luft, Boden und Wasser. I. Die Luft. Braunschweig. 1881.
- 120 GOPPELSCHRÖDER, F. R., 1870: Ueber Schwankungen im Gehalte der Trinkwasser an Salpetesäure und über deren Gemenge in den atmosphärischen *Chem.*, 9, 177 178.
- 121 GOPPELSCHRÖDER, F. R., 1871: Mitteilungen. *Journ. Prakt. Chem. (N.F.)*, 4, 139 159.
- 122 GOPPELSCHRÖDER, F. R., 1871: Bestimmungen des Salpetessäuregehaltes in Regenwasser, Quell-, Fluss- und Seewässern. *Journ. Prakt. Chem.* 4, 31
- 123 GOPPELSCHRÖDER, F. R., 1871: Beitrag zur Kenntnis der Chemie der atmosphärischen Niederschlägen, mit besonderen Berücksichtigung deren Geha *Chem.*, 10, 259 277.
- 124 GOPPELSCHRÖDER, F. R., 1872: Beitrag zur Kenntnis der Chemie der atmosphärischen Niederschlägen (Fortsetzung) und des Salpetersäure resp. Nitr *Bach-, Fluss und Seewässern. Zeitschr. Anal. Chem.*, 11, 16 22.
- 125 GRAY, G., 1888: On the dissolved matter contained in the rainwater collected at Lincoln, Canterbury, New Zealand. *Proc. Austr. Ass. Sydney.* 138 152.
- 131 HANSEN, F., 1931. *Undersøgelser av regnvand. Tidsrk. f. Plante-avl.*, 37, 123–150.
- 133 HARRISON J. B., & WILLIAMS, J., 1897: The proportions of chlorine and of nitrogen as nitric acid and as ammonia in certain tropical rain waters. *J. Ame*
- 144 HUDIG, J., 1912: The amounts of nitrogen as ammonia and as nitric acid (and nitrous) in the rainwater collected at Vithuizermeeden, Groningen. *J. Agr. !*
- 146 ILKOV, V., 1925: (Nitrogen compounds in atmospheric precipitation.) *Spisanic na zemedelskite opitni inst. v. Bulgarija.*, 3, 325 328. Ref. in *Exp. Sta. Rec.*
- 162 KOCH, D. E. V., 1941 and 1943: The nitrogen content of Ceylon rain. *Trop. Agr. (Ceylon)* 97, 74 77, 99, 18 19.
- 164 KUDRIN, S. A., 1948: (Nitrogen in rain in the serozem zone.) *Potchvovedenje*, 10, 608 611.
- 176 LECLERC, A., 1877: Analyse de pluies tombées à Methroy en 1877. *Bull. Soc. Agric. France*, 9, 302, 10, 77 & 163.

Coordinates of :

Name	Code	Altitude m	Latitude N	Longitude Greenwich
Kinnvika.....	Kn	—	80°03'	18°18' E
Riksgränsen...	Ri	508	68°26'	18°08' E
Abisko.....	Ao	390	68°20'	18°45' E
Kiruna.....	Ki	412	67°52'	20°14' E
Arjeplog.....	Ar	434	66°03'	17°54' E
Öjebyn.....	Öj	—	65°24'	21°30' E
Röbäcksdalen..	Rö	—	63°48'	20°12' E
Offer.....	Of	—	63°12'	17°48' E
Bredkälen.....	Br	400	63°54'	15°18' E
Åre.....	ÅF	440	63°24'	13°06' E
Åre Hummeln..	ÅH	900	63°24'	13°06' E
Frösön.....	Fö	364	63°12'	14°29' E
Sveg.....	Sv	356	62°02'	14°22' E
Rättvik.....	Rä	200	60°54'	15°06' E
Åmot.....	Åm	175	60°58'	16°25' E
Sala.....	Sa	80	60°00'	16°36' E
Ultuna.....	Ul	50	59°48'	17°42' E
Erken.....	Er	12	59°54'	18°42' E
Strängnäs.....	St	20	59°18'	17°06' E
Forshult.....	Fo	192	60°10'	13°47' E
Kvarntorp 7... Kv7	Kv7	100	59°12'	15°30' E
Vreta Kloster.. VK	VK	40	58°36'	15°38' E
Lanna.....	La	100	58°24'	13°06' E
Bornö.....	Bo	5	58°24'	11°36' E
Vinga.....	Vi	19	57°38'	11°37' E
Falsterbobruk.. Fa	Fa	50	57°42'	16°12' E
Flahult.....	Fl	225	57°42'	14°12' E
Ambjörnarp... Am	Am	220	57°25'	13°17' E
Fröslida.....	Fi	70	56°53'	13°03' E
Simlångsdalen.. Si	Si	150	56°42'	13°00' E
Plönninge..... Pl	Pl	50	56°42'	12°45' E
Söraby.....	Sö	180	57°00'	14°54' E
Smedby.....	Sm	20	56°42'	16°12' E
Sylfaste.....	Sy	40	57°36'	18°24' E
Bräkne-Hoby.. BH	BH	40	56°12'	15°06' E
Skurup.....	Sk	40	55°28'	13°30' E
Alnarp.....	Al	20	55°42'	13°06' E
Hilleshög..... Hi	Hi	—	55°54'	12°54' E
Tana.....	Ta	9	70°24'	28°12' E

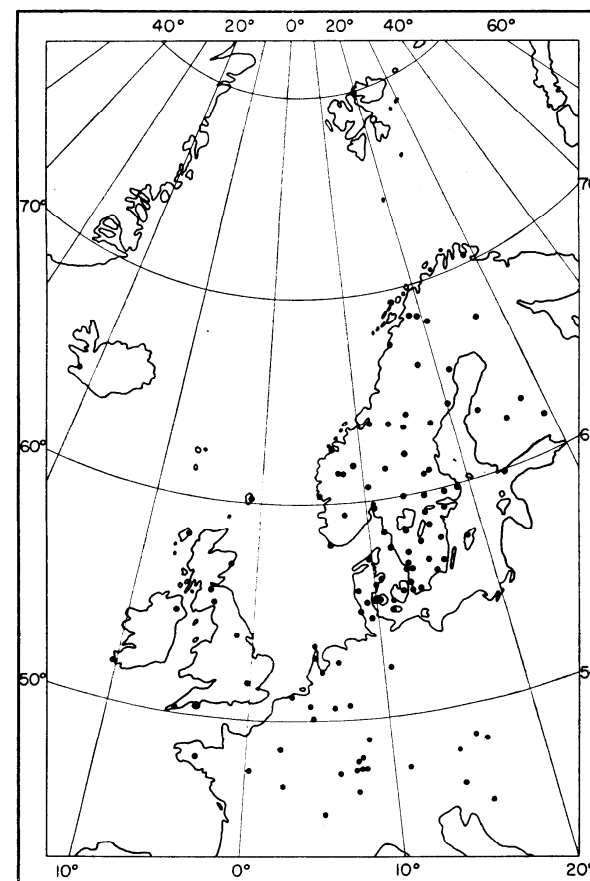
Map and Coordinates of the Chemical and CO₂ Stations Western Europe

Prepared by STIG FONSELIUS, International Meteorological Institute in Stockholm.

Note: The Station Kn is analyzed by the Swedish Finnish Swiss Expedition at Murchinson Bay, Spetsbergen, the stations Ri to Hi, Rj and Za at R. Agricult. College, Uppsala, Sweden, the stations So to Tv at Inst. Marine Research, Helsinki, Finland, Vn to Ad at Statens Planteavlslaboratorium, Lyngby, Denmark, Lw to Ca at Met. Office, Air Ministry, London, England, The station Va at Met. Office, Dublin Airport, Ireland, Sc to Bl at Staatl. Landwirtschaftl. Versuchs- und Forschungsanst. Augustenberg, Germany and DH to Ae at Institut d'Hygiene et d'Epidemiologie Bruxelles, Belgium. The CO₂ samples are analyzed at Int. Met. Inst. Stockholm, Sweden, except Kn, which is analyzed at Murchinson Bay and the stations So to Tv, which are analyzed at Inst. Marine Research, Helsinki.

In order to standardize the Code systems for the two networks, the names and codes for following stations are changed in the CO₂ network:

Station	Code	New Name	New Code
Abisko.....	Ab	Abisko.....	Ao
Bodö.....	Bo	Vågönes.....	Vg
Rissala.....	Ri	Kuopio.....	Ku
Luonetjärvi...	Lu	Jyväskylä.....	Jy

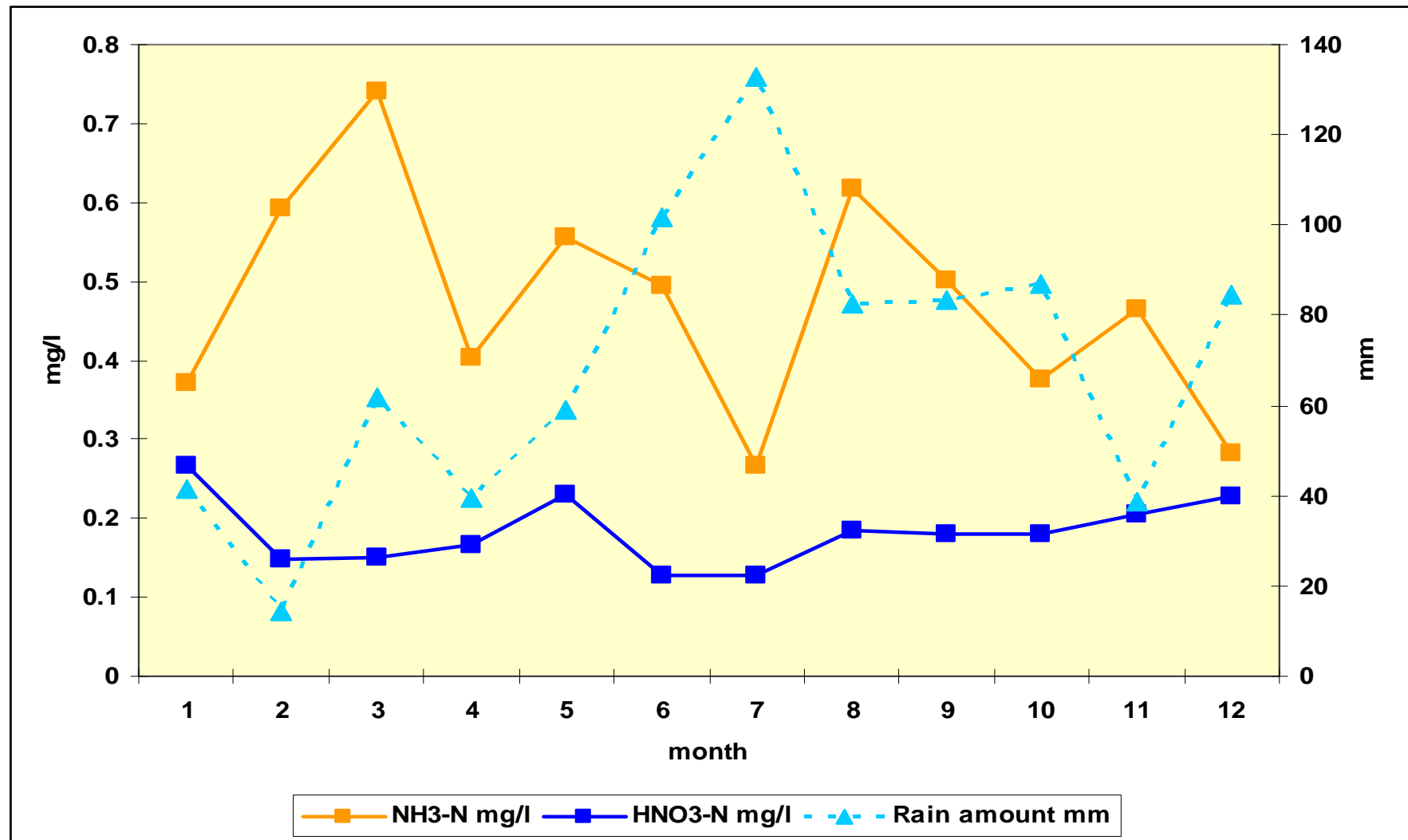


Summary of station information, tot 182 stations

Name of the station	Code letters	Country	Lat.	Long.	E, W	Alt. m	Source (code)	Table, page	Years	HUOM!	
Aakirbeay	Aa	DNK	55°04'	14°55'	E	-	A043			Start. Apr. 1	e
Aakirbeay	Aa						A044		1959		
Abed	Ad	DNK					A036-A044		1957-59	touko 57 julk myöhemmin	i
Abed	Ad		54°50'	11°20'	E	-	F045				
Aberdeen	Ab	GBR					A026-A044		1955-59		u
Aberdeen	Ab		57.1	2.1	W	-	A029				
Aberdeen	Ab		57°10'	2°15'	W	-	F045				
Aberdeen	Ab	GBR	57°10'	2°15' W		66	G019		1955-66		
ABERDEEN	AB	GBR	57°10'	2°10' W		66	S016	t1	1955-66		
Abisko	Ao	SWE	68°20'	18°45'	E	390	F045			CO2	i
Aldergrove	Ag	GBR					A040-A044		1958-59		u
Aldergrove	Ag	GBR					A046			Started sampling 1.5.58 Coordinates See Tellus 10.1958 p. 170 [=F045]	
Aldergrove	Ag		54°39'	6°13'	W	67	F045				
Alnarp	Al	SWE					E003, A004, A026-A044		1954-59		i
Alnarp	Al		55.7	13.1	E	-	A029				
Alnarp	Al	SWE					B002		1955-58		
Alnarp	Al		55°42'	13°06'	E	20	F045				
Alnarp	Al	SWE	55°42'	13°06' E		20	G019		1955-60		
Amberieu	Ae	FRA					A038-A044		1957-59	koodi Ac myös tätä?	u
Amberieu	Ae		45°59'	5°20'	E	254	F045				
Ambjörnarp	Am	SWE					E003, A004, A026-A044		1954-59		i
Ambjörnarp	Am		57.4	13.3	E	-	A029				
Ambjörnarp	Am		57°25'	13°17'	E	220	F045				
Ambjörnarp	Am	SWE	57°25'	13°17' E		220	G019		1955-60		
Andenes	An	NOR					A034-A044		1956-59		u
Andenes	An		69.3	16.1	E	5	A035				
Andenes	An		69°19'	16°07'	E	5	F045				
Arjeplog	Ar	SWE					E003, A004, A026-A044		1954-59		i
Arjeplog	Ar		66.0	18.0	E	400	A029				
Arjeplog	Ar		66°03'	17°54'	E	434	F045				
Arjeplog	Ar	SWE	66°03'	17°54' E		434	G019		1955-		
Askov	As		55.5	9.1	E	-	A029				
Askov	As	DNK					E003, A004, A026-A044		1954-59	Itämeri?	e
Askov	As	DNK					E006	p220	1922/23-1926/27		

Example of results:

Nitrogen concentration in rain water and precipitation amount in Flahult Sweden, 57°42' N 14°8' E, year 1909



Ref. von Feilitzen, H. & Lugner, I., 1910.



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Literature covering 1960-2100

- **a few articles found**
- **information welcome**