Seasonal trends in emission of ammonia from manure applied to grassland

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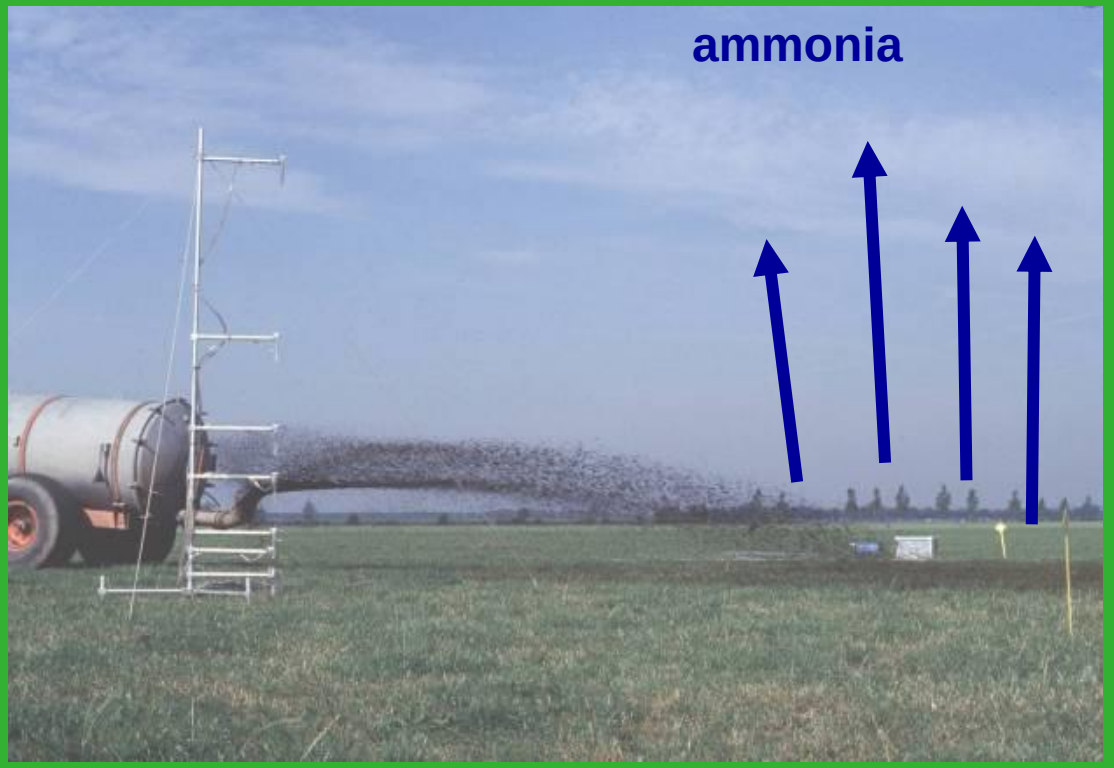
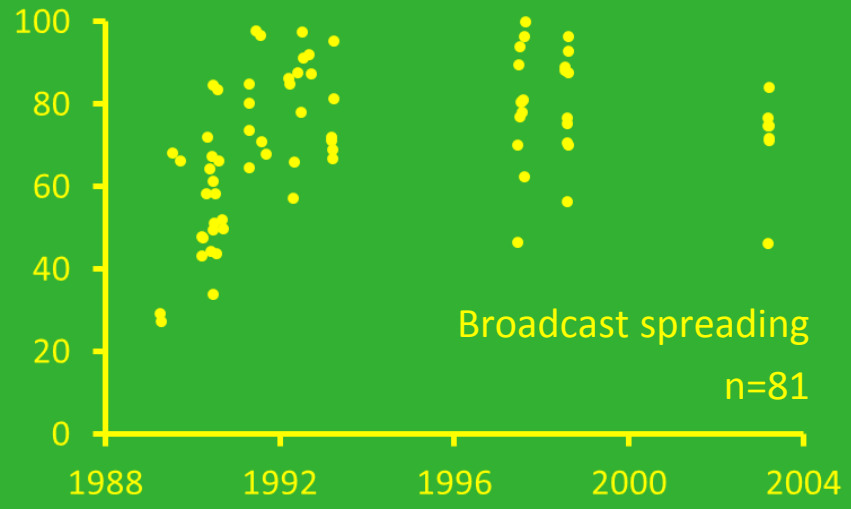
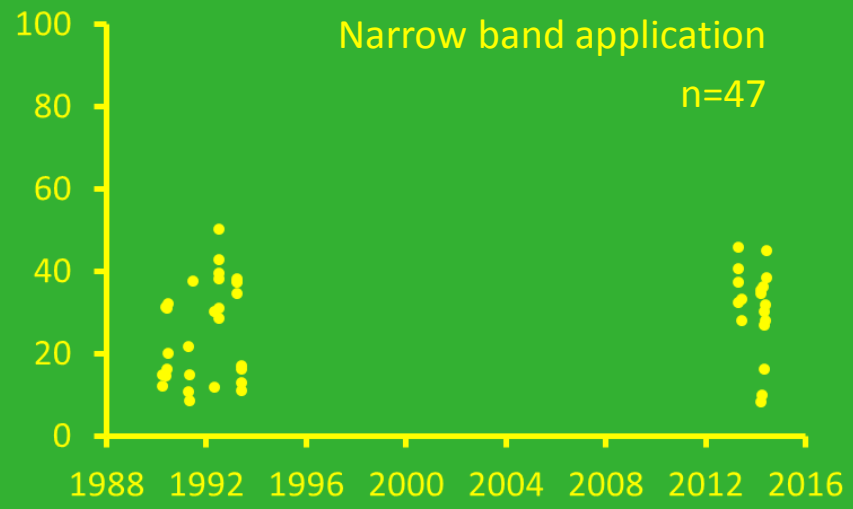
Introduction

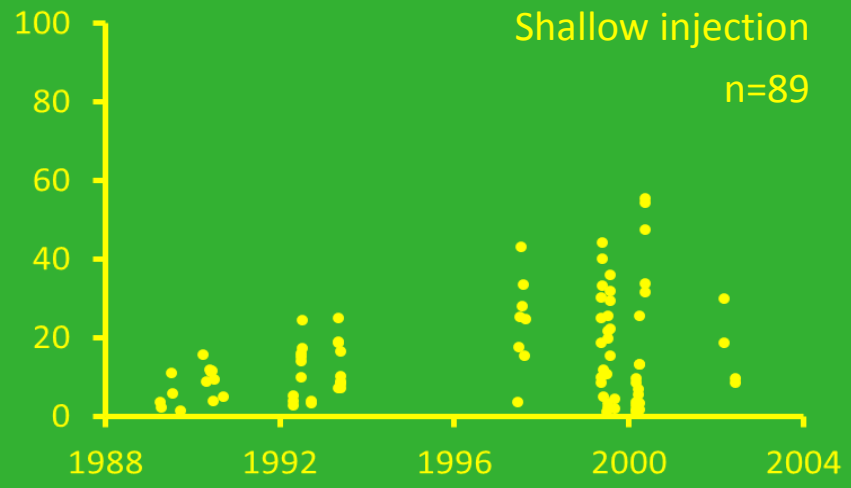
- Ammonia emission = volatilization process (evaporation)
- Fast process
- Influencing variables: wind speed, temperature, soil, application rate, TAN, dry matter content, etc.



NH_3 emission measurements grassland NL







Each point represents a complete emission curve with associated time-dependent influencing factors

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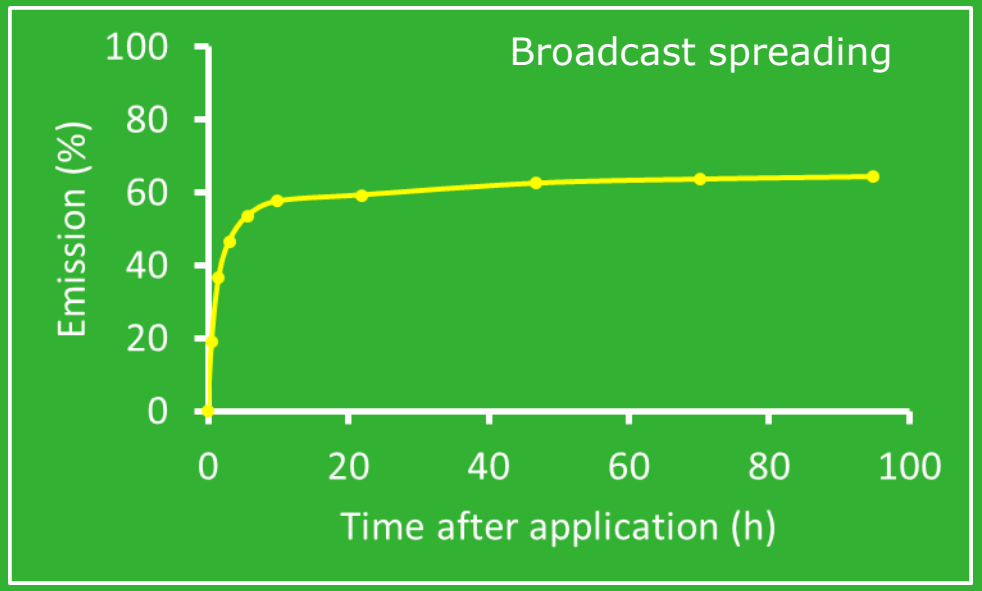
Analysis

- Which factors are playing a role
- When are factors playing a role during emission
- How large is their influence on the final emission

- Emission = f (time, wind, temp, radiation, RH, technique, manure, soil, crop)



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Analysis

Approach:

- Analysis per application technique
- Which factors significant per period after application

- Logistic modelling of 8 consecutive periods
- Sequence of the 8 models resulting in total emission
- Modelling EF as % TAN applied

Results significant factors

Shift	wind (m/s)			temp (°C)			app rate (m³/ha)			TAN (g/kg)		ds (%)		grass height (cm)	
9:00 - 10:30	+	+	+	+	+			-				-	-		-	
10:30 - 11:00	+	+	+	+	+	+	+					+			-	
11:00 -14:00	+	+	+	+	+	+	+	+			-				-	-
14:00 - 18:00	+	+	+			+		+	+				+		-	
18:00 - 07:00	+	+	+	+			+	+	+		-		+			
07:00 - 07:00	+	+	+					+	+	+			+		-	
07:00 - 07:00	+	+	+													-
07:00 - 07:00	+								+		-		+			

Broadcast spreading Narrow band application Shallow injection

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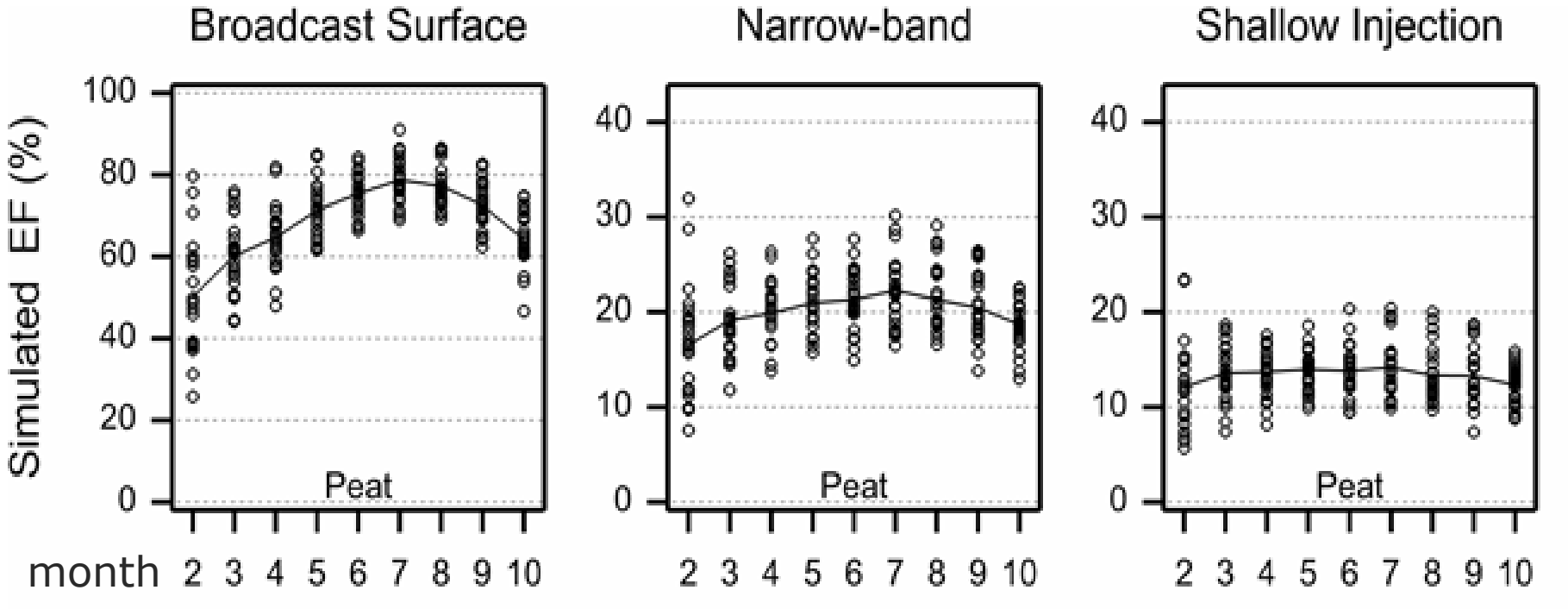
Seasonal emissions simulation results

- TAN 2 g kg^{-1}; dry matter 8%
- Application 20 m^3 ha^{-1}
- Soil type: sand, peat, clay
- Grass height 7 cm

- Weather conditions:
  - meteorological data 1991-2014
  - application morning day 15 of Febr-Oct

Calculated emission per application technique



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Conclusion

- Seasonal trend; large variation between years
- Clear effect application techniques
- Differences per soil: sand < peat < clay
- Influence of factors depends on time after application

Discussion

Weather condition may reduce emission

but reduction may be limited

National EF should be calculated by weighing of:

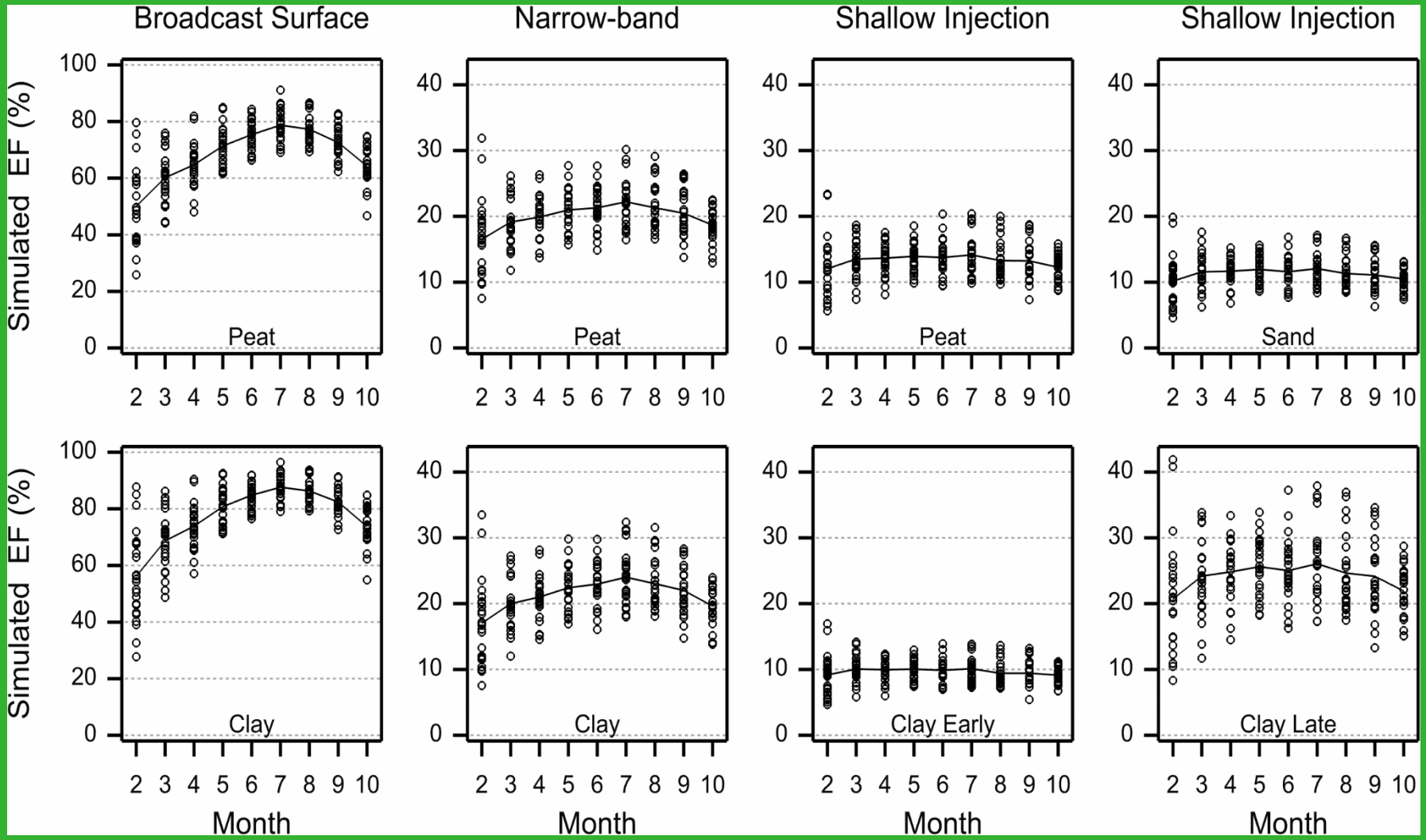
- technique and soil type
- application rate and season of the year

Results surface spreading

Shift	wind m/s	temp °C	app rate m^3/ha	TAN g/kg	ds %	grass height cm	soil type
9:00 - 10:30	+	+			-		X
10:30 - 11:00	+	+	+		+		X
11:00 -14:00	+	+	+				X
14:00 - 18:00	+						
18:00 - 07:00	+	+	+				X
07:00 - 07:00	+						
07:00 - 07:00	+						
07:00 - 07:00	+						

Results shallow injection

Shift	wind m/s	temp °C	app rate m^3/ha	TAN g/kg	ds %	Grass height cm	soil type
9:00 - 10:30	+				-		X
10:30 - 11:00	+	+					X
11:00 -14:00	+	+		-		-	X
14:00 - 18:00	+	+	+				x
18:00 - 07:00	+		+	-			X
07:00 - 07:00	+		+				
07:00 - 07:00	+					-	x
07:00 - 07:00	+		+	-			


Broadcast Surface
Narrow-band
Shallow Injection
Shallow Injection
Simulated EF (%)
Simulated EF (%)
Peat
Peat
Peat
Sand
Clay
Clay
Clay Early
Clay Late
Month
Month
Month
Month