

A Tier 3 method for ammonia from slurry

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14 May 2024

Topics

- ① Workflow for Tier 3
- ② Recent developments in ALFAM2 model
- ③ ALFAMI inventory calculations

Tier 3 workflow for ammonia emission from field-applied slurry

- 1 **Input data:** applied TAN quantity, application event details, weather
- 2 Data processing to prepare model inputs
- 3 ALFAM2 model (parameter values)
- 4 Data processing
- 5 **Results**

ALFAM2 model developments

Core component of inventory tools

- Predicts ammonia volatilization from field-applied slurry based on application method, slurry properties, and weather

New model structure

- Lumped sink for TAN removal makes for more realistic long-term predictions
- New closed-form solution and addition of ≥ 1 secondary parameter

New parameter set 3

- Based on original measurements plus newer data, in total 734 field plots, 9 countries
- Bootstrap approach used for uncertainty through parameter values

ALFAM2 model structure

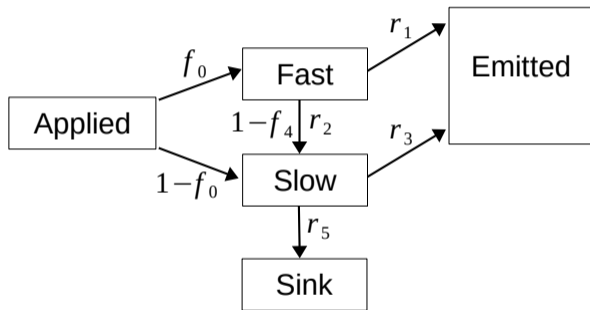


Figure 1: Structure of the latest version of the ALFAM2 model

ALFAM2 model structure

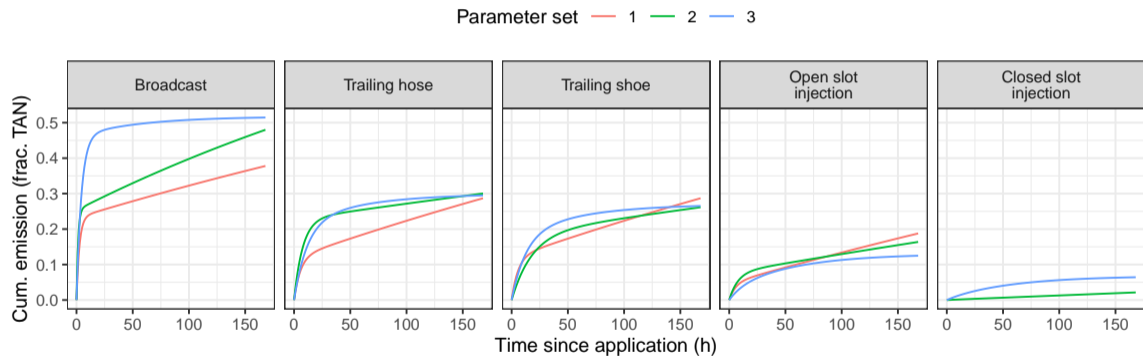


Figure 2: Comparison of predicted emission curves for 3 ALFAM2 parameter sets for a reference scenario

Predicted sensitivity

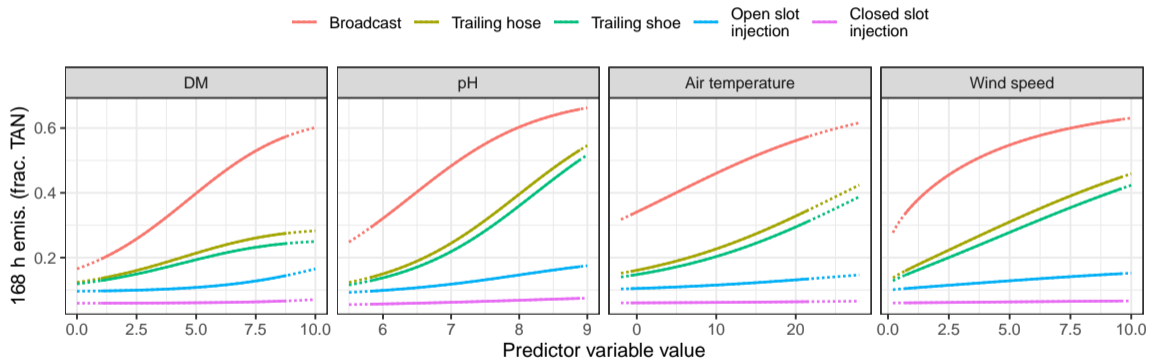


Figure 3: ALFAM2 model with parameter set 3 predicted sensitivity to 4 input variables

ALFAM2 model predictions - with uncertainty

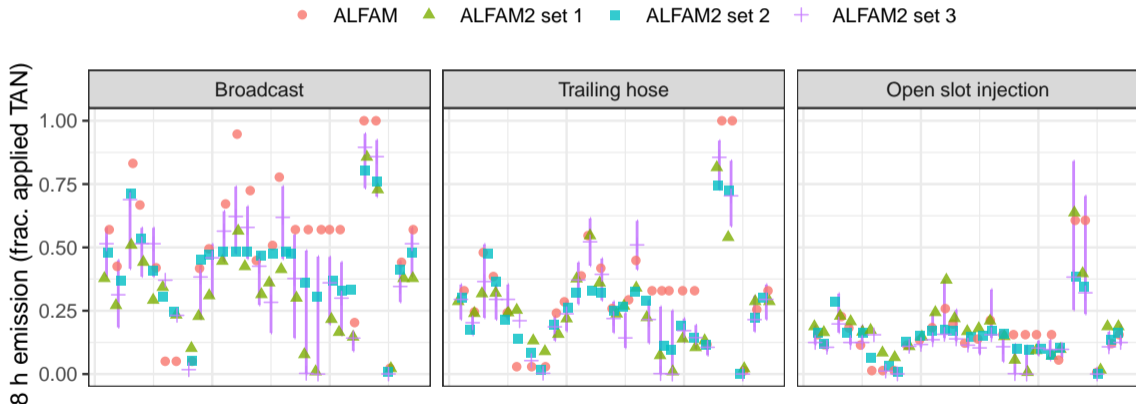


Figure 4: Example predictions from ALFAM and ALFAM2 models with uncertainty

ALFAMI inventory tool

Two approaches

- 1 In R
- 2 Web app

Key considerations for web app are ease of use and reproducibility

ALFAMI web app - inputs

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G
1	Application event name	Livestock category	Location key	Application year	Slurry key	Slurry application	TAN application
2	.	.	.	YYYY	.	Gg	Gg
3	3352 2020 cattle	cattle	3352	2020	cattle		0.2401
4	3352 2020 cattle	cattle	3352	2020	cattle		0.4415
5	3352 2020 cattle	cattle	3352	2020	cattle		0.1466
6	3352 2020 pig	pig	3352	2020	pig		0.0106
7	3352 2020 pig	pig	3352	2020	pig		0.0257
8	3352 2020 pig	pig	3352	2020	pig		0.0094
9	3352 2020 pig	pig	3352	2020	pig		0.0029
10	3352 2020 cattle	cattle	3352	2020	cattle		0.1201
11	3352 2020 cattle	cattle	3352	2020	cattle		0.0540

The spreadsheet interface includes a ribbon with various tools, a formula bar showing 'F6', and a navigation pane at the bottom with tabs for 'Instructions', 'Locations', 'Slurry composition', 'Application' (selected), 'Settings', 'Units', 'Uncertainty', 'Defaults', 'Reproducibility', and 'Directories'.

Figure 5: Example spreadsheet inputs for ALFAMI web app

ALFAMI web app - inputs

	A	B	C	D	E	F	G	H	I	J
1	Input	Units	Uncertainty type	Distribution type	Standard deviation	Minimum	Maximum	Centered minimum	Centered maximum	Shape
2	Slurry dry matter	% FM	Absolute	PERT				-2	4	4
3	Slurry pH		Absolute	Triangular				-0.3	0.3	
4	Application rate	t/ha	Absolute	PERT		0	50			4
5	TAN application	Frac. input value	Relative	PERT		-0.2	0.3			4
6	Incorporation delay	Frac. input value	Relative	Uniform		-1	2			
7	Air temperature	°C	Absolute	Normal	2					
8	Wind speed	m/s	Absolute	Normal	0.5					
9										
10										

Figure 6: Main uncertainty settings for ALFAMI app

ALFAMI web app - interface



ALFAMI Ammonia Estimator

Select An Excel File

No file selected.

Log

Figure 7: The ALFAMI web app, simple!

ALFAMI web app - interface

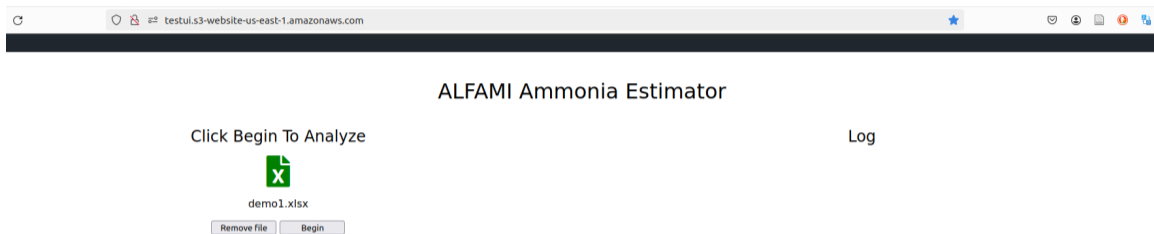


Figure 8: File selection in ALFAMI web app

ALFAMI web app - interface

The screenshot shows a web browser window at the URL `testul.s3-website-us-east-1.amazonaws.com`. The main content area displays the text "ALFAMI Ammonia Estimat" (partially cut off). Below this, there is a green Excel icon with an 'X' and the text "demo1.xlsx" and "File uploaded". A message states "Results will download automatically when ready." Below this message are two buttons: "Reset" and "Download Log".

On the right side, a download notification for "alfami_demo1.xlsx" (Completed — 13.9 KB) is visible. Below it, a "Log" section displays the following output:

```
-----  
Running ALFAMI tool v0.4  
-----  
See https://github.com/sashahafner/ALFAMI for latest version  
  
2024-05-14 10:10:10.753408  
  
System info:  
  
sysname: Linux  
release: 5.10.214-222.855.amzn2.x86_64  
version: #1 SMP Thu Apr 11 21:52:20 UTC 2024  
nodename: 169.254.128.125  
machine: x86_64  
login: unknown  
user: sbx_user1051  
effective_user: sbx_user1051  
  
R version info:  
  
R version 4.3.1 (2023-06-16)  
Platform: x86_64-pc-linux-gnu (64-bit)  
Running under: Amazon Linux 2  
  
LC_CTYPE=en_US.UTF-8      LC_NUMERIC=C  
LC_TIME=en_US.UTF-8      LC_COLLATE=en_US.UTF-8  
LC_MONETARY=en_US.UTF-8  LC_MESSAGES=C  
LC_PAPER=en_US.UTF-8     LC_NAME=C  
LC_ADDRESS=C             LC_TELEPHONE=C  
LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C  
.....
```

Figure 9: Completed ALFAMI web app run

ALFAMI web app - output

	L	M	N	O	P	Q	R
1	Upper total NH3-N emission	Lower total TAN application	Upper total TAN application	Lower effective emission factor	Upper effective emission factor		
2	1192	5219	6538	0.1515	0.2021		
3	932.2	5291	6627	0.1266	0.1428		
4	664.9	5219	6538	0.09434	0.107		
5							
6							

Navigation icons: K, left arrow, right arrow, double left arrow, double right arrow, download icon. Filter tabs: **By year**, By year, livestock cat., By application, Units

Figure 10: Example output from ALFAMI web app

Next steps

- ① Release new version of model and new parameter set
- ② Publish update to ALFAM2 model
- ③ Release ALFAMI software tools
- ④ Complete demonstration of ALFAMI tools

Thank you for your attention!

Website

- <http://www.alfam.dk>
- Updates, links, papers

Mailing list

Write to sasha.hafner@bce.au.dk

Thanks

- Many data contributors and collaborators who helped improve the model
- Funding from ALFAMI, eGylle, and MAG projects