SETAC DRAW

Current Status and Future Options for Representation of Drift

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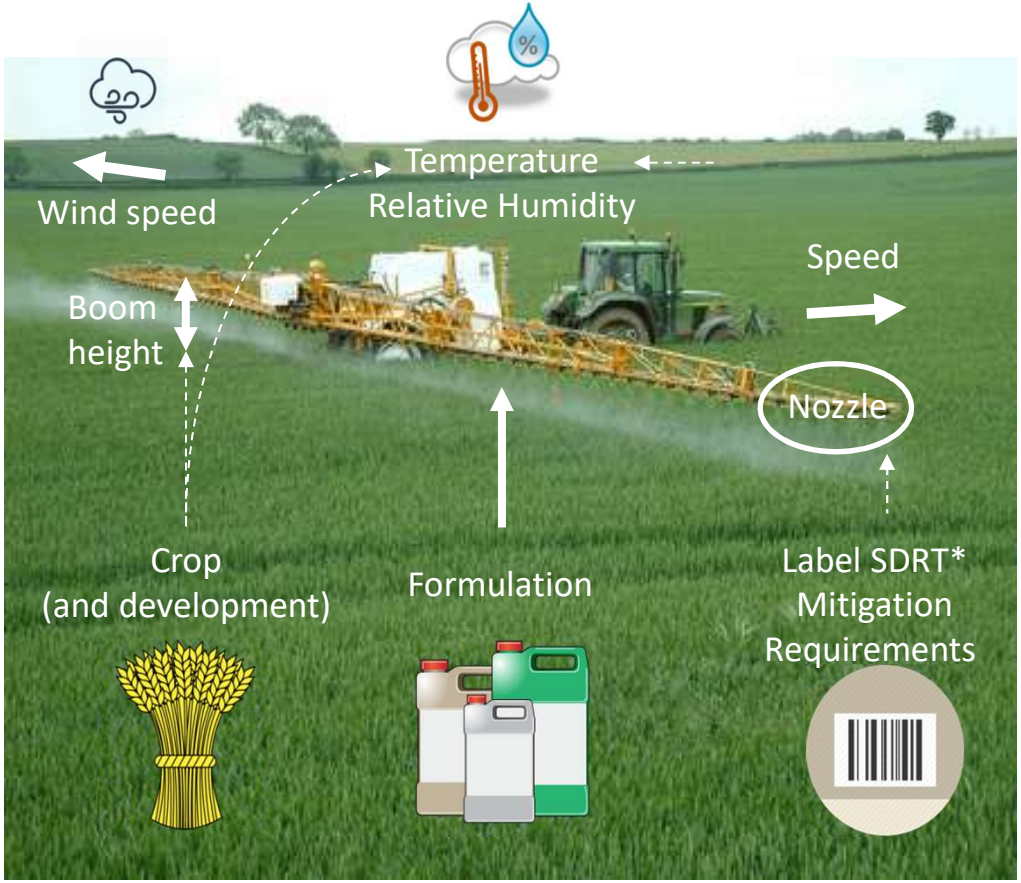
Spray Drift: Dependencies and Options for Management



Range of complex dependencies…

Drift is typically managed via;

- Generic "Good Practice" **recommendations**
- Supplementary specific label **restrictions**

Motivations to encourage discussion on spray drift and its management;

- Risk assessment conservatism
- Increasing risk assessment complexity
- Simplicity of drift representation
- Regulatory mitigation options constrained
- Lack of harmonisation in testing

**SDRT: Spray Drift Reduction Technology*

A path forward…

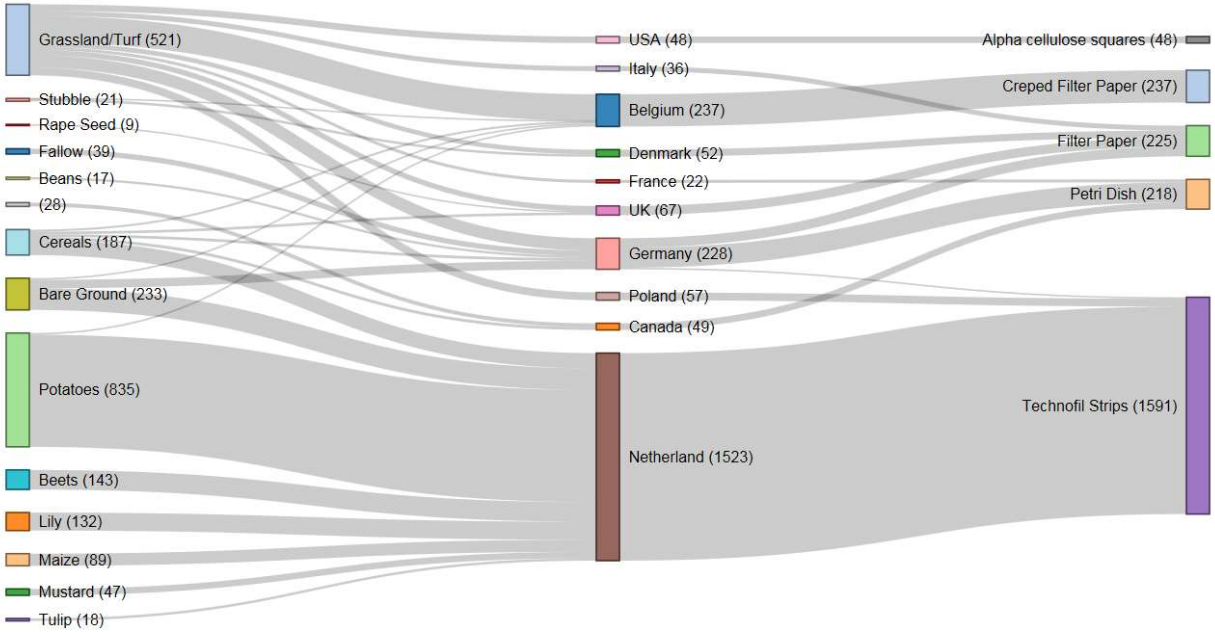
Development of expanded options and robust regulatory techniques to facilitate meaningful drift risk assessment and effective risk mitigation

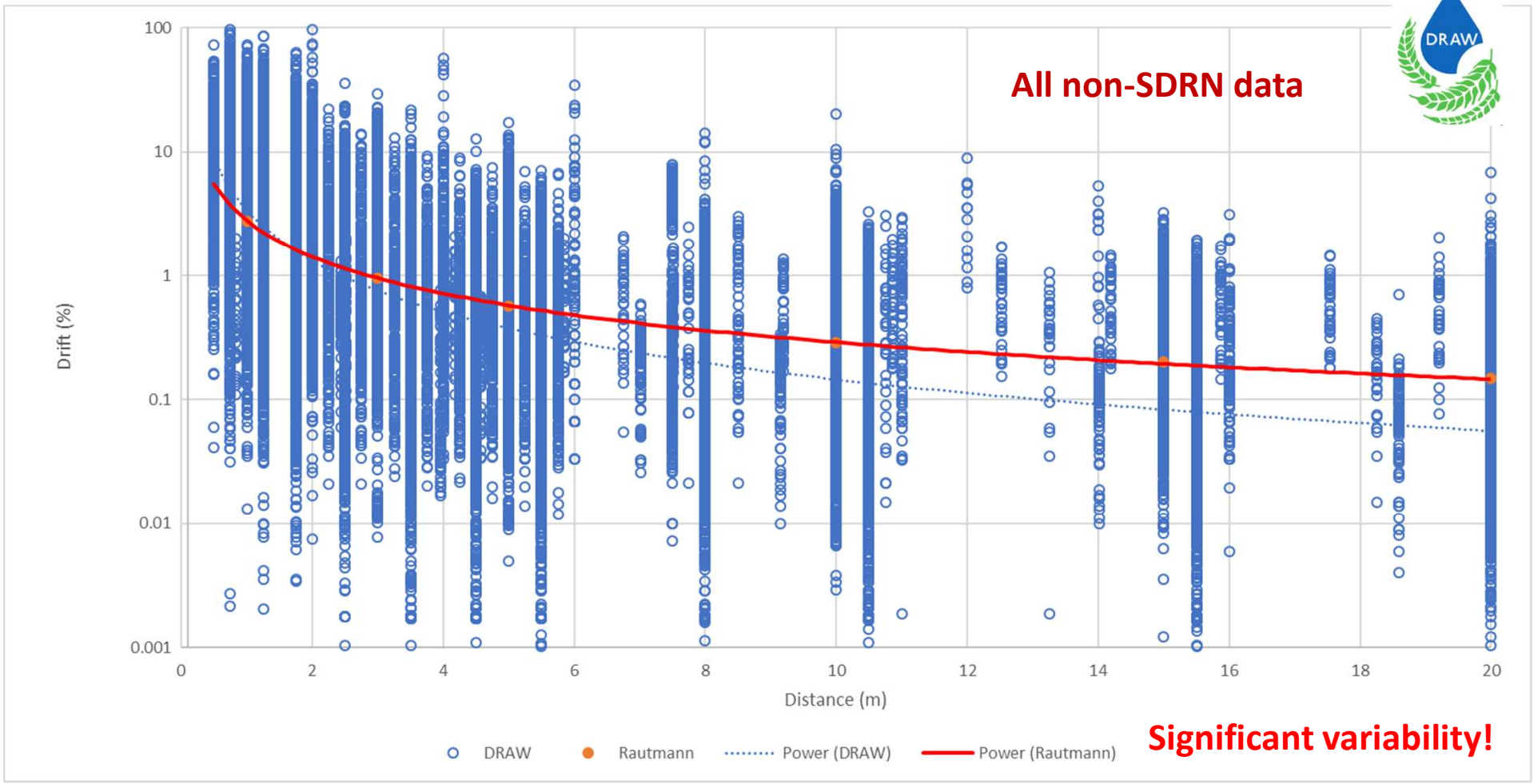
- This includes;
  - Organisation of multi-stakeholder SETAC workshops
  - 1st workshop Feb 2016, Montpelier, FR ☑;
  - 2nd workshop Feb 2017, Turin, IT ☑;
  - 3rd workshop Oct 17-18 2018 – Wageningen, NL
  - ECPA financial support for project activities, *e.g.*,
    - Drift trials to support protocol adjustments (2016; 2017/18)
    - Wind tunnel sampler investigations
    - Modelling comparison and scenario development
    - Database collation and analysis

Extensive and valuable heritage of research

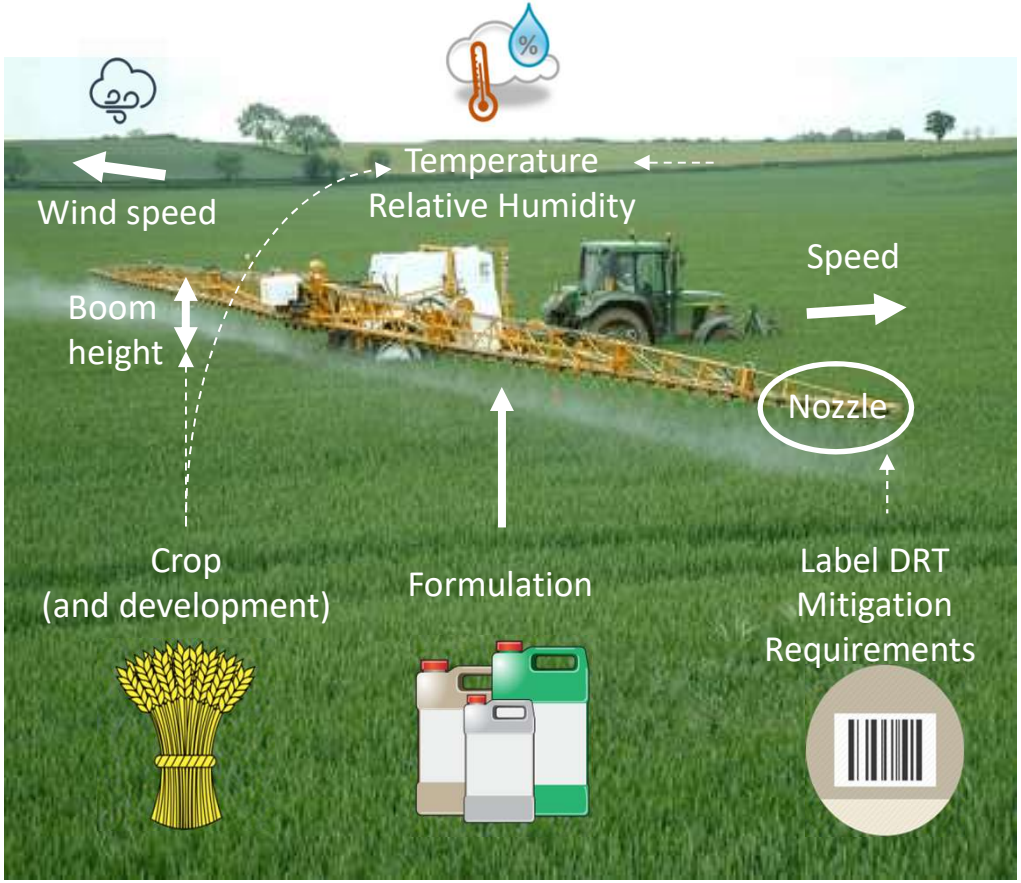
Review of available arable spray drift database

- 2307 drift trials – 56,839 lines of (validated) data so far – “standard” sprayer contribution is *circa* 1/3 of total database (899 trials)
- Parallel database compilation efforts completed by EFSA (released online May’17)
- Database continues to be expanded and improved.



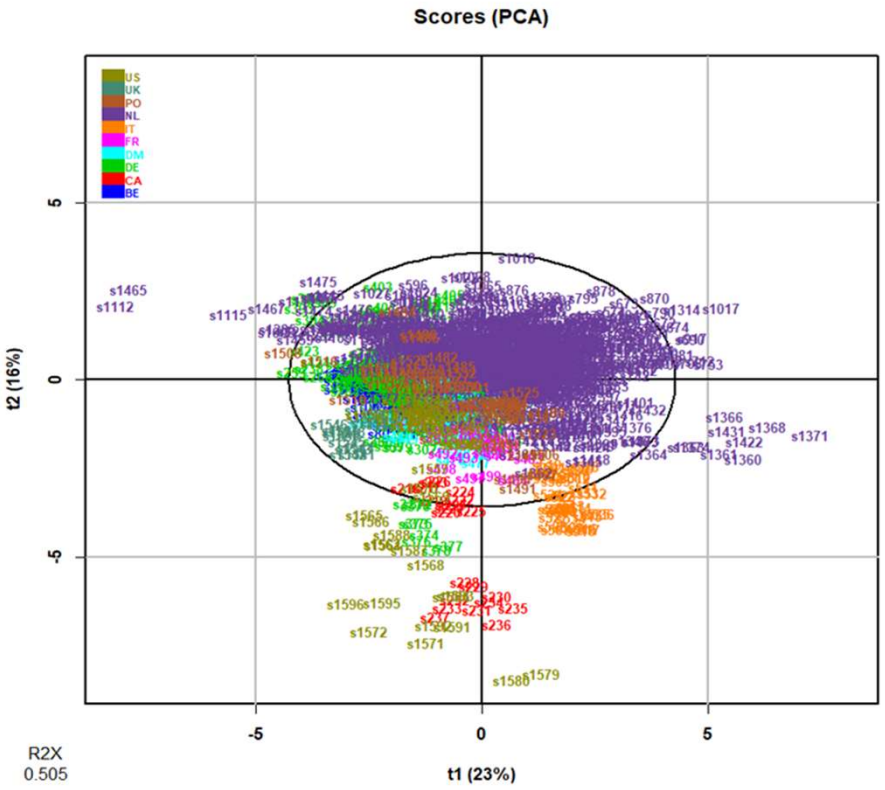

All non-SDRN data
Drift (%)
100
10
1
0.1
0.01
0.001
0
2
4
6
8
10
12
14
16
18
20
Distance (m)
DRAW
Rautmann
Power (DRAW)
Power (Rautmann)
Significant variability!

Drivers for Variability



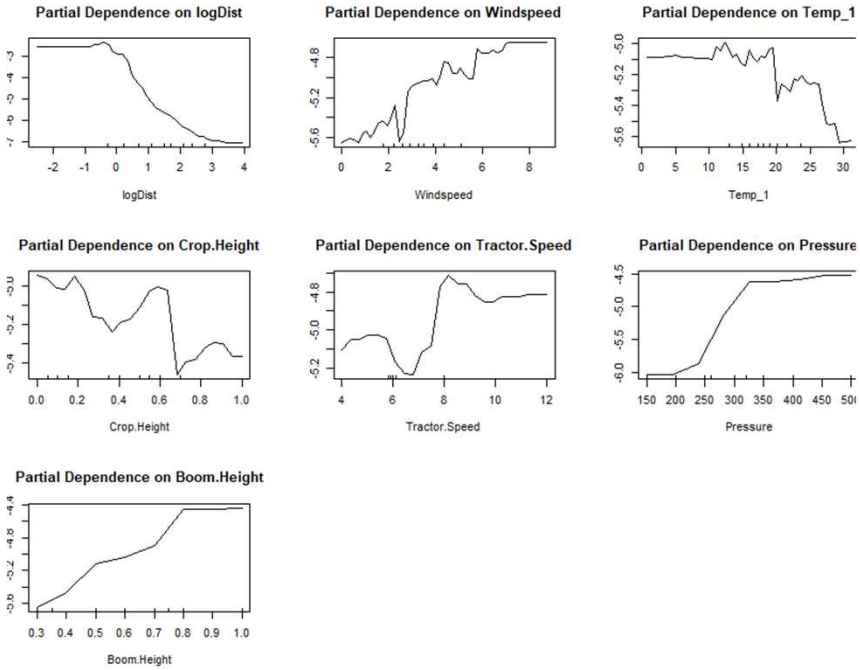
- How to interpret a large, diverse and variable dataset?
- Can we subdivide the dataset into more consistent “clusters” of data guided by sensitivity analysis?
- Can we derive meaningful drift curves based on these clusters?
- What are key drivers?

Multivariate Analysis



- One of the primary tasks in multivariate analysis is dimension reduction → focus on key variables
- Principle Component Analysis (PCA) reveals that "Institute" is a key differentiator
- Three key observations:
  - This is a motivation for greater harmonisation of study design!
  - Necessary to help explore other poorly understood factors (e.g. influence of landscape)
  - "Institute" is not a meaningful parameter when developing multivariate representations of drift for regulatory purposes!

Drift Dependency Sensitivity



- Key parameters from Random Forest Analysis:
  - Forward speed
  - Wind speed
  - Application pressure
  - Temperature
  - Boom height
  - Crop
  - Crop development

Illustrative Empirical Model Design

- Bayesian multilevel regression model structure:
  - log(Drift) ~ b1 + b2 * log(Distance) + ϵ
    - Intercept: b1 ~ 1 + Speed + Pressure + Temp + Wind Speed + Boom Height + $\epsilon_{Trial} + \epsilon_{Drift\ Line}$
    - Slope: b2 ~ 1 + Speed + Pressure + Temp + Wind speed + Boom Height + ϵ_{Trial}
- Data: Subsets divided by Crop and Crop Height
- Variance terms:
  - Inter-trial variance: ϵ_{Trial}
  - Intra-trial variance: $\epsilon_{Drift\ Line}$

Modelled Drift Curve Input

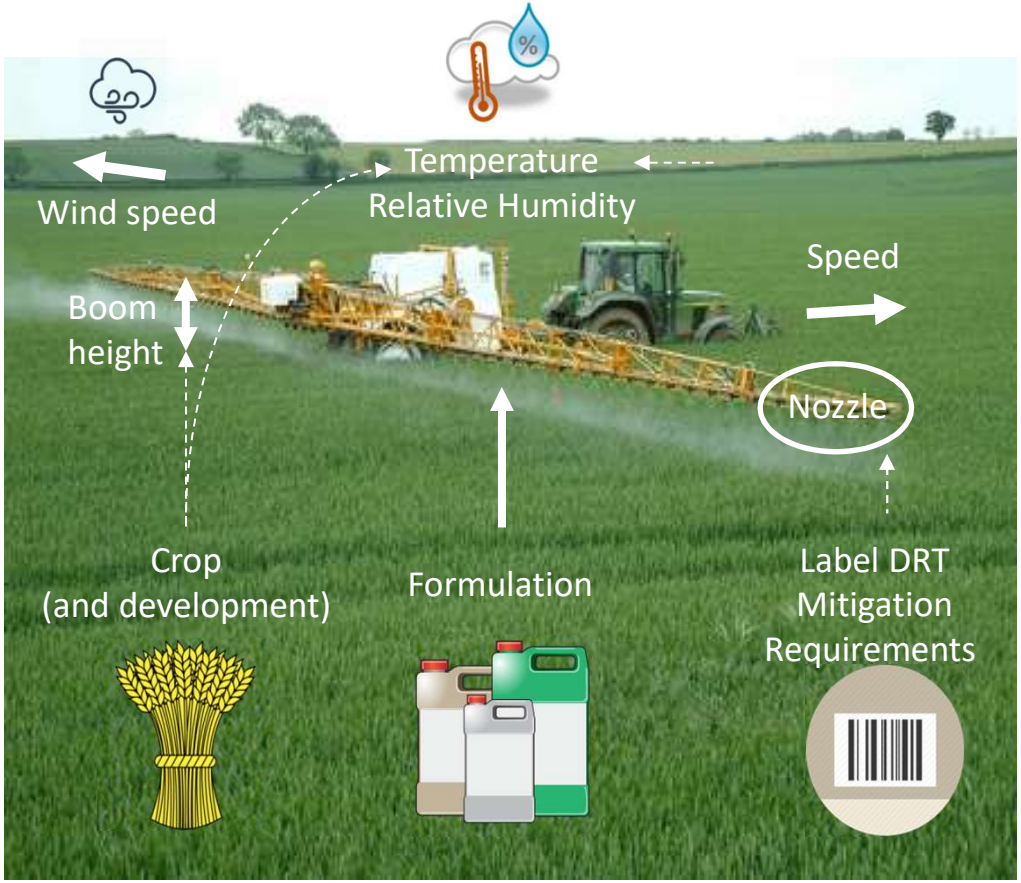
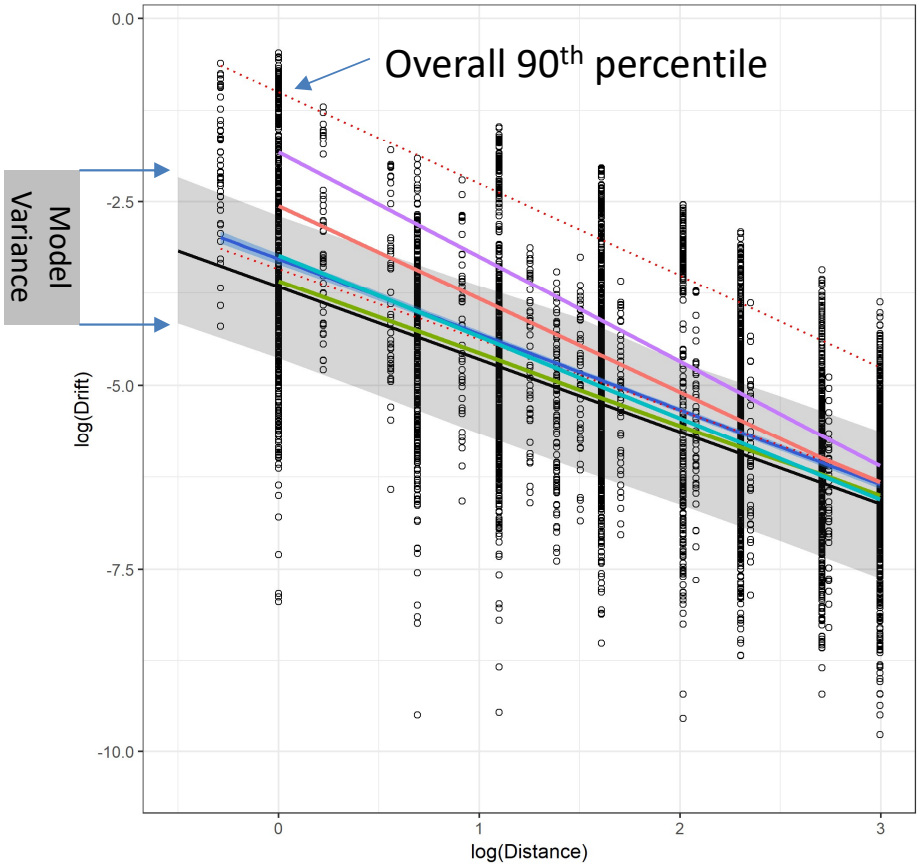


Illustration:

- Forward speed = 6 kph
- Wind speed = 3.2 m/s
- Application pressure = 300 kPa
- Temperature = 18°C
- Boom height = 0.5 m over target
- Crop = Monocot
- Crop development = ≤0.20 m

- *How does this illustrative curve compare with data holdings?*
- *How does this illustrative curve compare with other derived curves?*
- *How to address variability or uncertainty tied to model?*

Illustration: Monocot Crop ≤0.20 m



Surface

Low Crop (Illustrative Bayesian model representation*)

interaction(Source, Country)

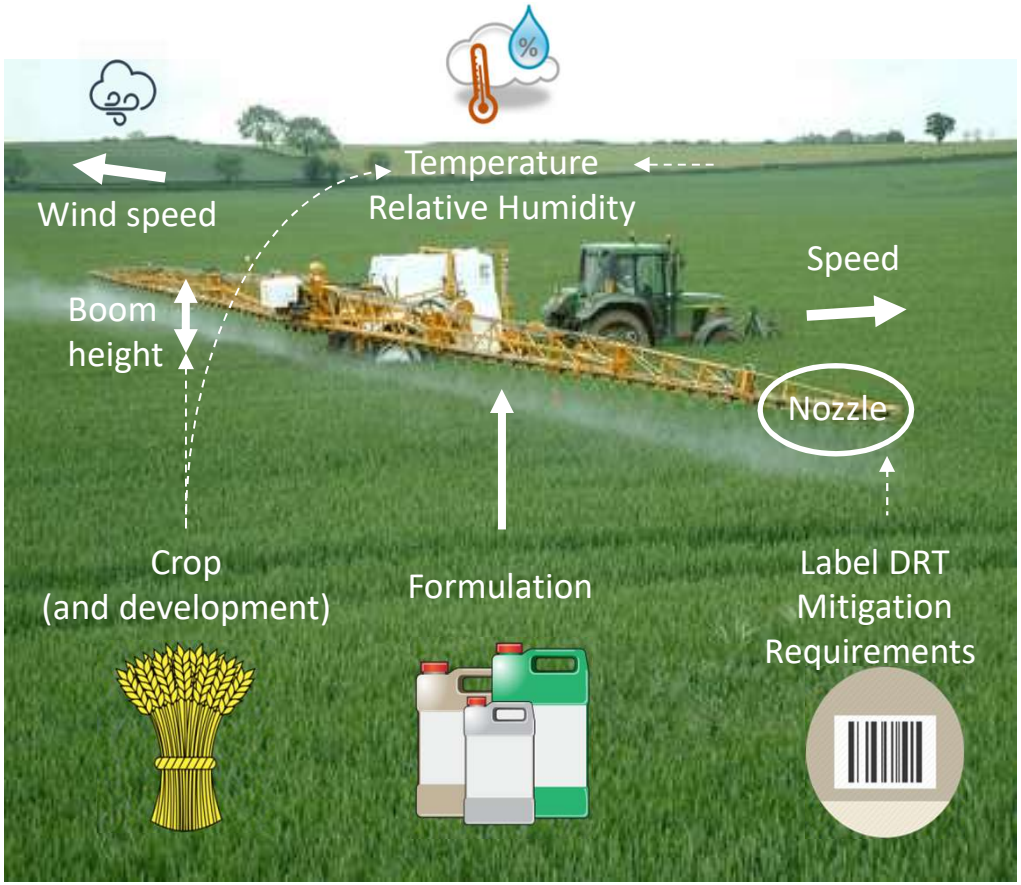
- PRI526.DE-NL
- Rautmann.DE
- PRI526.DE
- PRI526.NL

90th percentile curves DE/NL subsets

*Illustrative scenario:

Pressure=300 kPa; Temperature=18°C;
Wind speed=3.2 m/s; Tractor speed=6 kph,
Boom height=0.5 m

Regulatory Scenarios?



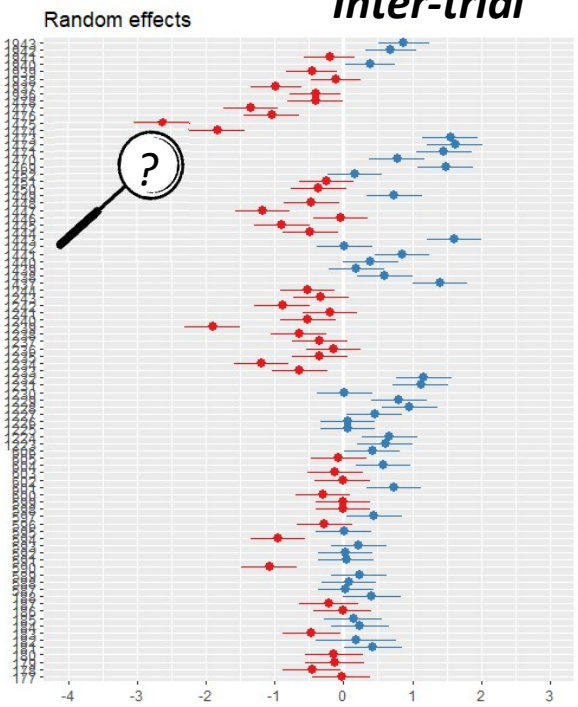
Settings:

- Forward speed = ?
- Wind speed = ?
- Application pressure = ?
- Temperature = ?
- Boom height = ?
- Crop = Bare soil, monocots, dicots?
- Crop development
  - Intervals tied to BBCH bands?
  - ≤0.20, 0.2-0.4, 0.4-0.6, 0.6-1.0 m?

- *Typically application settings can only be assigned by expert judgement …*
- *Consensus through workshop discussions?*

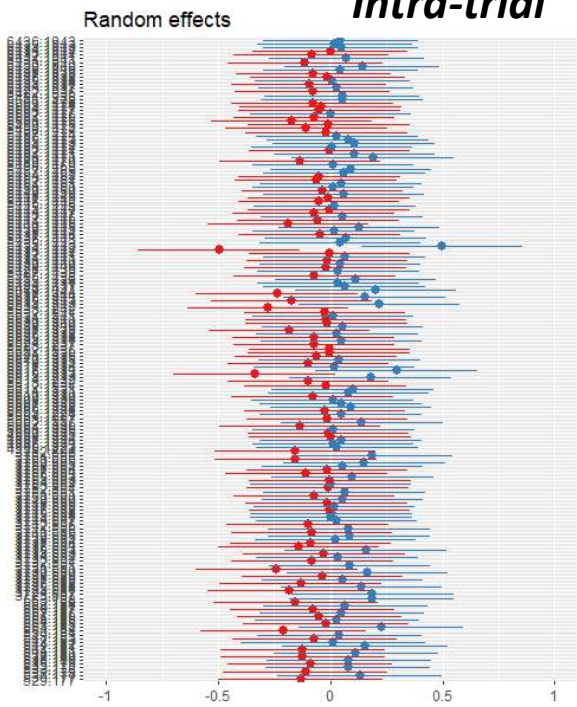
Inter-trial and intra-trial variance

Inter-trial



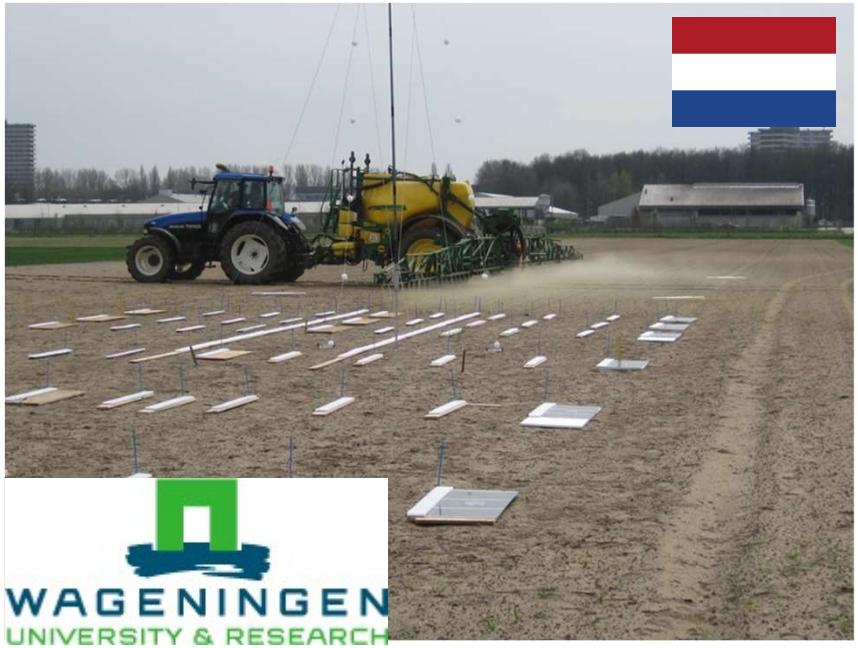
Can we better understand influences?
Incentive for study harmonisation?

Intra-trial



Assists understanding of edge of field variability? → Feedback to study design?

WS2 Protocol: Layout and Scale



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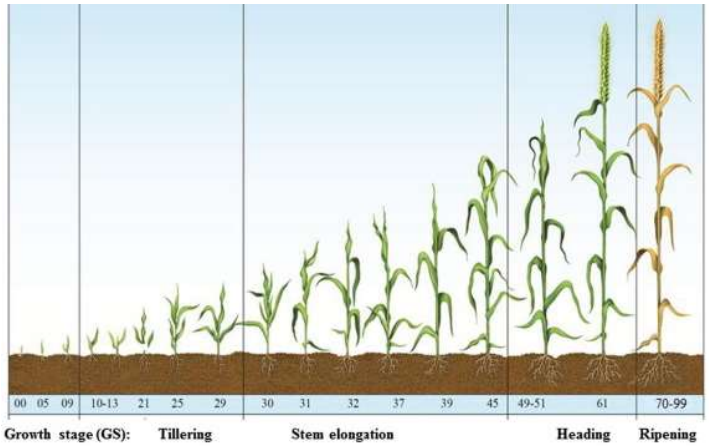
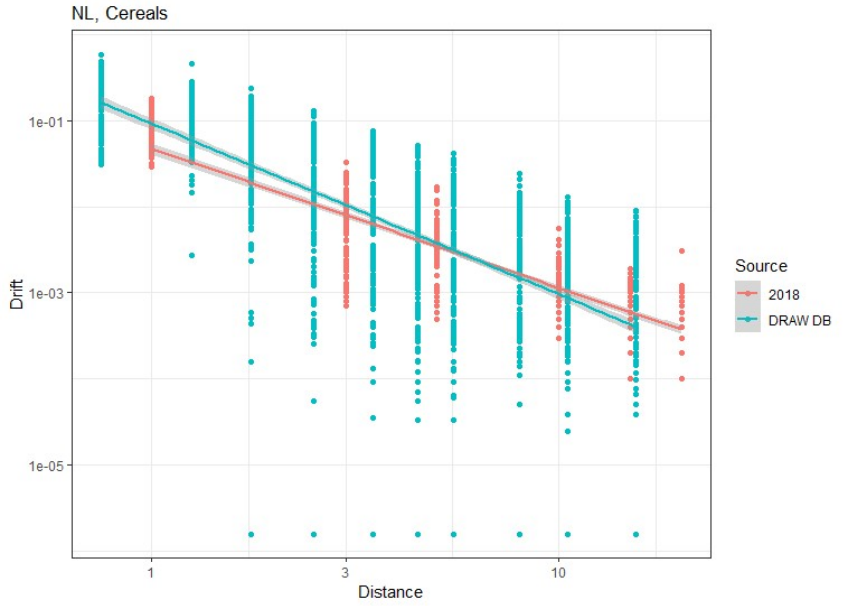
INSTYTUT OGRODNICTWA

Illustration: Trial Results Vs Database

- High quality trial datasets conducted under a wide range of conditions are a useful modelling resource for model testing and development





Preparing for Future Trends

Modelling accommodates future trends:

- Modelling provides a basis for readily accommodating future trends…
- SDRT becomes the new regulatory baseline? (note Good Practice in NL)
- Essential component within "Landscape Risk Assessment"

- Current drift representations highly simplistic…
- Robust models supported by diverse, high-quality datasets for validation are essential to move forward…
- SETAC Trials contribute to this supported by nozzle (DSD) testing…

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Thank you for your interest!

Regulatory Relevant Discussion Points

How to best interpret complex diverse datasets?

How much differentiation is needed in derived drift curves?

How to define “realistic worst case” regulatory drift curves/scenarios?

How to best address variability / uncertainty?

How to make best use of variance analysis for research & regulation?

How to develop role for regulatory drift modelling?