Possibilities and challenges of modelling the agricultural tracks at field scale

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References:
Augustin, K., Kuhwald, M., Brunotte, J. & Duttmann, R. (2019): FiTraM: A model for automated spatial analysis of wheel load, soil stress and wheel pass frequency at field scale. In: Biosystem Engineering 180, S. 108-120. DOI: 10.1016/j.biosystemseng.2019.01.019

Objective of Modelling with FiTraM

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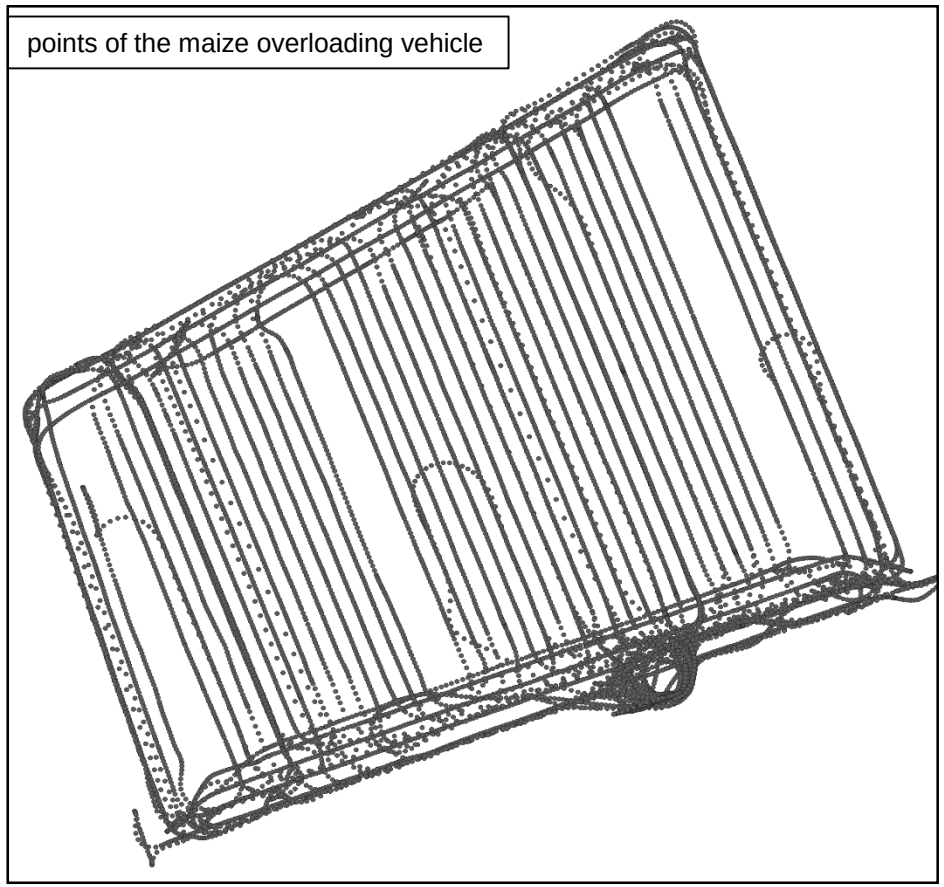
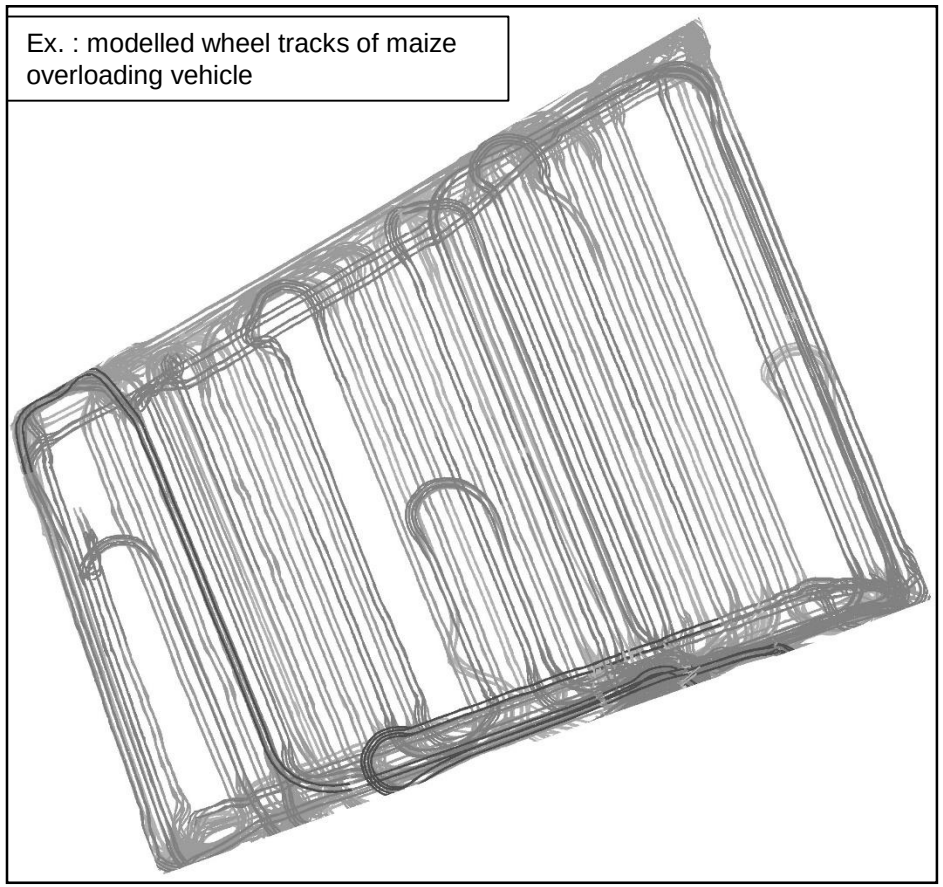
Gather Input Data

- measure machinery characteristics
- weighing the axle load
- record route using (RTK) GPS



Results

- wheel tracks for every axle
- spatial wheel load and soil stress
- spatial number of wheel passes



Characterisitcs of Work Processes – Possibilities and Challenges

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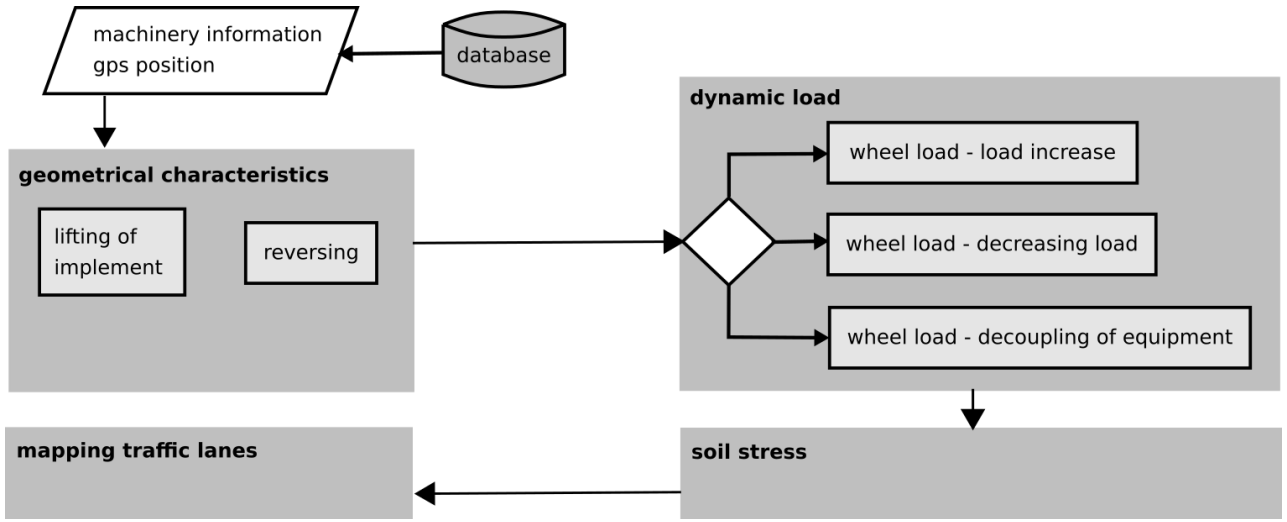
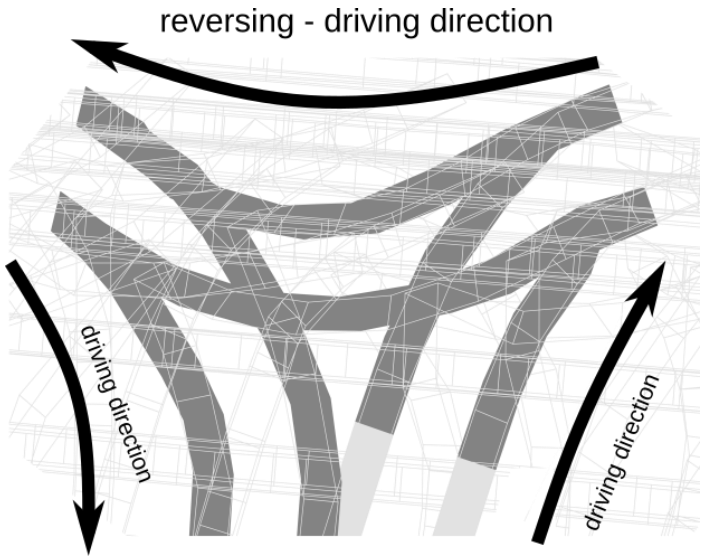


P = Possibility C = Challenge M = Method

Reversing (all work processes)

- P: dynamic changes in wheel load/wheel passes
- C: „pretty“ mapping of the tracks when reversing for short periods
- M: geometrical calcultation +empirical assumptions



Lifting implement (tillage, sowing)

- P: Modelling the dynamic changes
- C: smooth transition of the wheel load
- M: geometrical calcultation + empirical

(according to Augustin et al. 2019, p 116)

Payload/Unload (harvest,sowing,spraying,fertilizer)

- P: dynamic changes in wheel load/soil stress
- C: calculate the real payload/unload
- M: linear calculation + averaging

Potential Uses

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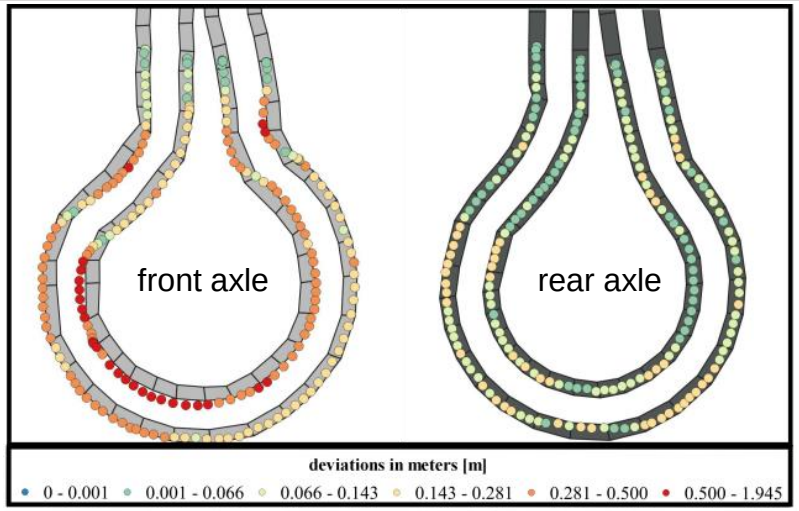
Position accuracy during turning

Validation

Compared to manual GPS recording of tracks



(according to Augustin et al. 2019, p.117)

Linear load calculation

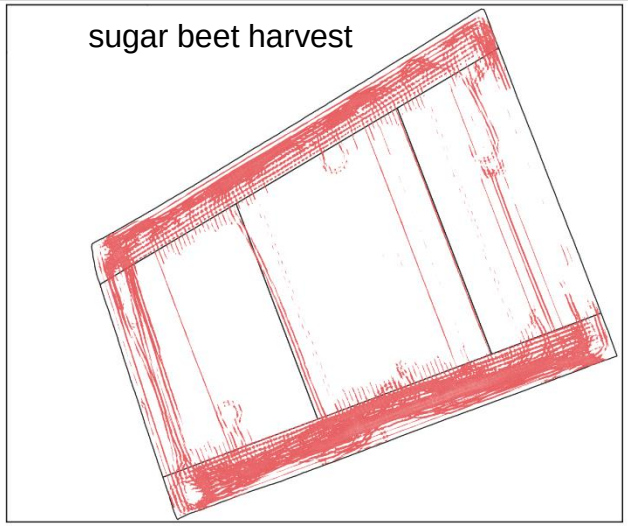
Comparison of the average maize yield from different measuring stations and methods

Recorded by	Average harvest [t\ha]
Modelling (linear) *based on average from Biogas plant	53.15
Biogas plant	51.40
Hand harvest	45.59
Machine recording	65.56

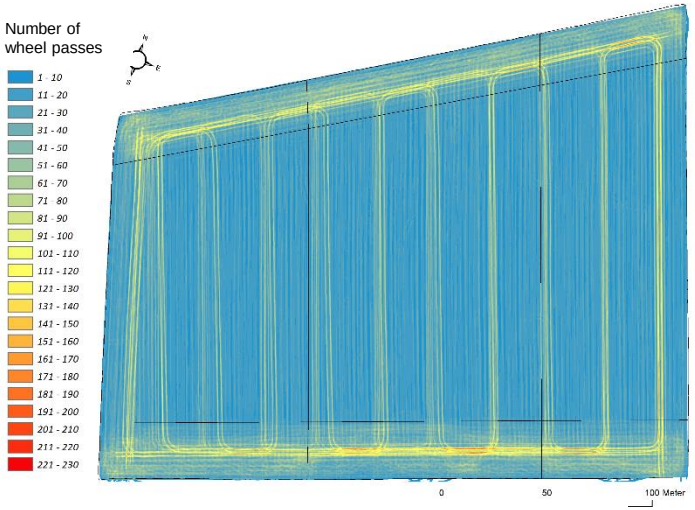
Further Processing

Intensive areas

Areas with more than 5 Mg wheel load and 5 wheel passes



complete seasons



crops:

2 x winter wheat

maize

sugarbeet