In-field variations of soil properties and wheel loads result in a spatially highly variable soil compaction risk

Evaluating of agricultural field traffic by modelling traffic intensity and related soil compaction risk

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OBJECTIVES
Soil compaction risk is spatio-temporal dynamic, not only on regional but also on field scale. However, no analyses exist focusing on in-field variation of soil compaction risk. Thus, this study aims to model and analyze the variability of soil compaction risk within fields for different crops.

RESULTS & DISCUSSION
This is the first approach enabling soil compaction risk analyses for an entire field with such a high spatial resolution (10 cm). The analyses show that soil compaction risk is highly variable on a certain field depending on soil properties and dynamic changes in wheel load.

<table>
<thead>
<tr>
<th>Maize-harvest</th>
<th>Winter wheat-harvest</th>
<th>Sugar beet-harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel load: 2,700 - 7,100 kg</td>
<td>Wheel load: 1,900 - 8,600 kg</td>
<td>Wheel load: 5,600 - 10,300 kg</td>
</tr>
<tr>
<td>Soil moisture: 17.5 - 21.2 vol.%</td>
<td>Soil moisture: 22.4 - 36.6 vol.%</td>
<td>Soil moisture: 17.7 - 25.1 vol.%</td>
</tr>
<tr>
<td>Year: 2016</td>
<td>Year: 2017</td>
<td>Year: 2018</td>
</tr>
</tbody>
</table>

METHODS
- A field in northern Germany (silt loam), three years (2016, 2017, 2018), three crops (maize, winter wheat, sugar beet)
- Soil moisture measurements at 30 sites (20, 40 cm depth)
- Further soil measurements at 60 sites (e.g. texture, Corg)
- Application of the “FiTraM”-model (Augustin et al. 2019) for calculating exact traffic lanes and wheel loads
- Application of the “SaSCIA”-model (Kuhwald et al. 2018) for modelling soil compaction risk for different depths