TYRE WEAR MAPPING

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Microplastics at Fraunhofer UMSICHT

- Research projects
  - Multi-Client Study: Microplastics and marine plastic litter
  - Circular Plastic Economy Cluster
  - iMulch - Influence of polymers on a terrestrial ecosystem
  - PlastikBudget – Socioeconomic effects of plastics in the environment
  - FibrEX – Development of a bioinspired washing machine microplastics filter

- TyreWearMapping – geographical distribution, fate and quantification of TRWP | 11/17-05/20

http://www.initiative-mikroplastik.de
http://www.umsicht.fraunhofer.de/content/dam/umsicht/de/dokumente/pressemitteilungen/2015/konsortialstudie-mikroplastik.pdf
TyreWearMapping Methodology

DATA ACCESS
- collection of scientific publications and reports
- evaluation of literature
- data gap analysis

DATA BASED APPLICATION
- extraction of data
- probabilistic model
- digital dispersion model
- validation and verification
- planning and decision-making tool

VERIFICATION OF THE MODEL
- implementation model region "Wupper"
- sample collection and analysis
- generation of empirical data

12/19 Stakeholder Workshop, Berlin
01/19, Brussels
02/20, Brussels
Modelling approach for the calculation and distribution of the total tyre wear

- **Mileage Approach**
  - driven kilometers (KBA 2016: 63.7 millions vehicle | 733 billions km/a)
  - number of tyres per vehicle type (car, trucks, buses, motor bikes etc.)
  - average runtime of tyres during their service life
  - tyre wear per vehicle\(^1\): 53 - 200 mg/km (car), 1500 mg/km (semitrailer)
  - masses losses during service life (car)\(^2\): 7.6 – 33 %

⇒ distribution of the entire mass over different road types by the means of statistical data (traffic distribution, stress intensity, road condition, weather, etc.)

⇒ allocation of typical, probable, distance based tyre wear emissions to classified roads

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\(^1\) B. Kocher: Stoffeinträge in den Straßenraum – Reifenabrieb, BAST- Bericht V 188, (2010)

\(^2\) 40 000 km run length, 7000 g weight of the new tyre
In the municipal sector many data gaps or data that have not been acquired so far exist.
Results of TyreWearMapping as example of the Saarland

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<tr>
<th>Federal States</th>
<th>Completion Status</th>
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<td>Rhineland-Palatinate</td>
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</table>

**Data Sources**

- Sachdaten Bearbeitung
- Geodaten GeoBasis-DE / BKG 2015

**Contact**

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- boris.dresen@umsicht.fraunhofer.de

**Scale**

- 1:3,500,000
Tyre wear distribution in Saarland

2,570 km² = 0.75 % of the German territory

[kg_{TW}/(m_{road} * a)]

- ✔ Saarland_TW_selection_8km
- TW_total_per_section

- 0.000 - 0.005
- 0.006 - 0.050
- 0.051 - 0.500
- 0.501 - 12.028
Tyre wear distribution in Saarland > Homburg

Average annual tyre wear mass for a section (radius of 8 km) around Homburg [kg\textsubscript{TW}/m\textsubscript{road}]

HOTSPOT! 500 g/(m*a)
Tyre wear distribution in Saarland > Homburg

HOTSPOT! 300 kg/a

average wind direction

approx. 600 m

3900 habitants!

\[ 600 \text{m} \times 500 \text{g/(m*a)} = 300 \text{kg/a} \]
Atmospheric transport of tyre wear in the Wupper river basin

Total emission of pm-4 (>50 μm)
(no differentiation of meteorology!)
Glance into the future

- Tyre wear emission models for environmental friendly, future mobility scenarios (autonomic driving, e-mobility)
- Development of an overall data portal for tyre emission involving all relevant organizations
- Integration of municipalities and authorities for a common environmental and traffic strategy
- Evaluation of the emission model → metrological mapping
Thank you for your attention!

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