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MODELLING OF THE DISTRIBUTION AND FATE OF TYRE AND ROAD WEAR PARTICLES

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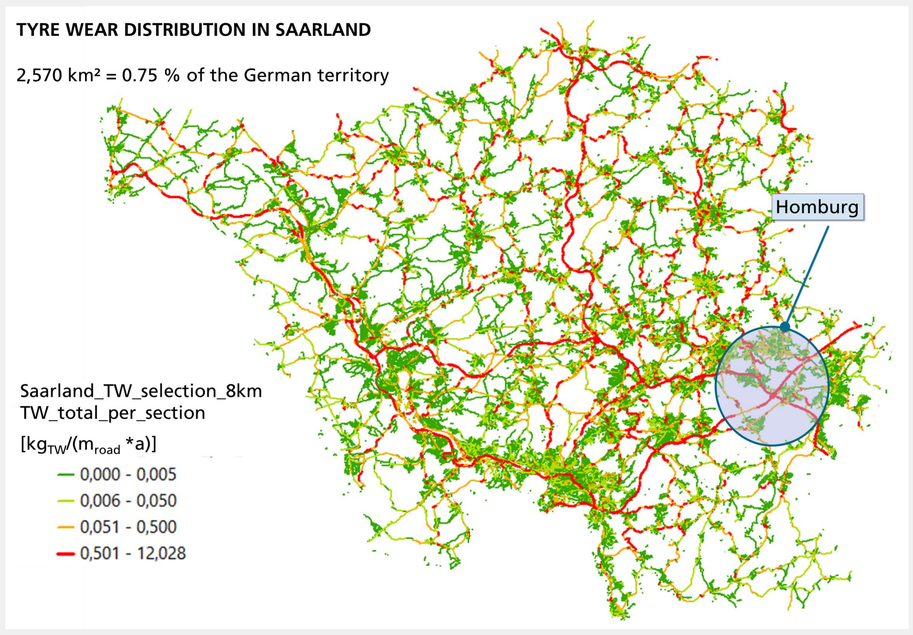
MOTIVATION

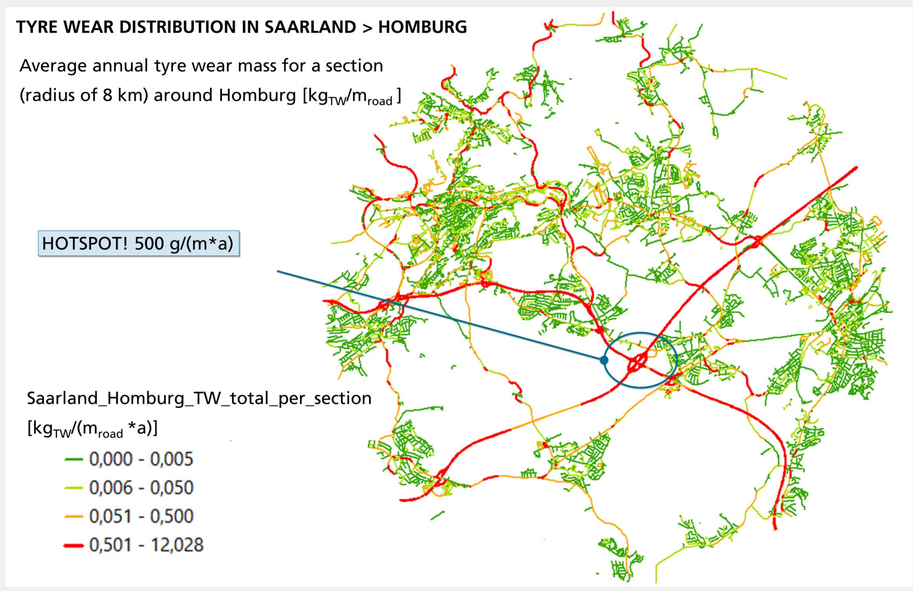
Tire abrasion (Tire Wear Particles, TWP) has been identified as a major source of microplastic emissions: It is estimated that in the European Union 1,327,000 and in Germany 133,000 t/a of TWP are released [1,2].

The authors aim to develop a model for the spatial distribution of the generation of TWP and dispersion models for both the fate of TWP in the atmosphere and in water which could be implemented in planning and decision tools allowing public authorities to identify hot spots.

MATERIALS AND METHODS

They combined a probabilistic and GIS (Geo Information System) model in order to calculate the TWP distribution for Germany. The probabilistic model is realized as “plug-in” of the GIS. It aims to calculate a *relative wear intensity* for each street segment depending on the estimated driving forces for cars and trucks, respectively. The forces depend inter alia on velocity, slope and curvature. Combined with the information on the traffic intensity, this information is used to assign an amount of TWP on each street segment. A main issue is the compilation of the data sets, because the data are available in different formats and level of detail due to the federal responsibilities. Furthermore, traffic intensities are available only for major roads and models were developed to fill these data gaps for other roads.



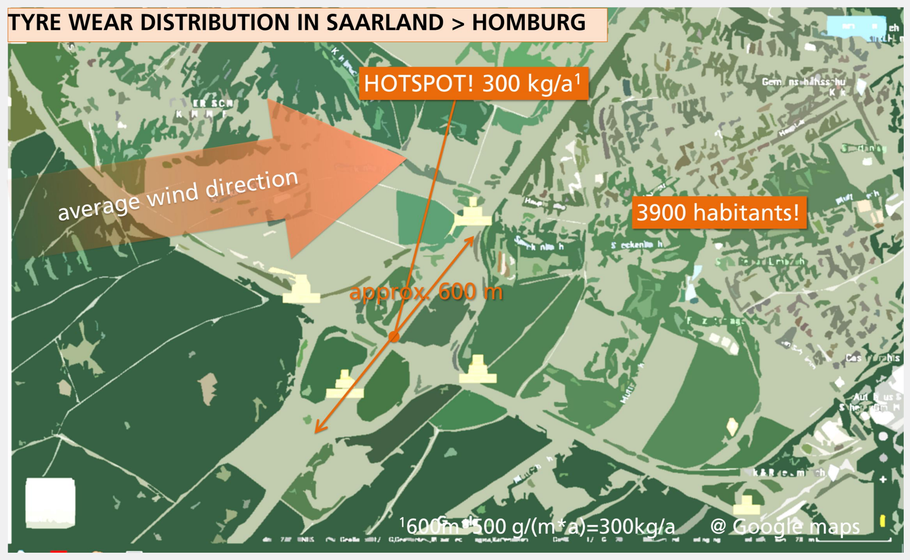


RESULTS

The results can be expressed as follows:

- A GIS data set for all German states is available
- distribution of the entire mass over all roads 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

The figures visualize a typical hotspot analysis for the region of Homburg, Saarland. Highways show the highest local emissions (red), due to the high traffic density, although the wear intensity (not shown here) is lower than for urban roads.



OUTLOOK

The propagation in water will be demonstrated at two river basins: Wupper and Panke and a systematic metrological mapping will show the influence of the atmospheric fate.

[1] Wagner S et al. 2018. Water research 139:83–100
[2] Bertling J; Hamann L; Bertling R. 2018. Kunststoffe in der Umwelt. DOI: 10.24406/UMSICHT-N-497117.

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