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INPUT REQUIREMENTS FOR MODELLING THE MICROSCALE SPATIAL DISTRIBUTION OF EMISSION HOTSPOTS BASED ON REAL-WORLD MEASURED VEHICLE ACTIVITY

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Introduction

Quantification of the spatial distribution in vehicle emission rates is needed to identify emission hotspots and provide insight regarding why these occur.

Objective

Define the input requirements of a microscale vehicle tailpipe emissions model to support estimation of on-road emission rates at high spatial resolution.

Microscale emission estimation methodology and results

One Hz measured data of vehicle activity and emissions for a sample of 10 light duty gasoline vehicles demonstrate a method to create segmented trajectory data files for input to a emissions model.

Segmented trajectories are used as inputs to the microscale emission model U.S. E.P.A. Motor Vehicle Emission Simulator version 3 (MOVES3).

LabVIEW code was developed to run MOVES3 batch calculation in five main steps (Fig.2).

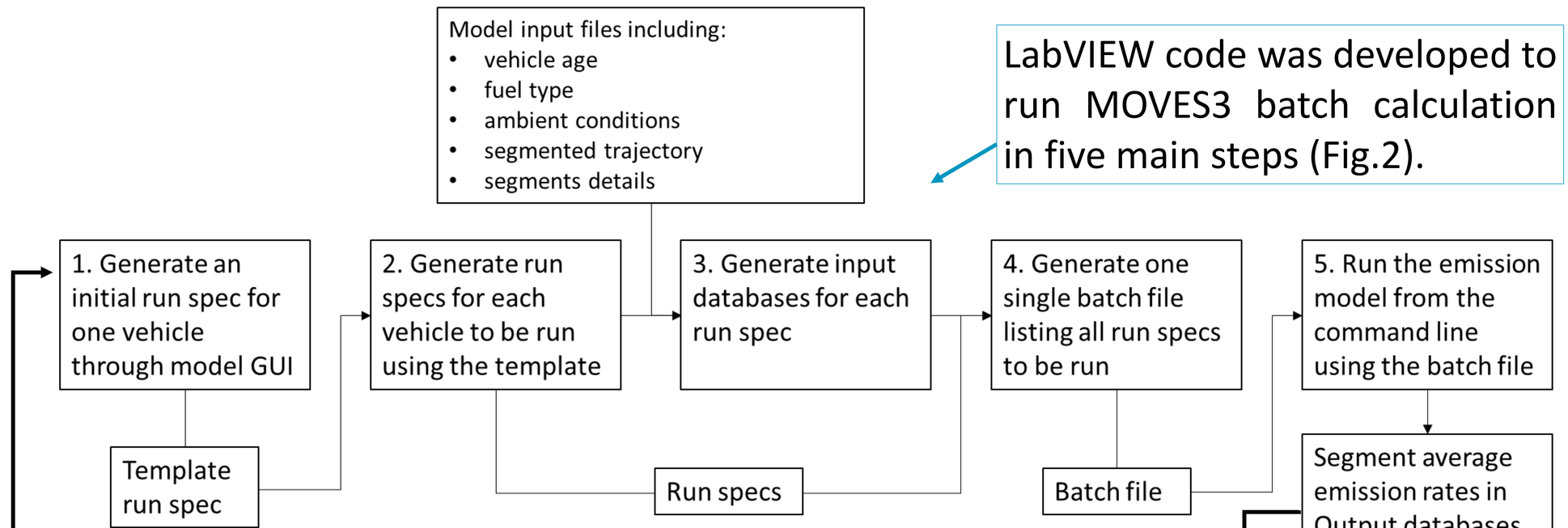

Fig.2. Model batch calculation process flow diagram.

The 1 Hz data of speed and road grade over 8 predefined routes were spatially joined with ArcGIS to 450 road segments that average 0.4 km in length (*Fig.1*).

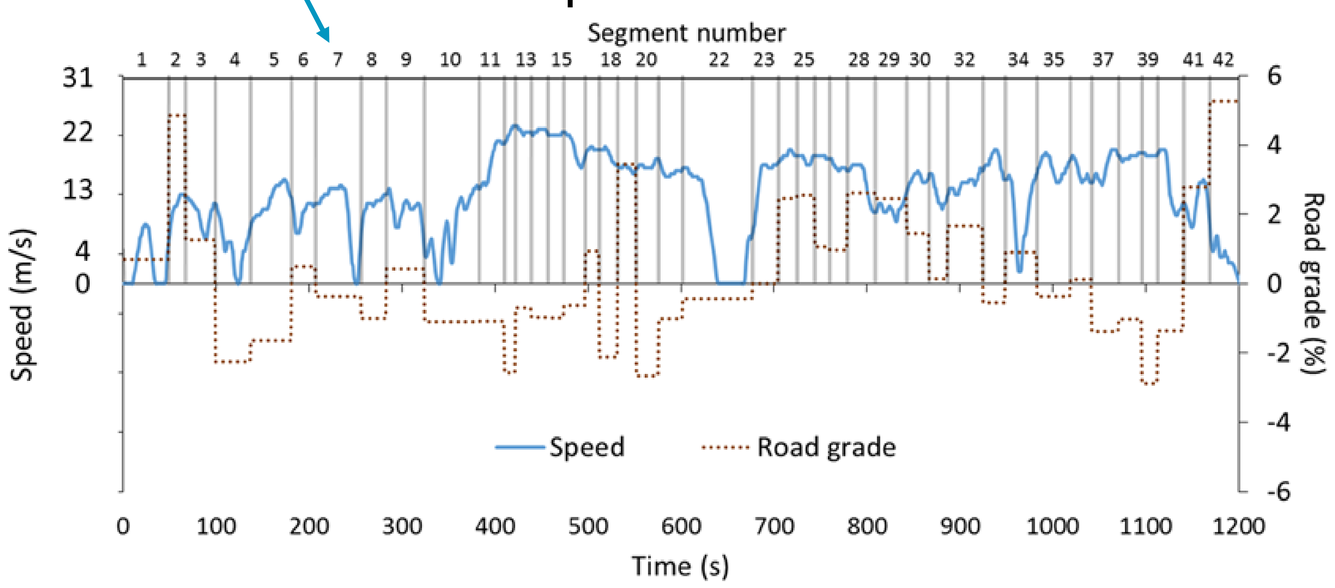

Fig.1. Second by second vehicle speed and segment average road grade for an example vehicle trajectory (Ford Fusion) over route A-out (42 segments).

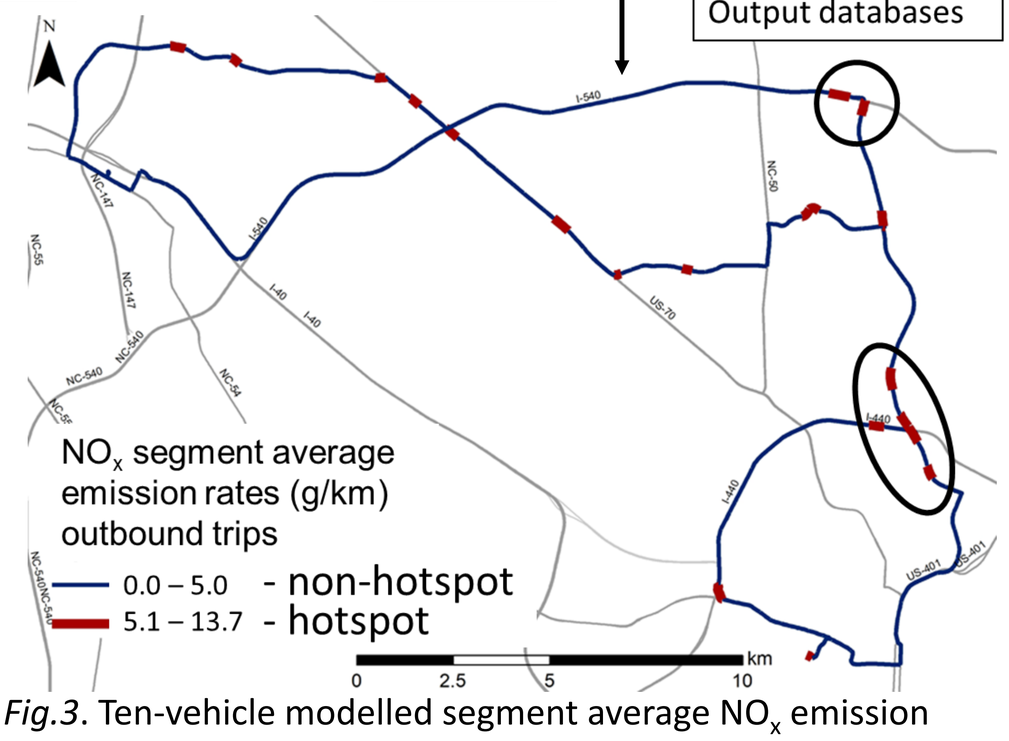

Fig.3. Ten-vehicle modelled segment average NO_x emission rates for outbound trips.

The outcomes are segment average emission rates (g/km) for the fleet of the modelled vehicles and pollutants over the 450 segments (*Fig.3*) enabling the identification of hotspots.

Conclusions

- Second-by-second (1 Hz) vehicle activity is used by microscale vehicle tailpipe emissions models to support estimation of on-road emission rates at high spatial resolution.
- Estimation of segment average emission rates by means of a microscale emission model has been demonstrated for a set of 10 vehicles.
- This methodology is useful to identify microscale emission hotspots locations at high spatial resolution.

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