Modeling timber truck speed and fuel consumption in Finland based on CAN bus data and auxiliary information

Perttu Anttila, Tuomas Nummelin, Kari Väätäinen, Juha Laitila & Jari Ala-Ilomäki

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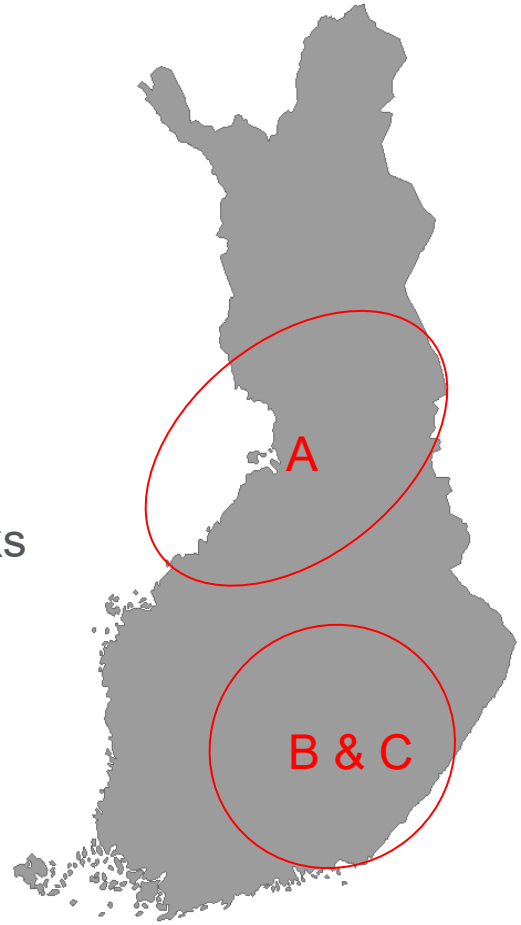
Background

- Information on timber truck speed and fuel consumption in varying conditions needed for route optimization and cost estimation
- Data on speed and consumption are automatically collected by trucks' fleet management systems
- Auxiliary information describing road properties and weather conditions can be connected with the data
- Aim to create prediction models for driving speed and fuel consumption

CAN Bus Data

- A follow-up study in April 2018 – March 2019 with three entrepreneurs
  - Entrepreneur A 8 trucks
  - Entrepreneur B 3 trucks
  - Entrepreneur C 2 trucks
- Combination vehicles: 3 * 68 t + 10 * 76 t
- Scania Fleet Management System operative in all trucks
- Recording interval mostly 10 min
- Roughly 480,000 data points
- Odometer reading, cumulative fuel consumption, coordinates, time stamp
- Average speed and fuel consumption calculated for all the routes between two consecutive tracking points



Weight Data

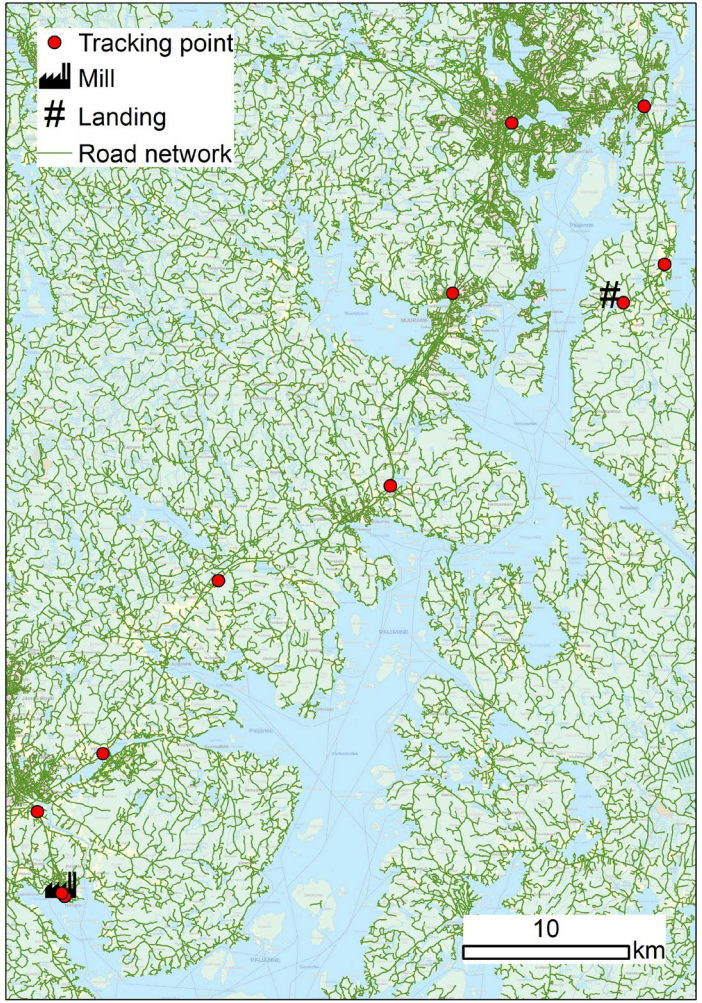
- Transport management system LogForce by Trimble
  - locations of loading and unloading points and weights of all the loads transported under the system
  - altogether 8287 truck loads, 408 kt

- Receiving mills of Metsä Group, Stora Enso and UPM
  - pulp mills: weight of each timber assortment based on stationary weighing systems
  - sawmills and plywood mills: solid volume of each timber assortment
  - altogether 15 mills
  - 171 kt of these deliveries found in LogForce data (42% of all deliveries in LogForce)

Photo: Jari Lindblad

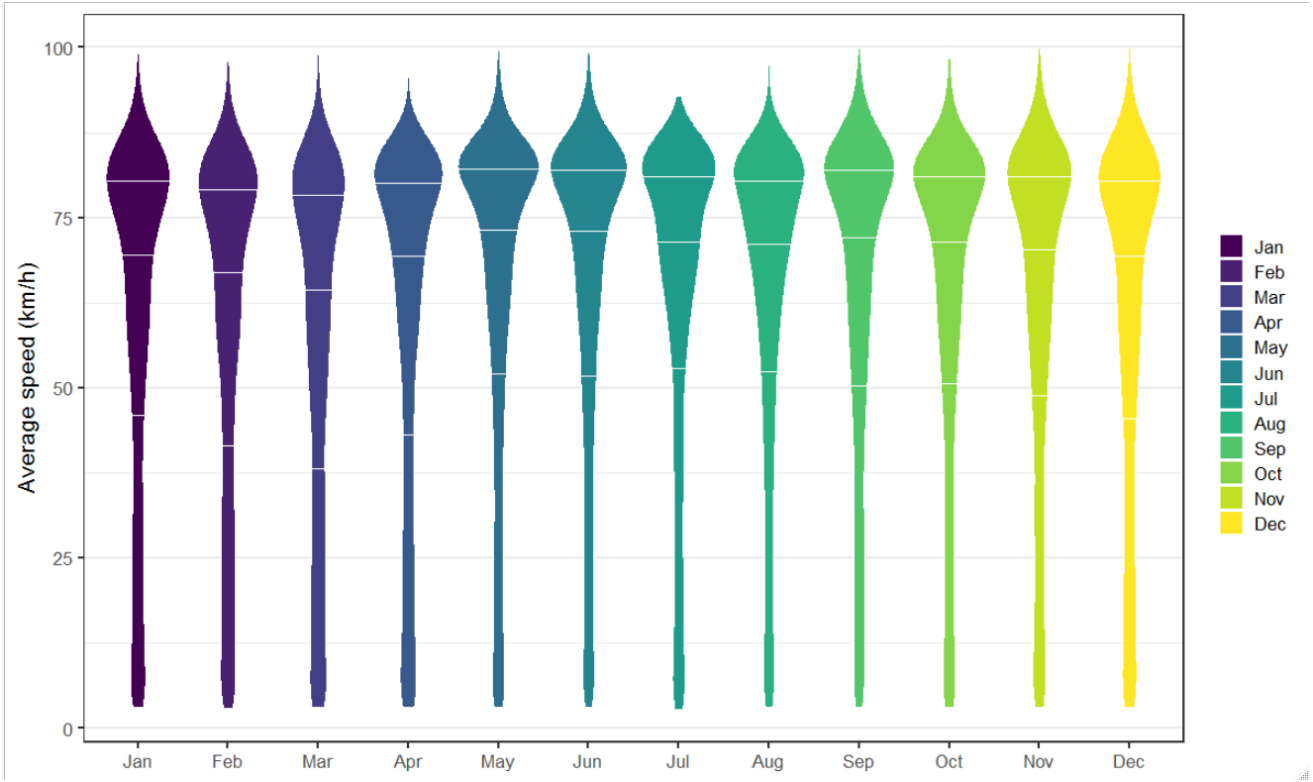
Road and Weather Data

- National road and street database Digiroad
  - Road geometry & attribute data
  - Includes in practice all the roads
- Weather data
  - e.g. rainfall, temperature, wind speed and direction
  - daily average, minimum and maximum values
  - 1 km * 1 km grid



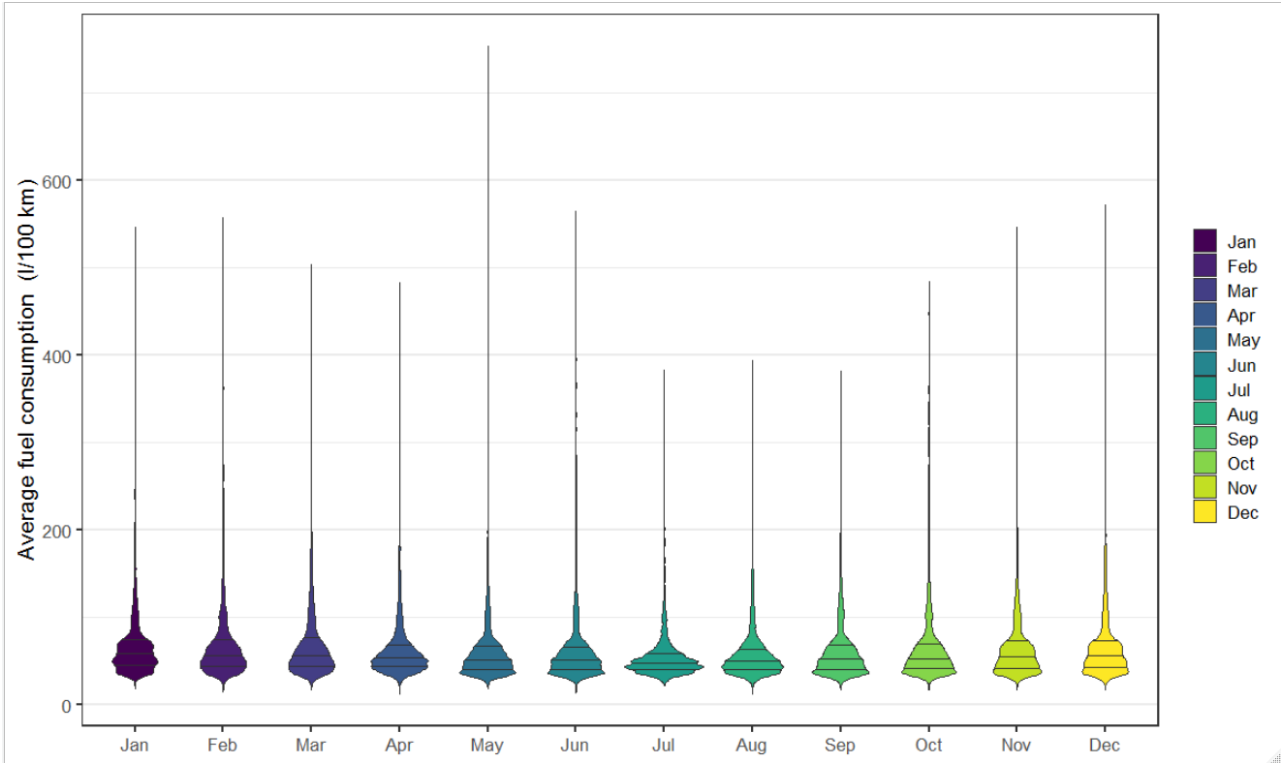
Preliminary Results…

Distribution of Speeds on Routes between Tracking Points



mean 61 km/h
(median 70 km/h)

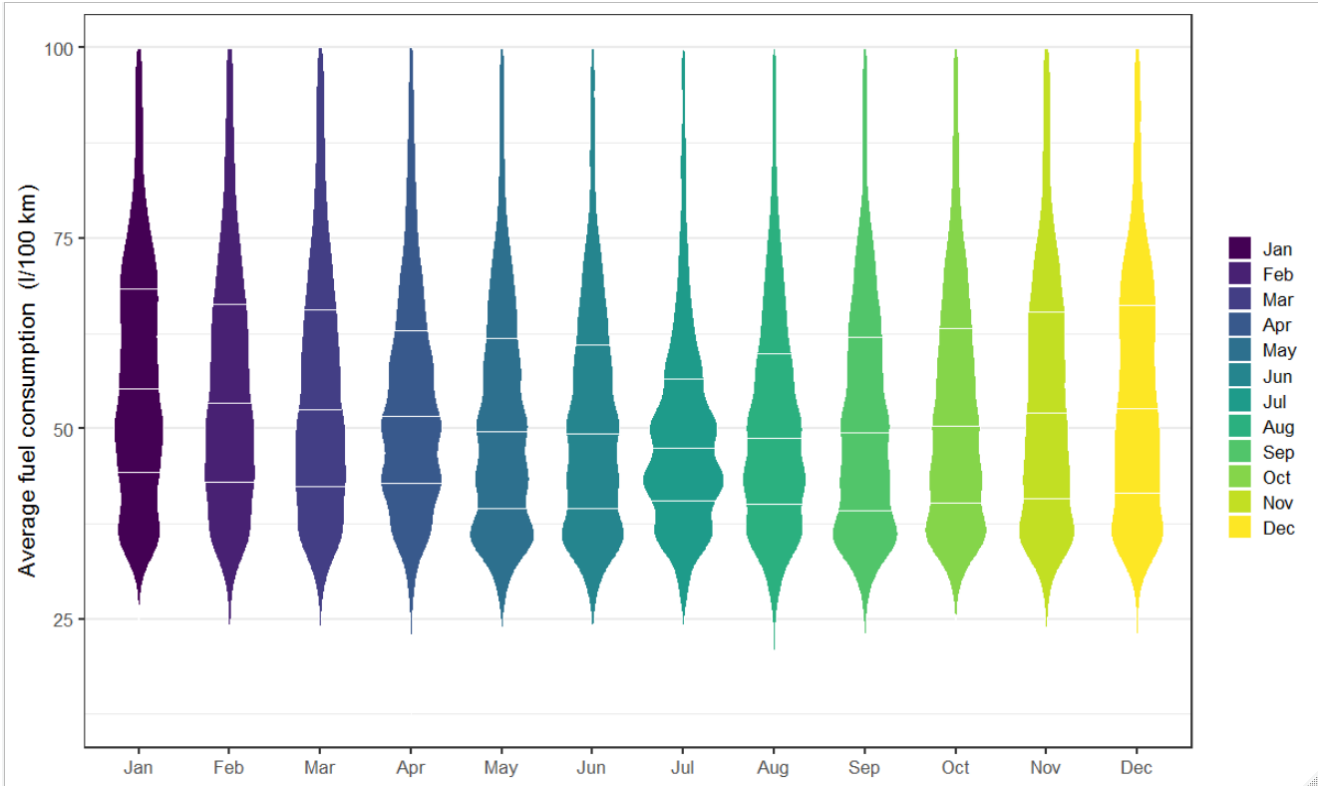
Distribution of Fuel Consumptions on Routes between Tracking Points



mean 65 l/100 km

(median 54 l/100 km)

Fuel Consumptions Filtered (under 100l/100km)



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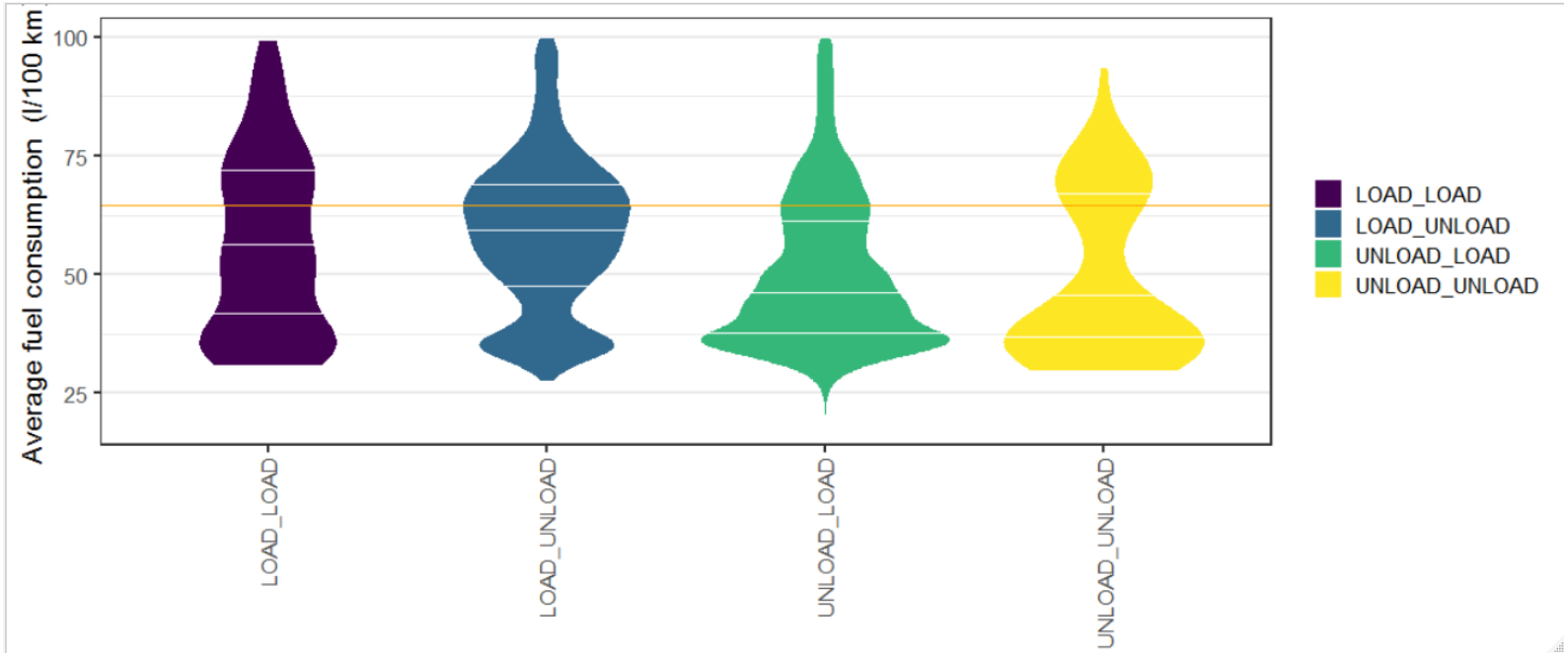
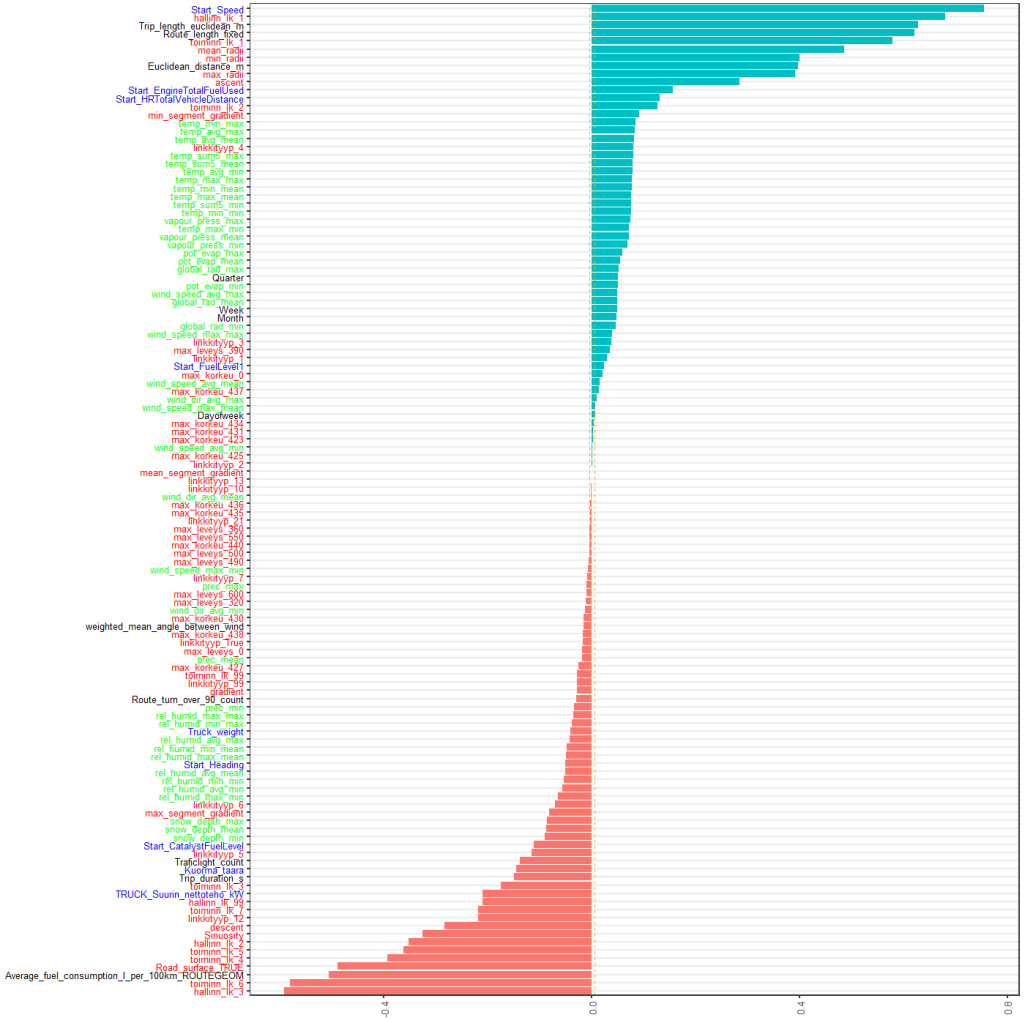


Spearman Correlations with Speed

- road properties
- weather
- truck
- misc



Spearman Correlations with Fuel Consumption

- road properties
- weather
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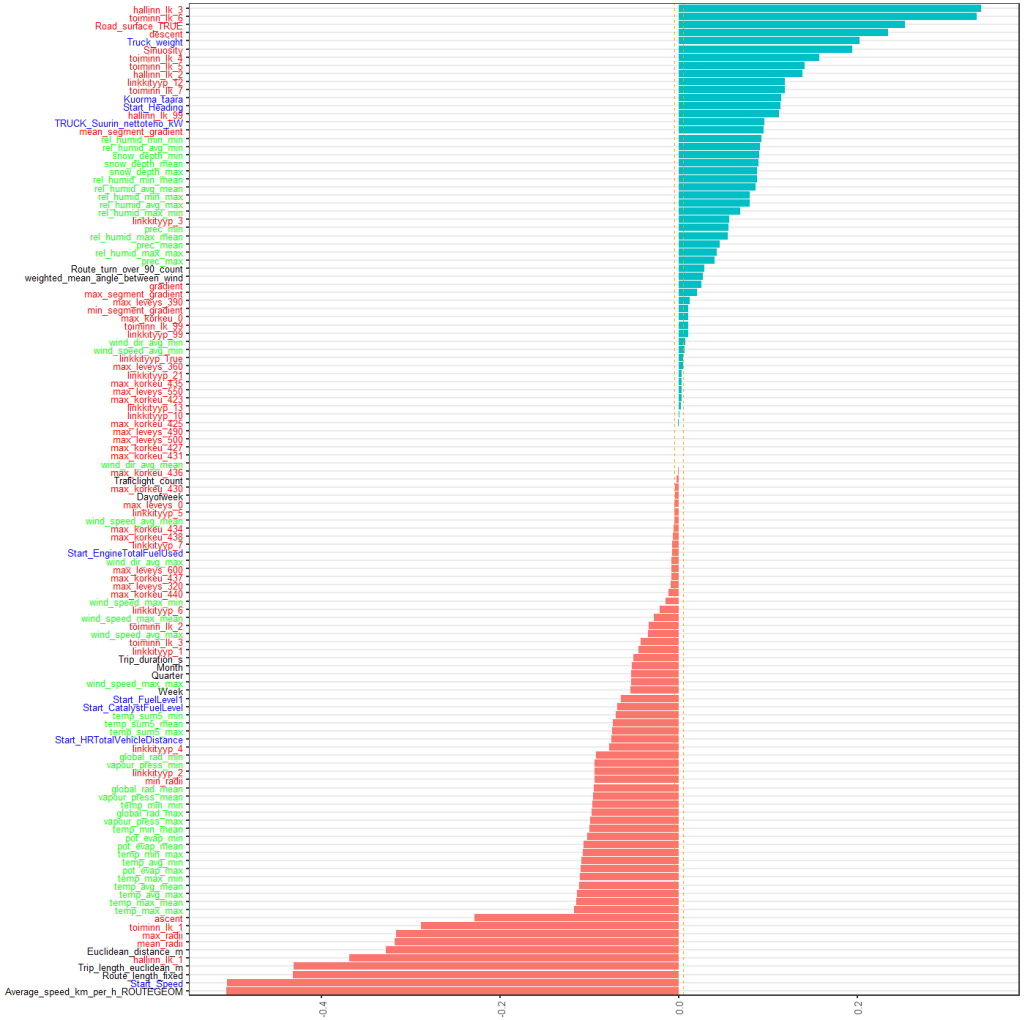

Discussion

- CAN bus data has good temporal coverage, but low measurement accuracy of distance and fuel consumption
- Average speed and fuel consumption in line with previous studies
- Weight data lacking time of loading and unloading time not exact
- Weather data averaged
- Modeling lacking explanatory variables which could explain peak fuel consumptions

Photo: Jutta Kuure

Conclusions

- Pros and cons compared with traditional time studies
- More focus to explain extremely high fuel consumptions
- Better temporal resolution for weather data needed

Photo: Perttu Anttila

Thank you!

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