Size distributed traffic emission factors
Evaluation of simplified method by comparison with inverse modelling

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A novel simplified method to calculate E.R. has been developed

Objectives

- Validate this method with inverse modelling method
- Apply this method on larger data sets (In this presentation Copenhagen data)
- Use the method to initialise parameterisation of E.R.
Simplified approach

\[ E.R. = \frac{UFP_{\text{emitted}}}{\text{NO}_x_{\text{emitted}}} \]

\[ \text{Conc}_{\text{emitted}} = \text{Conc}_{\text{traffic}} - \text{Conc}_{\text{background}} \]
Simplified approach

\[ E.R. = \frac{UFP_{\text{traffic}} - UFP_{\text{background}}}{NOx_{\text{traffic}} - NOx_{\text{background}}} \]
Traffic selection
(According to Janhäll and Hallquist, ES&T 2005)

- High traffic
  - 20% of data with highest \([\text{NO}] / [\text{NO}_2]\)

- Low traffic
  - 20% of data with lowest \([\text{NO}_x]\)
Copenhagen data
(see e.g. Ketzel et al 2003)

- Data from May 2001-Jan 2002
  - (1908 data points)
- Time resolution: 30 min
- SMPS – 6-700 nm diameter
- NO, NO₂
- Meteorology
  - Wind speed
  - Temperature
  - Humidity
  - Solar radiation
Comparison
Simplified (GU) vs inverse modelling (DM)
Diurnal Behaviour – Day time
(06.00-19.00)
Diurnal Behaviour – Night time
(00.00-05.00)
Diurnal Behaviour – Night time
(00.00-05.00)
Meteorological effects – Temperature
Meteorological effects – Radiation

Emission factors – Radiation

\[ \times 10^{14} \]

\[ 10^0, 10^1, 10^2, 10^3 \]

\[ \text{Partikelstorlek (nm)} \]

\[ \text{dN/dlogDp per km (NOx=1.4 g/km)} \]

- **622 W/m²**
- **227 W/m²**
- **43 W/m²**
- **16 W/m²**
- **4 W/m²**

NORPAC Norrköping October 2005
Meteorological effects – Humidity

Emission factors – RH

NORPAC Norrköping October 2005
Meteorological effects – Wind speed
Conclusion

- New method give similar results as two station-inverse modelling
- Simplified method enables ER calculation from road site stations
- Method can be used to evaluate the change in ER due to e.g.
  - Meteorology
  - Time of day
- Further evaluation of method
  - Use of other (larger) data sets
  - Parameterisation of ER by e.g. Temperature