Overview

- Overview of remote sensing data
- Remote sensing results
- Policy applications
- Summary and outlook
Overview of European RS data

Current status and future developments
Overview of European remote sensing data

- First TRUE publications (June 2018):
  - 2011–2017
  - France, Sweden, Switzerland, UK
  - Two technologies: HEAT and OPUS/FEAT
  - >700k measurements
  - >300k valid NO\textsubscript{x} measurements from cars
- Since then:
  - >100k measurements in London, 2017–2018
  - >200k measurements in Paris, summer 2018
- Vehicles measured:
  - mostly light-duty vehicles
  - City-specific vehicles (examples: buses, London, car sharing fleets)
- Collecting data from other regions: U.S., China, Mexico…
### Overview of European remote sensing data

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Avg. CO₂ value (g/km NEGO)</th>
<th>Data sources</th>
<th>Measurement year</th>
<th>Ambient temperature (°C)</th>
<th>VSP (kW/ton)</th>
<th>Accel. (km/h/s) over speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro 2 Petrol</td>
<td>17,338 15.1 195</td>
<td>CH: Switzerland, ES: Spain, SE: Sweden, UK: United Kingdom</td>
<td>11 12 13 14 15 16 17</td>
<td>Median: 9.2</td>
<td></td>
<td>0 20 40 60 80</td>
</tr>
<tr>
<td>Euro 3 Diesel</td>
<td>19,702 11.6 173</td>
<td>CH: Switzerland, ES: Spain, SE: Sweden, UK: United Kingdom</td>
<td>11 12 13 14 15 16 17</td>
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<tr>
<td>Euro 3 Petrol</td>
<td>31,535 11.6 184</td>
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<td>43,780 7.2 172</td>
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<td>10.1</td>
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</tr>
<tr>
<td>Euro 5 Diesel</td>
<td>57,883 3.4 150</td>
<td>CH: Switzerland, ES: Spain, SE: Sweden, UK: United Kingdom</td>
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<td>20.3</td>
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<td>Euro 5 Petrol</td>
<td>53,797 3.6 148</td>
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<td>Euro 6 Diesel</td>
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</table>

https://www.theicct.org/publications/real-world-emissions-using-remote-sensing-data
Comparison with driving cycles

https://www.theicct.org/publications/real-world-emissions-using-remote-sensing-data
Results

$\text{NO}_x$ emissions measurements and policy applications
Emissions modeling

[Diagram showing average NOx emissions (g/km) for different emission standards (Euro 1 to Euro 6). The emissions are compared for diesel and petrol vehicles, with error bars indicating the 95% CI. The type-approval limit is also shown as a red line.]
Market surveillance

https://www.theicct.org/publications/real-world-emissions-using-remote-sensing-data
Tailor-made policies

source: upcoming publication on remote sensing in Canton of Zurich
Informing consumers: TRUE rating explanation

Vehicle groups with confidence intervals above the red threshold are rated red.

RED THRESHOLD: 0.18 g/km

Vehicle groups with confidence intervals between/across the thresholds are rated amber.

GREEN THRESHOLD: 0.09 g/km

Vehicle groups with confidence intervals below the green threshold are rated green.

90% CONFIDENCE INTERVAL
## Informing consumers: results (1)

<table>
<thead>
<tr>
<th></th>
<th>Diesel vehicles</th>
<th>Petrol vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro 3</td>
<td>![Image]</td>
<td>![Image]</td>
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<td>Euro 4</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
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<td>Euro 6</td>
<td>![Image]</td>
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TRUE rating: Good
TRUE rating: Moderate
TRUE rating: Poor
1% of families

https://www.theicct.org/publications/real-world-emissions-using-remote-sensing-data
Informing consumers: results (2)

[Chart showing the share of Euro 6 passenger car sales of each manufacturer group for diesel and petrol.]

TRUE rating
- Green: Good
- Yellow: Moderate
- Red: Poor
- White: Unrated

Manufacturer group:
- VW Group
- BMW
- Daimler
- Renault-Nissan
- PSA Group
- General Motors
- Ford
- Hyundai
- Fiat Chrysler
- Total

https://www.theicct.org/publications/real-world-emissions-using-remote-sensing-data
Informing consumers: Application
Low-/High-emitter screening

almost 50% of vehicles were measured 5+ times
Conclusion

Summary, recommendations, and outlook
Why measure in your city? (1)

- Unique driving conditions (extreme ambient temperature, speeds, road grade, …)
- Unique fleet composition (e.g., vehicle age, domestic vehicle brands, …)
- City-specific vehicles: bus, taxi, car sharing fleets
Why measure in your city? (2)

source: upcoming publication on Canton of Zurich remote sensing
Summary & outlook

- Large and growing remote sensing database
- Examples of policy applications:
  - Emissions modeling
  - Market surveillance
  - Tailor-made city-level policies
  - Consumer information
  - Low-/high-emitter screening
- Upcoming publications
  - TRUE report on London measurements
  - Report on Zurich measurements
  - Results on CO and PM emissions