



**Kanton Zürich
Baudirektion
Office for Waste, Water, Energy and Air**

Remote Sensing vehicle real emssions

A long term monitoring perspective

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TRUE initiative Seminar, 13.12.2018



Background

- Canton Zürich, Office for Waste, Water, Energy and **Air** (AWEL)
- Two larger cities with own air quality office
- Air quality monitoring, air quality plans, ...

www.luft.zh.ch



Long term Remote Sensing Zürich

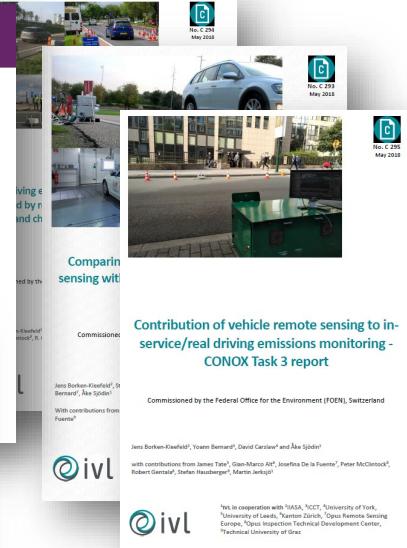
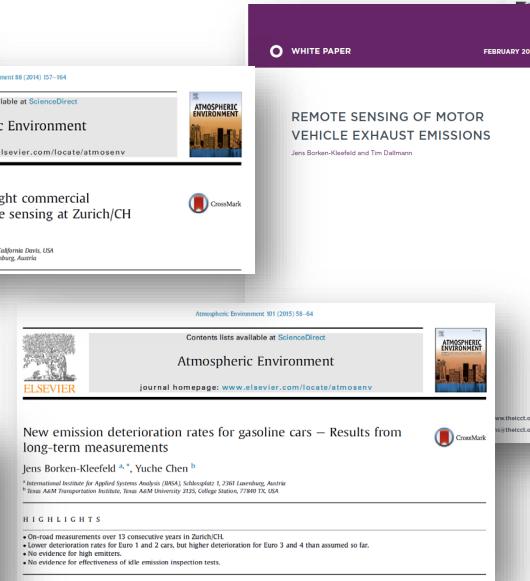
- > 20 years experience with Remote Sensing measurements
- RS campaign virtually every year at the same site
- Products: large RS dataset, report (in german), scientific contributions (Jens Borken et al.), CONOX, ...

https://awel.zh.ch/internet/baudirektion/awel/de/luft_klima_elektrosmog/verkehr/rsd.html



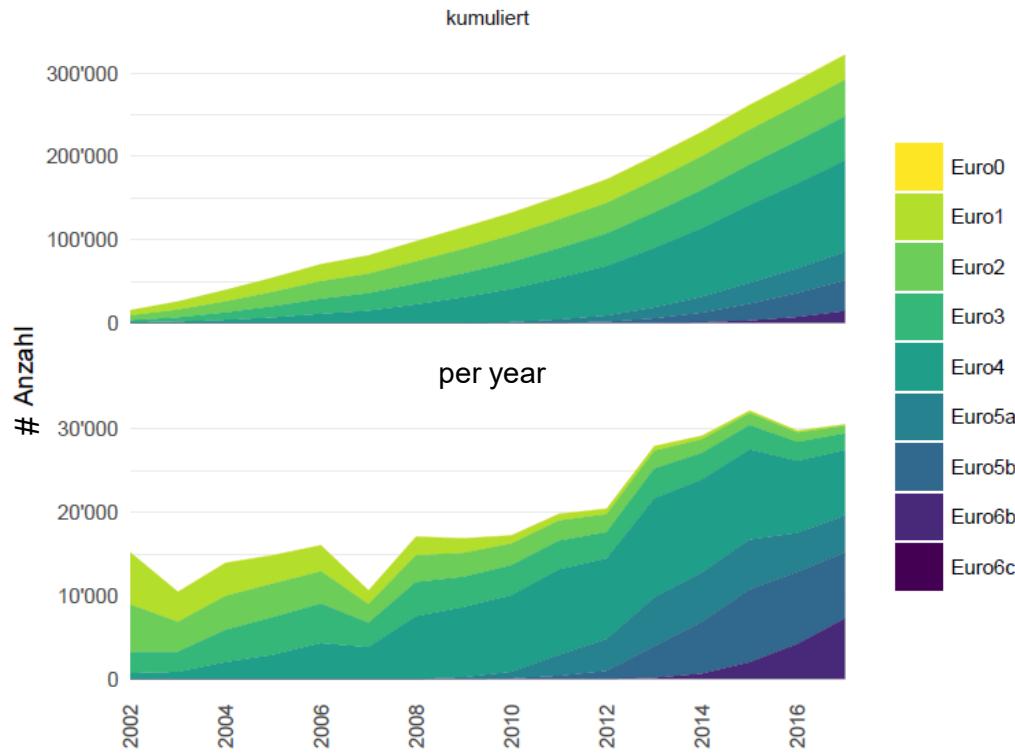


Long term Remote Sensing Zürich





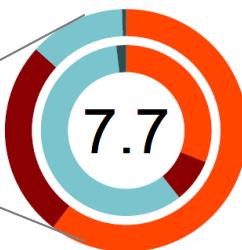
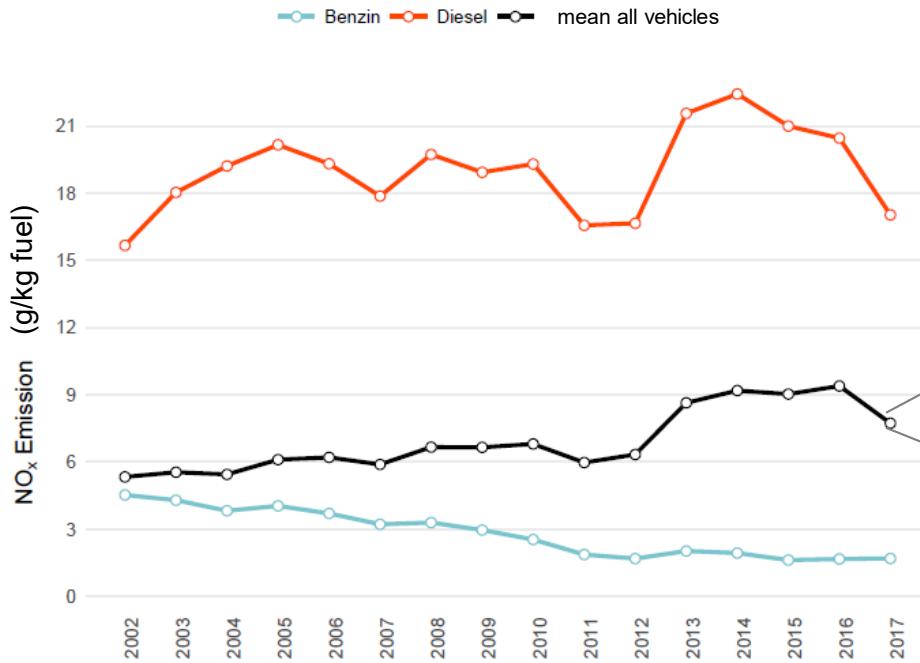
Examples



after quality selection



Examples – fleet emissions over time

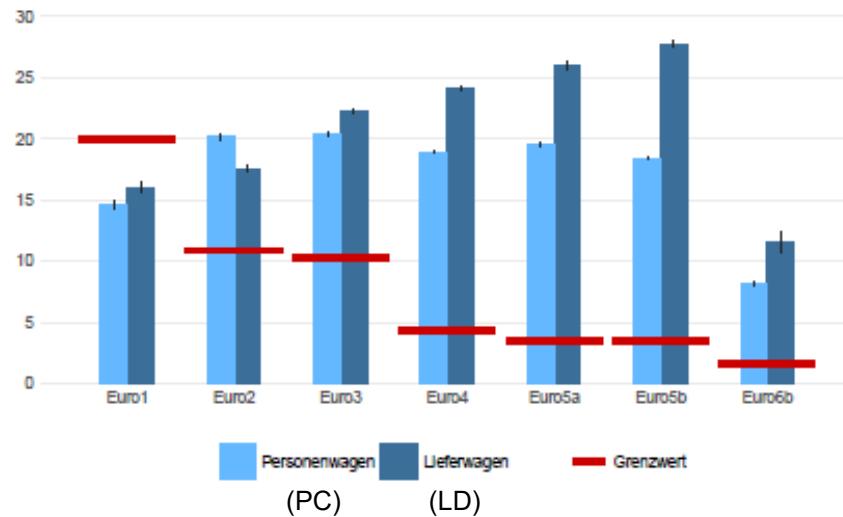
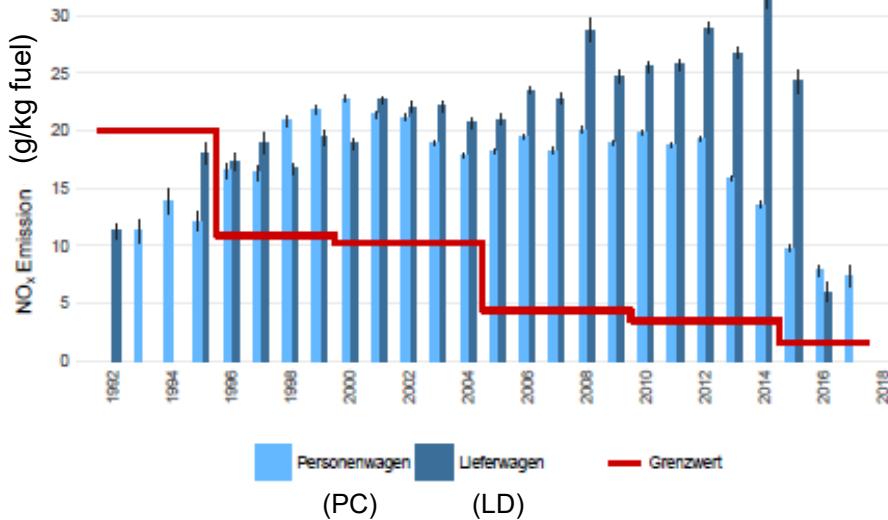


Fleet NO_x emission 2017:
Number = mean emission (g/kg fuel)
Inner ring = distribution number measured vehicles
Outer ring = distribution contribution to mean value



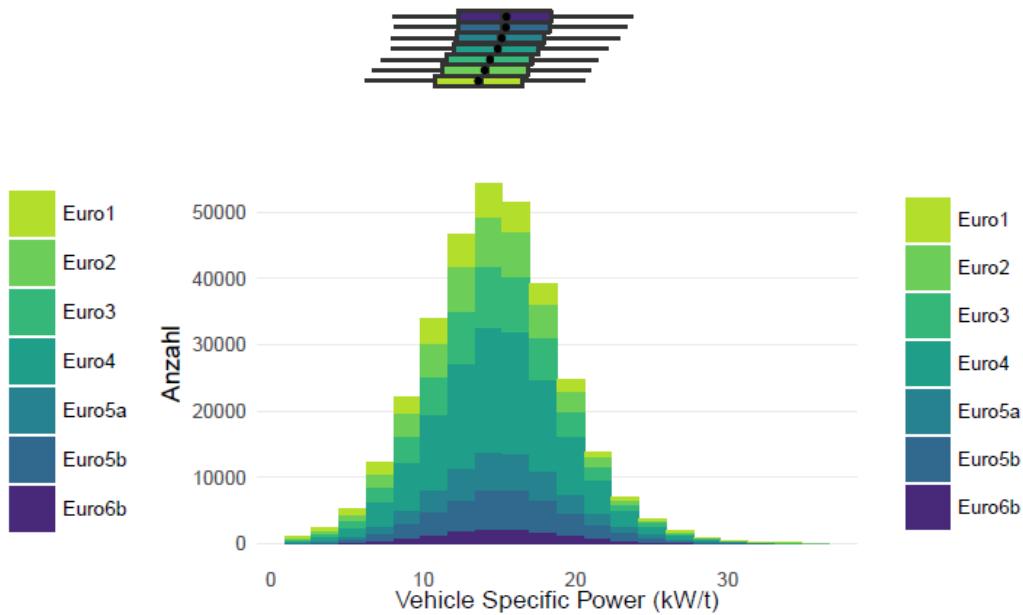
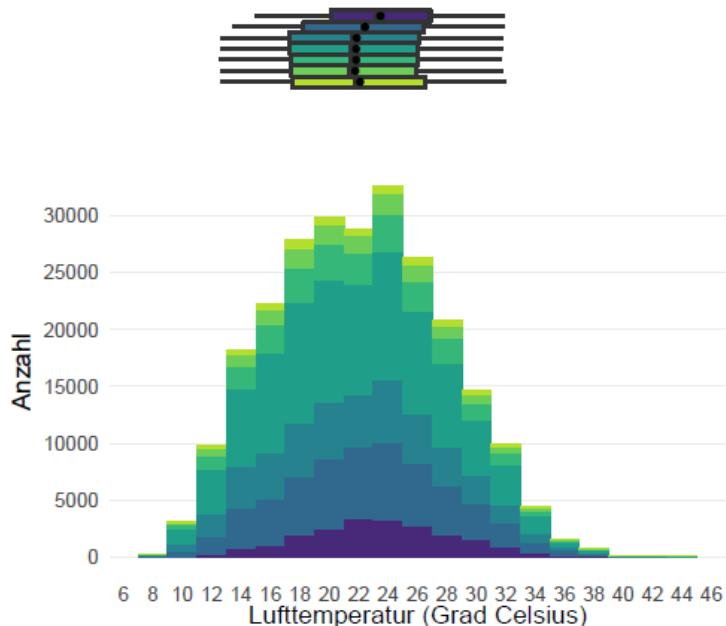


Examples – over time and norms



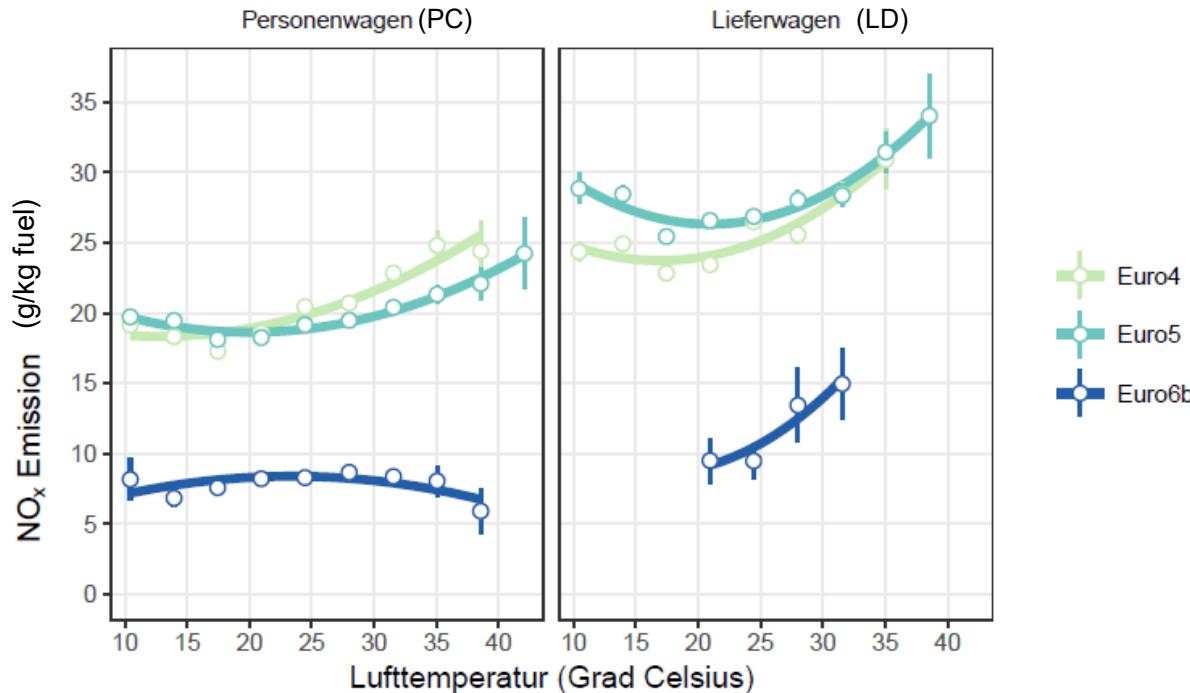


Examples – range of conditions





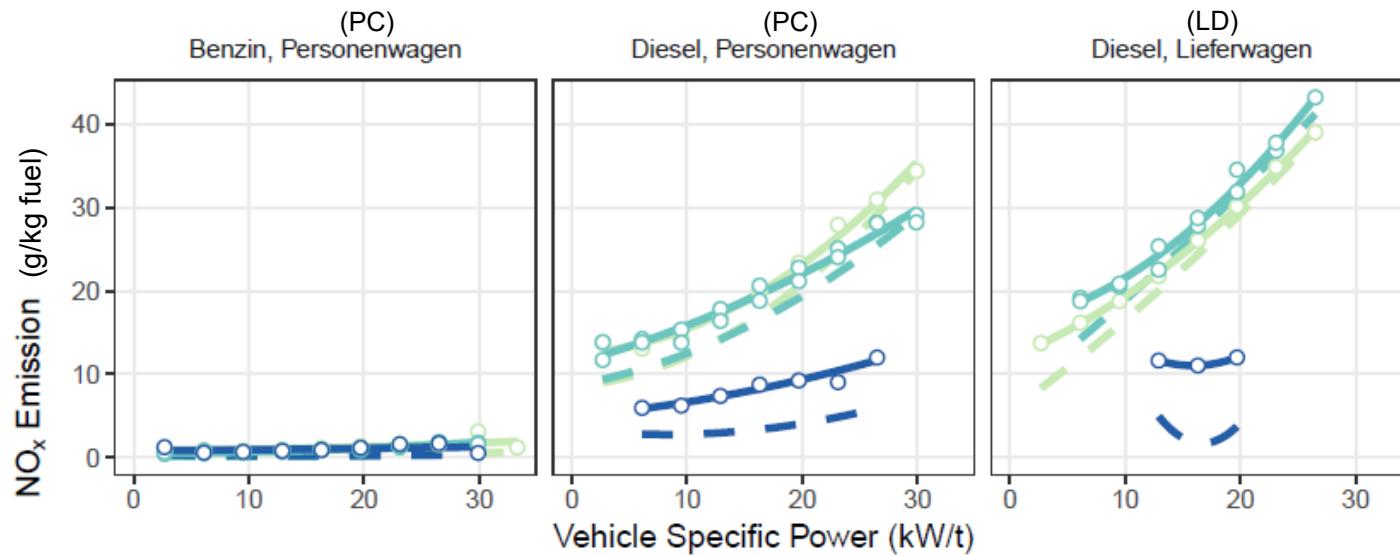
Examples – range of conditions



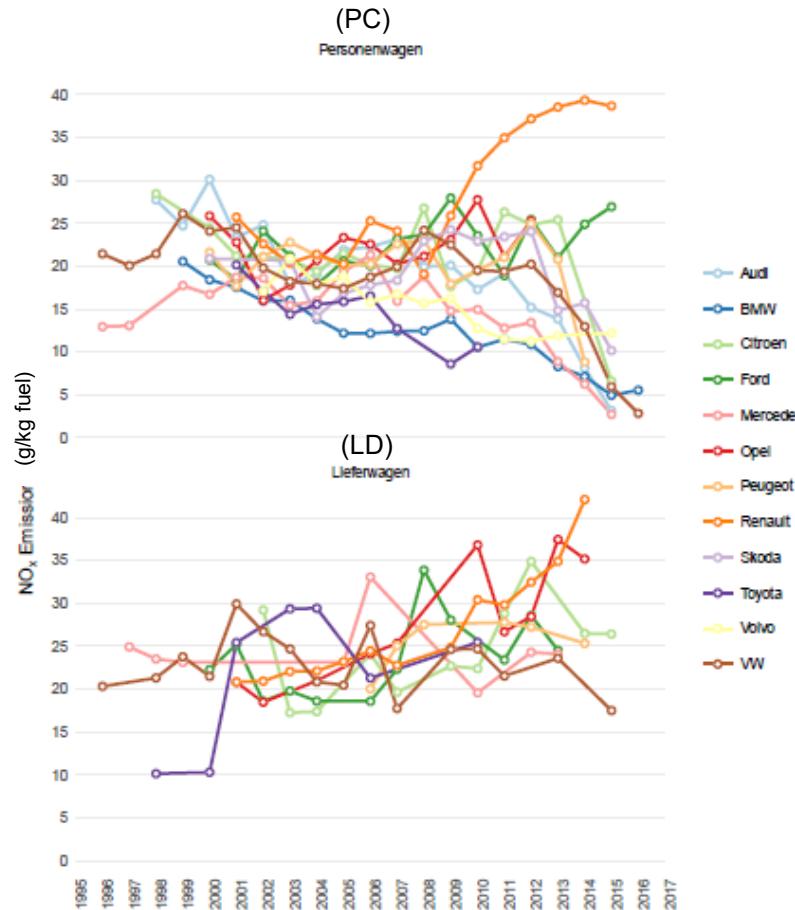
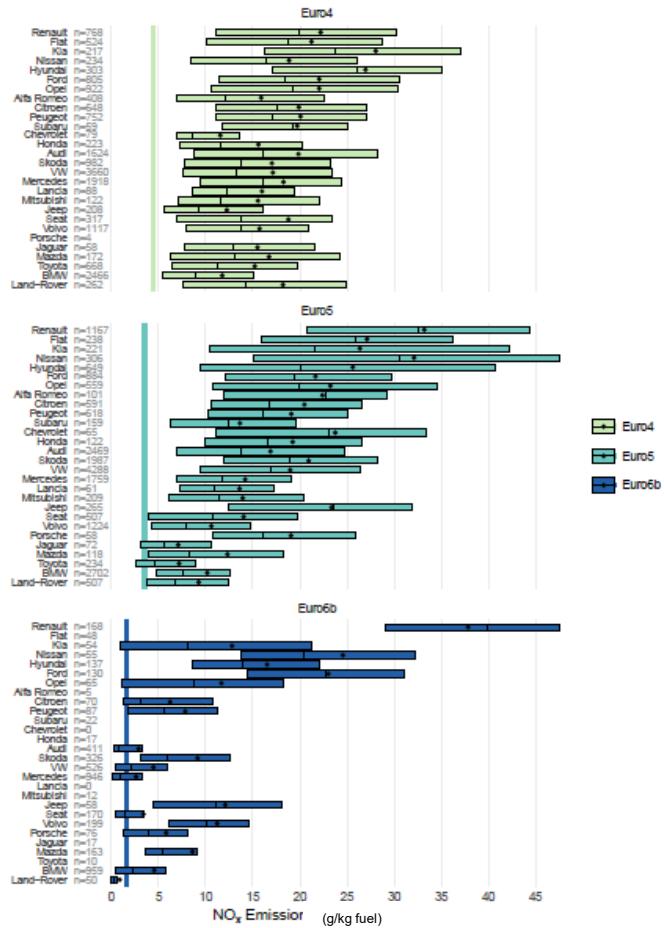


Examples – range of conditions

Euro4 (light green) Euro5 (medium green) Euro6b (dark blue)

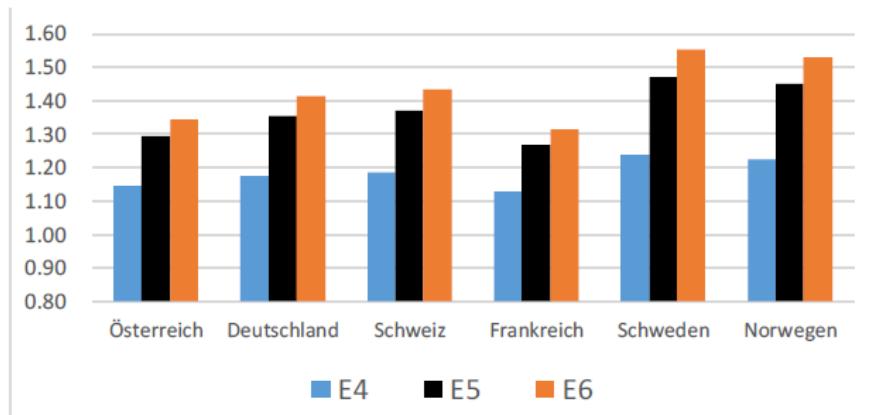
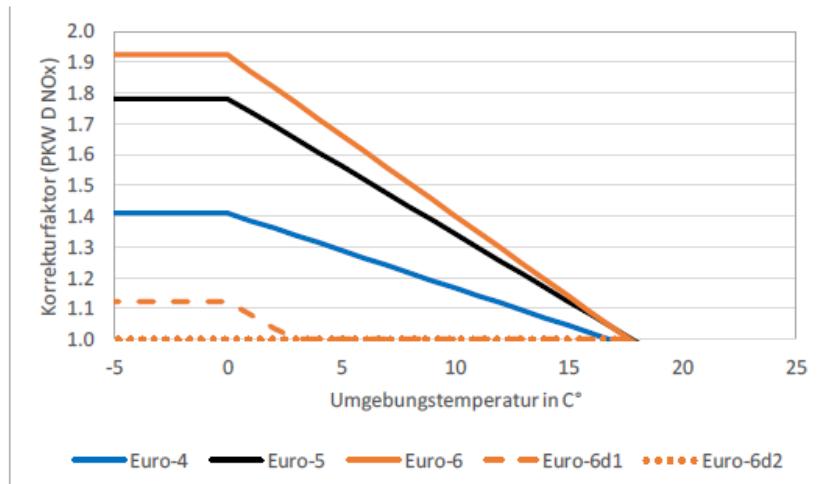


Examples – high emitting groups





Examples – emission factors





Long term Remote Sensing

- Large, historic dataset, # > 300'000 (after QS)
 - Covering all Euro norms
 - Dataset consistent over time (same site & driving conditions)
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- ⇒ Emissions of groups over time
 - ⇒ Emission deterioration
 - ⇒ High emitters
 - ⇒ Identify knowledge / regulation gaps
 - ⇒ Fleet real emission development => observing the effectiveness of emission reduction measures



Recommendations

- Strong quality checks necessary due to instrument development over the years
- Long term monitoring at minimum two sites (varying slopes / VSP ranges)
- Sample enough data per campaign (e.g. >50'000 before QS)
- Don't underestimate the effort



Thanks to all collaborators

- AWEL Team: Gian-Marco Alt, Michael Götsch, Felix Baum, Valentin Delb, alumnis
- Jens Borken
- ..