



Correlation of PM_{2,5} with other emission components based on SIMO database

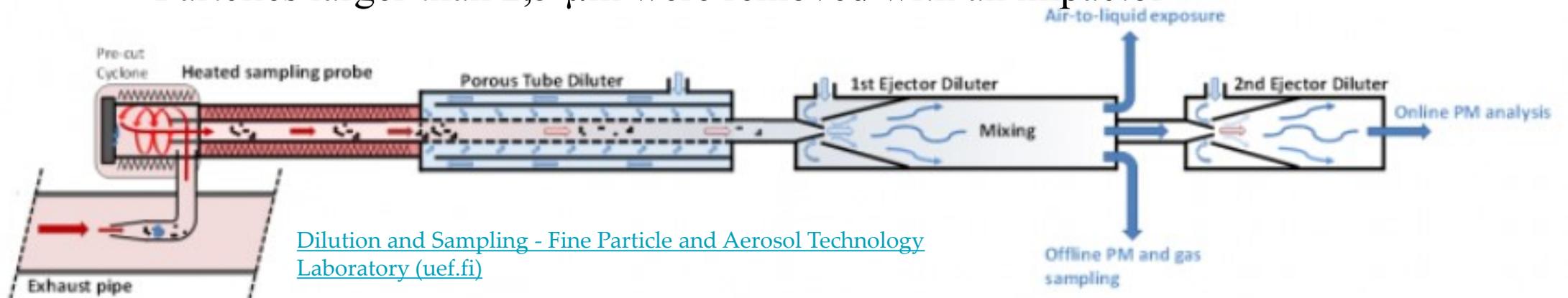
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PTD+ED used as PM measurement method

- A combination of porous tube diluter (PTD) with ejector diluter (ED)
 - Dilution ratio (DR) 90
 - Filter collection temperature about 20-30 °C
 - Condensable fraction is mainly in particulate phase
 - Particles larger than 2,5 µm were removed with an impactor





General information of the database

- 352 combustion experiments
 - Average values from whole combustion and each batch
- 50 different appliances
 - Sauna stoves, wood stoves, masonry heaters and kitchen ranges
 - Mainly new and modern appliances
 - Birch wood logs used as fuel
- Results calculated to 20 °C, 1 ATM and 13 % O₂

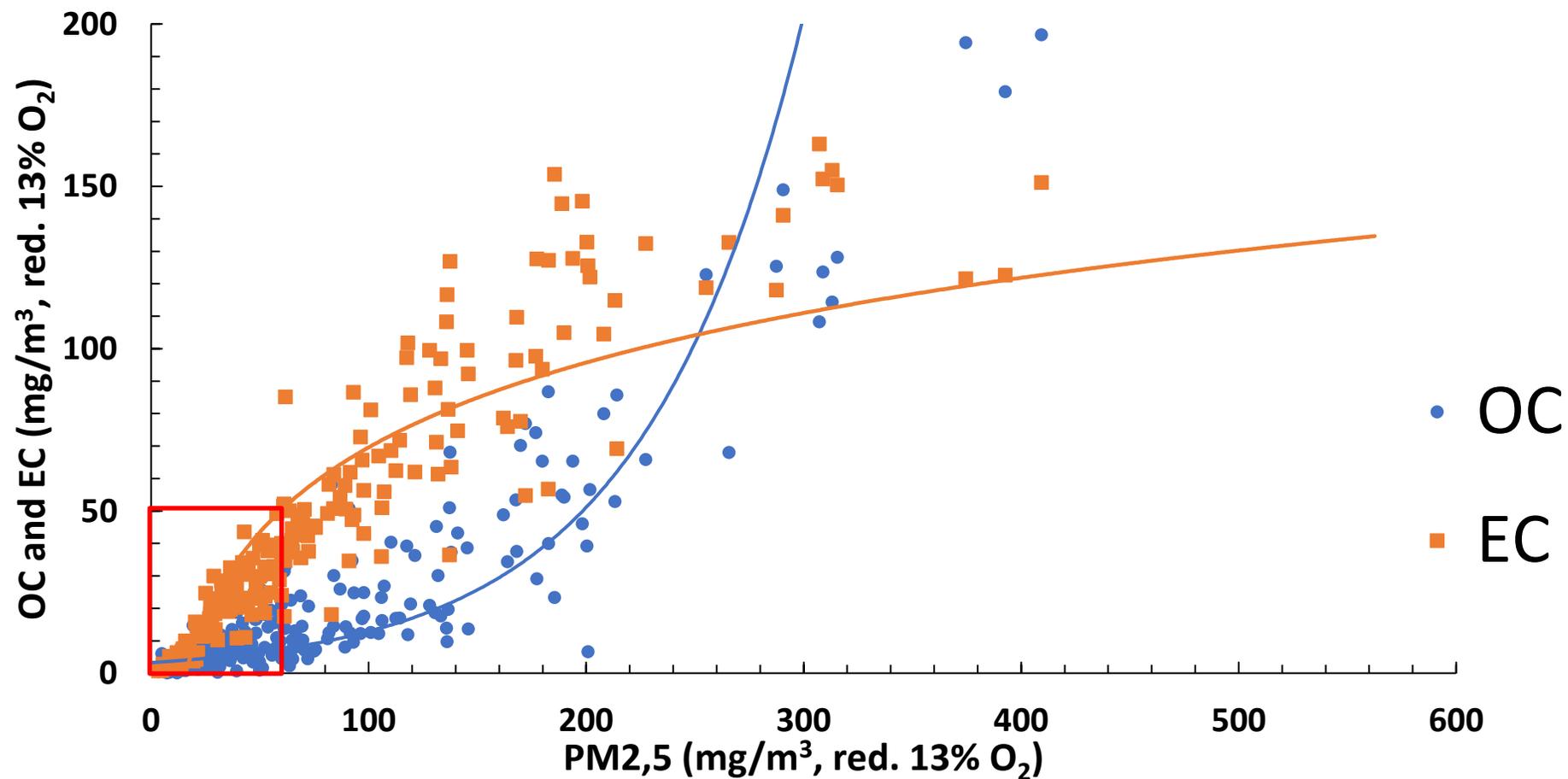


Content

- Organic carbon (OC) and elemental carbon (EC) vs. PM_{2,5}
- OC vs. OGC (FID)
- Number concentration (CPC) vs. PM_{2,5}
- PM_{2,5} vs. CO, OGC and NO

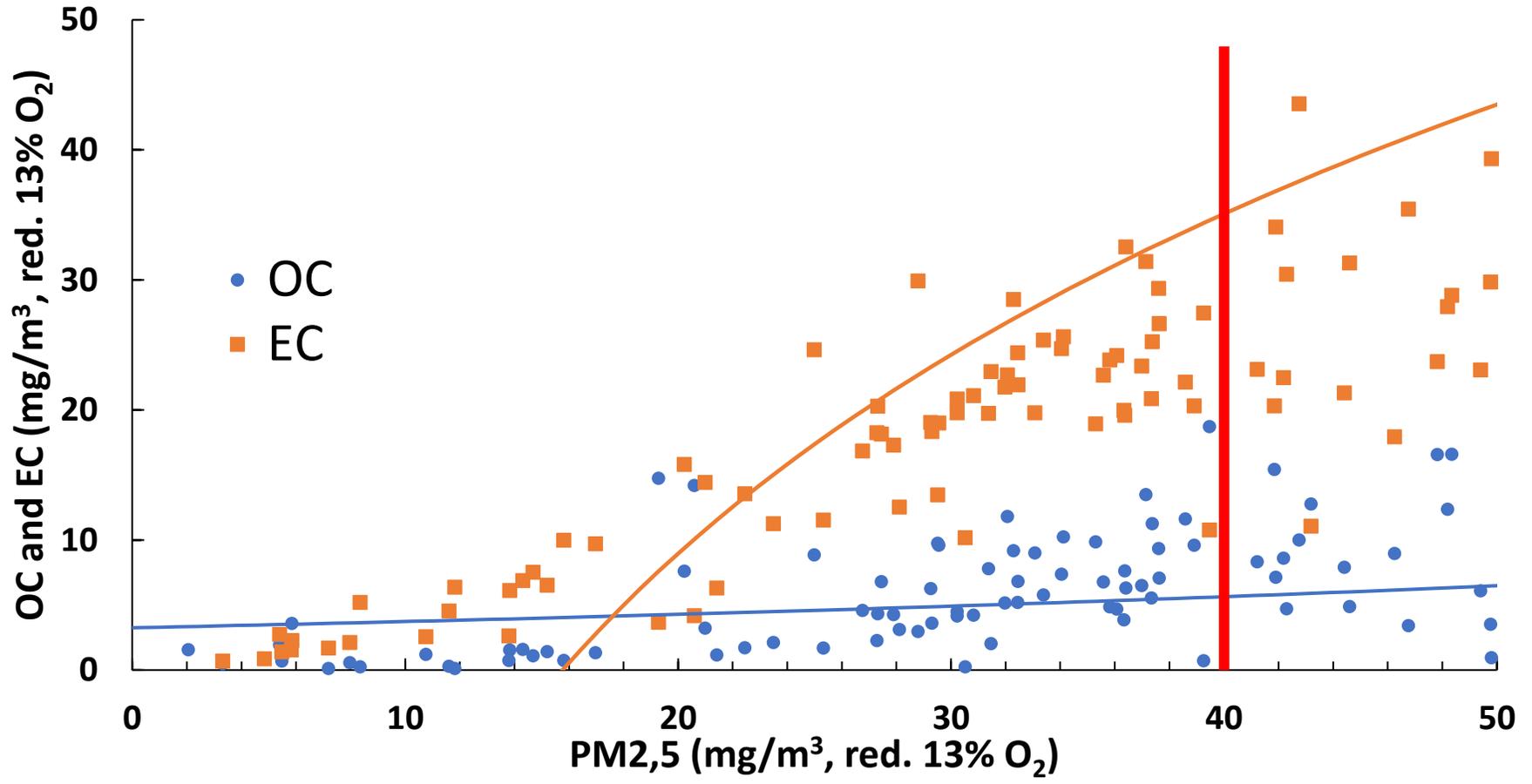


PM_{2,5} vs. OC and EC



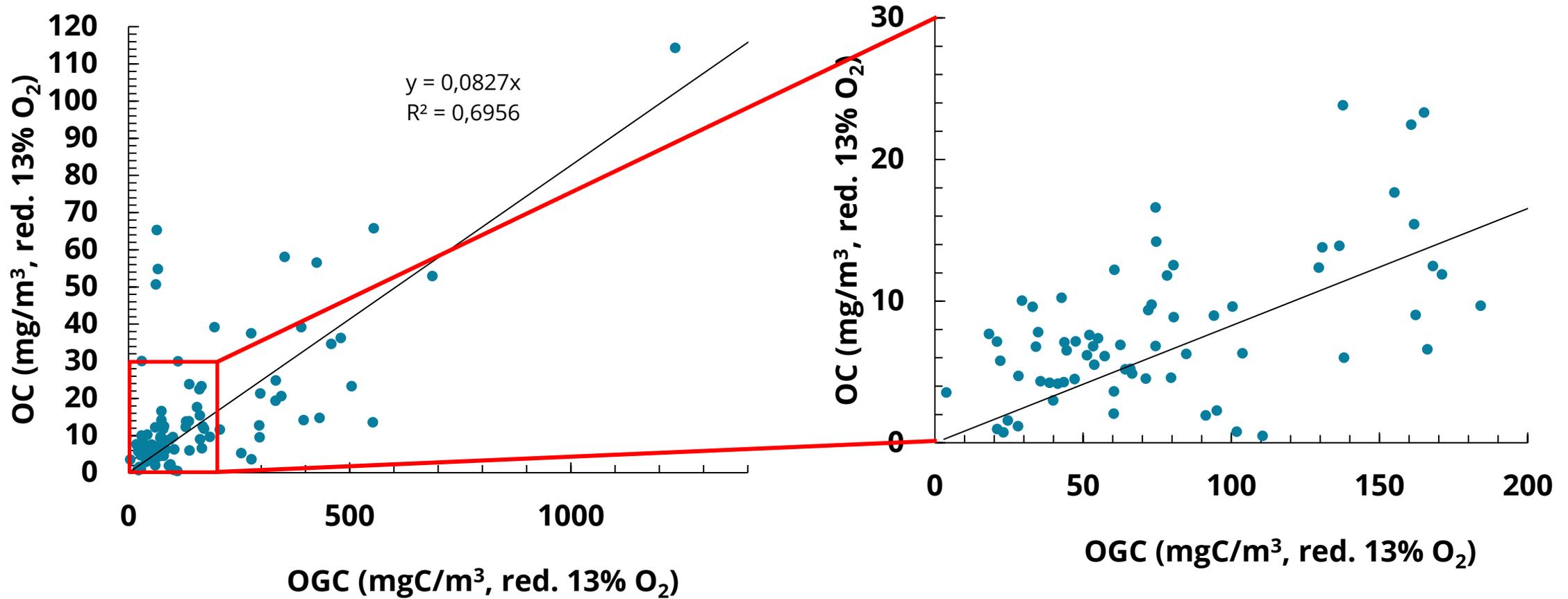


PM_{2,5} vs. OC and EC



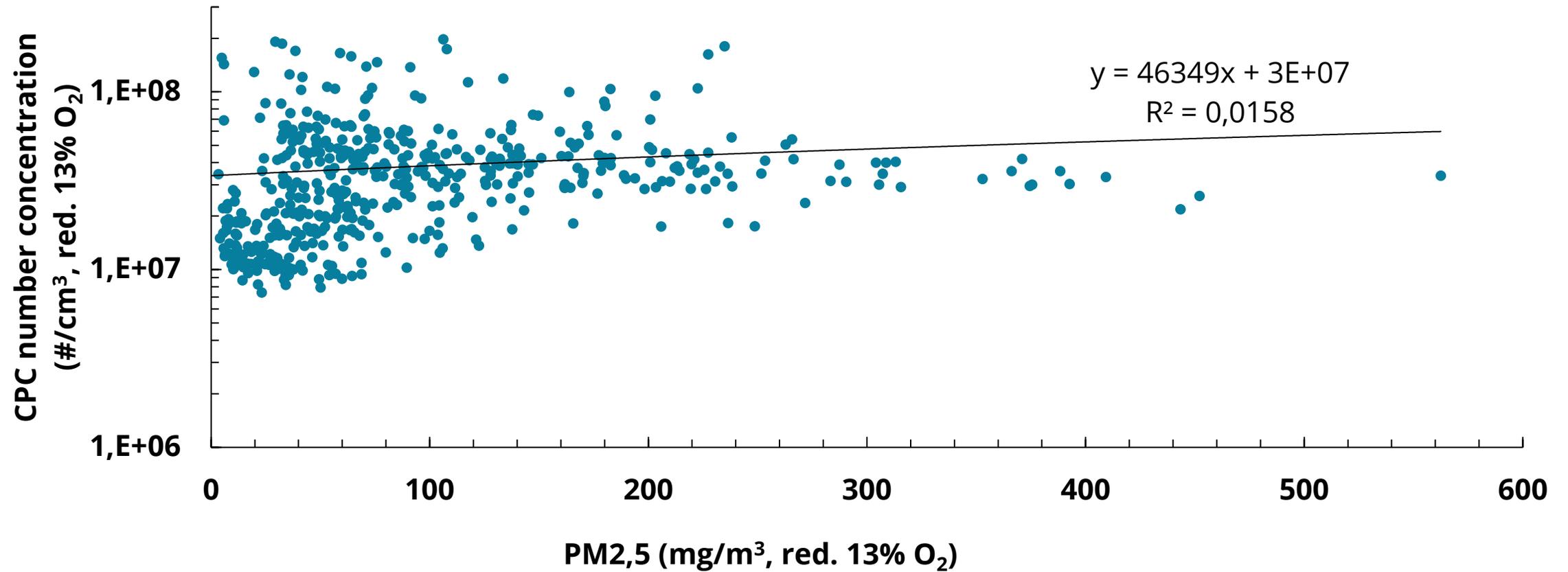


OC vs. OGC



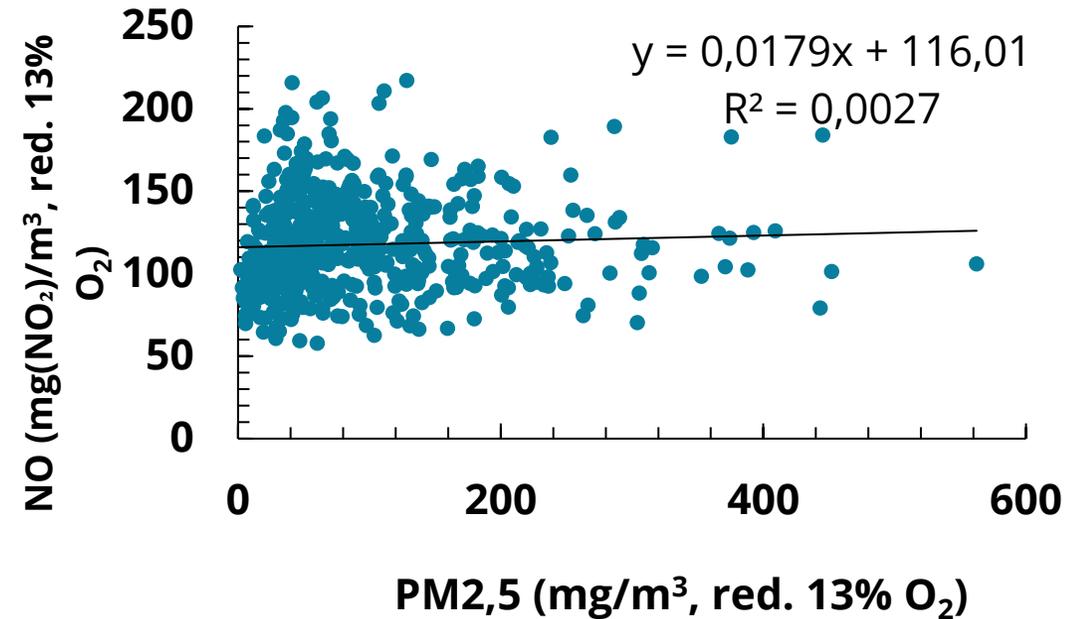
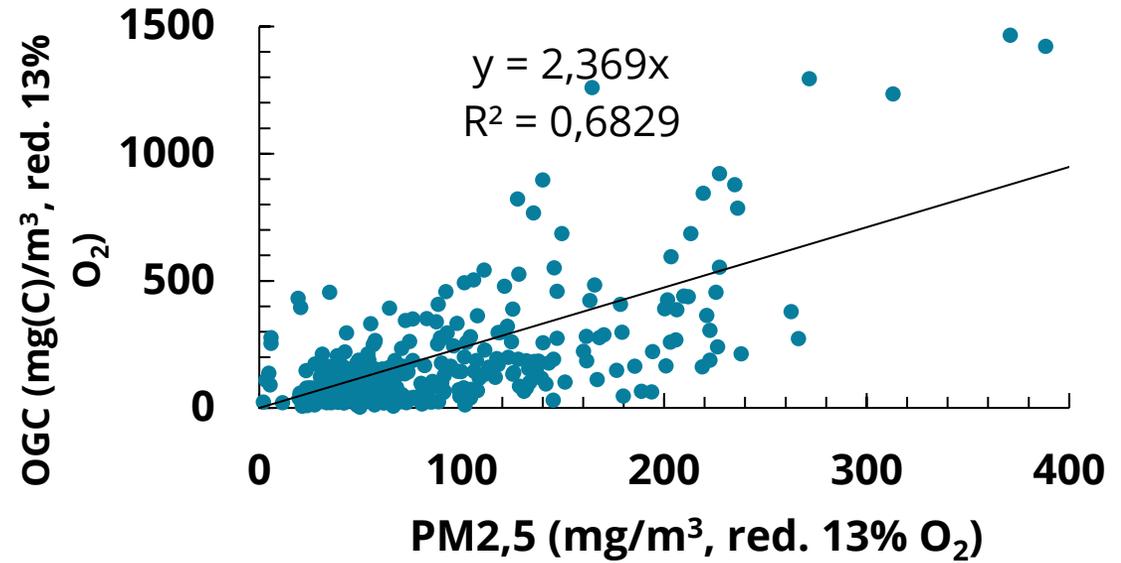
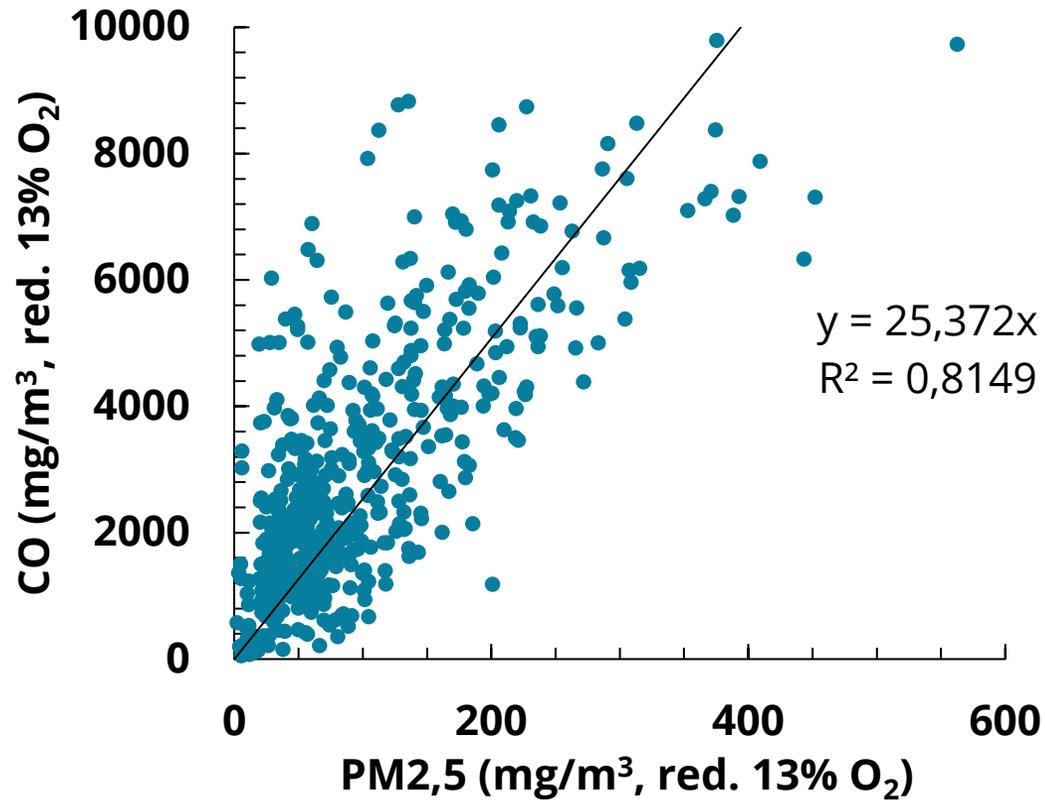


PM2,5 vs. Number concentration, CPC





PM and basic gas components





Conclusion

- Particulate organic matter is important also with new residential wood combustion appliances
 - Measurement technologies should be able to detect organic particulate emissions
- Number concentration doesn't correlate with PM_{2,5} concentration
 - Can't be decreased with traditional combustion technologies
 - Electrostatic precipitators can be used for that
- Different emissions may correlate with high emission levels (old appliances) but with today's relevant emission levels they do not correlate
 - It is important to measure gas and particulate emissions separately



Thank you

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References

- Tissari, J., Väätäinen, S., Leskinen, J., Savolahti, M., Lamberg, H., Kortelainen, M., Karvosenoja, N., Sippula, O. 2019. Fine Particle Emissions from Sauna Stoves: Effects of Combustion Appliance and Fuel, and Implications for the Finnish Emission Inventory. *Atmosphere*, 10(12), 775. <https://www.mdpi.com/2073-4433/10/12/775>
- <https://sites.uef.fi/fine/front-page/research-areas/combustion-facilities/dilution-and-sampling/>