Carbon dioxide (CO$_2$) emission rate estimates for coal fired power plants and analysis from MAMAP airborne instrument data

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The passive airborne remote sensing grating spectrometer MAMAP (CarbonMapper) was designed for measuring columns of methane and carbon dioxide (CO$_2$) in the absorption bands around 1.6 μm with an instrument precision of typically about 1% or better relative to background. For the data under consideration the aircraft altitude was fairly constant at 1250 m with a velocity of 200 km/h resulting in ground scenes of 30 m $\times$ 35 m.

Detailed analysis results in accurate emission rates for CO$_2$ from point sources provided that sufficiently accurate knowledge of the meteorological parameters, such as wind velocity and atmospheric stability, are available. At the example of the two German coal fired power plants Jänschwalde and Schwarze Pumpe two basic inversion approaches – a gaussian plume model inversion and a simple gaussian integral inversion – are performed and evaluated in terms of stability and accuracy in comparison with the actual emissions reported by Vattenfall Europe.

The inversion approaches presented here have the potential to be used also for high resolution satellite data with sufficient coverage as for example the proposed greenhouse gas satellite mission CarbonSat would provide.