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O2/CO2 emission ratios as a diagnostic for source identification?

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High-precision measurements of atmospheric oxygen play an increasingly important role in our understanding of the global carbon cycle. In combination with CO_2-measurements, they allow the partitioning of global oceanic and terrestrial sinks of anthropogenic CO_2. In addition, local source/sink patterns can be identified from the combination of O_2 and CO_2-signals since different combustion processes have different oxidative ratios (OR= -O_2/CO_2). Therefore, atmospheric O_2 measurements can help to distinguish between industrial and terrestrial influences on observed CO_2 variations. In addition, the oxidative ratios for fossil fuel combustion vary for different types of fuels, from 1.95 for natural gas over 1.44 for liquid fuels to 1.17 for coal; hence oxidative ratios can also be used for distinguishing different fossil fuel sources.

This study aims to create a detailed map of the global O_2 uptake associated with the combustion of fossil fuels. For this, we combine the oxidative ratios for diverse fossil fuel types with a fossil fuel inventory, created using the EDGAR emission database in combination with BP fossil fuel consumption statistics on oil, gas and coal. This information on spatial patterns of O_2/CO_2 emission ratios together with continuous measurements of O_2 and CO_2 will be useful for separating different emission sources and thus for better interpretation of regional CO_2 budgets, but it will also be useful for the attribution of other pollutants in the atmosphere to the different source types and regions.