



## **Detailed characterization of a Comparative Reactivity Method (CRM) instrument for ambient OH reactivity measurements: experiments vs. modeling**

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The Hydroxyl radical (OH) is the main daytime oxidant in the troposphere, leading to the oxidation of Volatile Organic Compounds (VOCs) and the formation of harmful pollutants such as ozone ( $O_3$ ) and Secondary Organic Aerosols (SOA). While OH plays a key role in tropospheric chemistry, recent studies have highlighted that there are still uncertainties associated with the OH budget, i.e. the identification of sources and sinks and the quantification of production and loss rates of this radical. It has been demonstrated that ambient measurements of the total OH loss rate (also called total OH reactivity) can be used to identify and reduce these uncertainties. In this context, the Comparative Reactivity Method (CRM), developed by Sinha et al. (ACP, 2008), is a promising technique to measure total OH reactivity in ambient air and has already been used during several field campaigns. This technique relies on monitoring competitive reactions of OH with ambient trace gases and a reference compound (pyrrole) in a sampling reactor to derive ambient OH reactivity. However, this technique requires a complex data processing chain that has yet to be carefully investigated in the laboratory.

In this study, we present a detailed characterization of a CRM instrument developed at Mines Douai, France. Experiments have been performed to investigate the dependence of the CRM response on humidity, ambient  $NO_x$  levels, and the pyrrole-to-OH ratio inside the sampling reactor. Box modelling of the chemistry occurring in the reactor has also been performed to assess our theoretical understanding of the CRM measurement. This work shows that the CRM response is sensitive to both humidity and  $NO_x$ , which can be accounted for during data processing using parameterizations depending on the pyrrole-to-OH ratio. The agreement observed between laboratory studies and model results suggests a good understanding of the chemistry occurring in the sampling reactor and gives confidence in the CRM measurements. We will present the data processing that is needed to derive reliable OH reactivity values from CRM measurements and will discuss the limitations of this technique.