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Measurements of total OH reactivity at the PROPHET site

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As the main oxidant in the daytime atmosphere, the hydroxyl radical (OH) initiates the oxidation of organic trace gases and the formation of pollutants such as ozone and secondary organic aerosols. Understanding both the sources and sinks of OH is therefore important to address issues related to air quality and climate change. Total OH reactivity measurements have proved to be of interest to investigate the OH budget and have highlighted an incomplete understanding of OH sinks in forested environments, which are characterized by high concentrations of biogenic volatile organic compounds (BVOCs) and their oxidation products.

A research facility located in a Michigan forest, US, has hosted several campaigns of OH reactivity measurements over the last 15 years through the PROPHET (Program for Research on Oxidants: Photochemistry, Emission and Transport) program. This site is characterized by deciduous trees emitting isoprene and other BVOCs and a low impact of anthropogenic emissions. Measurements of OH reactivity were performed during PROPHET 1998 and CABINEX 2009. More recently, OH reactivity was measured during the PROPHET 2016 – AMOS (Atmospheric Measurements of Oxidants in summer) field campaign using the Comparative Reactivity Method (CRM) and the Total OH Loss Rate Method (TOHLM). In this presentation, we will show that the two measurement techniques agree within uncertainties, giving confidence in the measured OH reactivity. In addition, concomitant measurements of trace gases (VOCs, NO_x, O_3) made by online and offline instruments were used to perform a comprehensive apportionment of OH sinks. We will provide insights into the OH reactivity budget and will show how it compares to the previous abovementioned studies.