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Sources and sinks of acetone, methanol, and acetaldehyde in North Atlantic marine air

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Abstract. Measurements of acetone, methanol, acetaldehyde and a range of non-methane hydrocarbons have been made in North Atlantic marine air at the Mace Head observatory. Under maritime conditions the combination of OVOCs (acetone, methanol and acetaldehyde) contributed up to 85% of the total mass of measured non methane organics in air and up to 80% of the OH radical organic sink, when compared with the sum of all other organic compounds including non-methane hydrocarbons, DMS and OH-reactive halocarbons (trichloromethane and tetrachloroethylene). The observations showed anomalies in the variance and abundance of acetaldehyde and acetone over that expected for species with a remote terrestrial emission source and OH controlled chemical lifetime. A detailed model incorporating an explicit chemical degradation mechanism indicated in situ formation during air mass transport was on timescales longer than the atmospheric lifetime of precursor hydrocarbons or primary emission. The period over which this process was significant was similar to that of airmass motion on intercontinental scales, and formation via this route may reproduce that of a widespread diffuse source. The model indicates that continued short chain OVOC formation occurs many days from the point of emission, via longer lived intermediates of oxidation such as organic peroxides and long chain alcohols.

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