Long-Term Observations of NMHCs from the IAGOS-CARIBIC Flying Observatory

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Non-methane hydrocarbons (NMHCs) are ubiquitous trace components of the atmosphere whose broad range of lifetimes and unique source signatures make them useful indicators of sources and transport histories of air masses. This is particularly true of the light (C2-C4) alkanes, which are predominantly anthropogenic in origin and have relatively well-characterized emission ratios. These species are typically measured as part of an ensemble NMHC analysis, as is the case for whole air samples collected during deployments of the IAGOS-CARIBIC observatory (In-service Aircraft for a Global Observing System - Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrument Container; www.caribic-atmospheric.com). Since 2005 the IAGOS-CARIBIC observatory has operated from onboard a Lufthansa Airlines A340-600 passenger jet, where it is deployed monthly to make detailed atmospheric observations during a series of 2-6 long-distance commercial flights. The container operates at aircraft cruise altitudes of 10-12 km, placing the observations primarily in the upper troposphere and lowermost stratosphere (UT/LS). In this region there is a relative lack of information about distributions of NMHCs, and data is generally restricted to measurements during short-term field campaigns. Here we take advantage of the nearly 7000 measurements of NMHCs from air samples collected during 10 years of CARIBIC flights in order to better understand their global distributions and investigate transport and chemistry in the tropopause region. Additionally, we explore the possibility of using NMHC observations to understand sources of the methane, which is often co-emitted with the light alkanes.

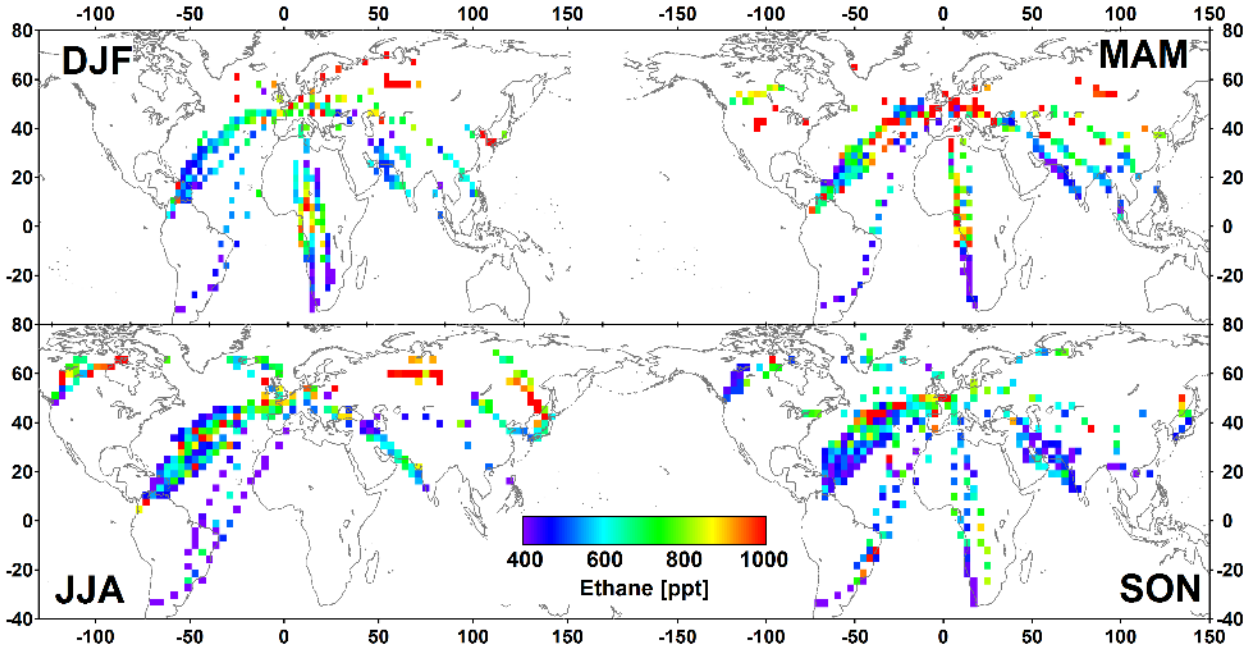

Figure 1. Global distributions of ethane in the upper troposphere (2005-2014) during winter (upper left), spring (upper right), summer (lower left), and autumn (lower right).