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Fluorinated greenhouse gases in the troposphere and stratosphere

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Fluorinated organic trace gases in the atmosphere are almost exclusively thought to be of anthropogenic origin. In the case of fully fluorinated alkane and cycloalkane-derivatives their IR absorption features and very long atmospheric lifetimes (on the order of thousands of years) make them very strong greenhouse gases. We here present measurements of 10 of these perfluorocarbons in the UT/LS and stratosphere as derived from deployments of regular passenger aircraft (CARIBIC project, http://www.caribic-atmospheric.com/) and the high-altitude research aircraft M55 Geophysica. In combination with long-term tropospheric records obtained from the Cape Grim observatory, Tasmania, we estimate their impact on radiative forcing expressed as CO_2-equivalents. As these gases have no significant sinks in the stratosphere they could also be suitable to derive an important transport diagnostic: the so-called mean age-of-air i.e. the average stratospheric transit time of an air parcel. We evaluate this possibility for all above-mentioned species and compare their characteristics with other inert species such as SF6, SF5CF3, and long-lived chlorofluorocarbons.