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Impact of atomic chlorine on the modelisation of total methane and $\delta^{13}C$ isotopic signature in LMDz

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Methane (CH_4) is the second strongest anthropogenic greenhouse gas after carbon dioxide (CO_2) and is responsible of about 20% of the warming induced by long-lived greenhouse gases since pre-industrial times. Oxidation by the radical hydroxyl OH is the dominant atmospheric sink for methane, contributing to approximately 90% of the total methane mass loss. Chemical losses by atomic oxygen (O^1D) and chlorine radicals (Cl) in the stratosphere are other sinks, contributing to about 3% of the total loss. Besides, the chlorine reaction is very fractioning, thus having a much larger impact on $\delta^{13}C$ - CH_4 isotopic values than on the global methane loss. In this presentation, we assess the impact of atomic chlorine on methane atmospheric loss and on $\delta^{13}C$ - CH_4, with a focus on the stratosphere where discrepancies between model simulations and observations have been previously noted. Observations used here consist in methane vertical profiles obtained using Aircores samplers above Trainou/Orleans in France. The global circulation model (GCM) LMDz, coupled to a chemistry module including the major methane chemical reactions, is run to simulate CH_4 concentrations and $\delta^{13}C$ - CH_4 at the global scale. Simulations with and without chlorine chemical sink are performed. Atmospheric methane sink by chlorine atoms in the stratosphere is found to be about 5 Tg/yr. Above 20 km, the presence of chlorine in the model is found to have only a small positive impact on the vertical profile of total methane but a major influence on $\delta^{13}C$ values, increasing the agreement between simulations and available observations.