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Continuous (CFA) CH4 record of the Elbrus ice core, Caucasus (preliminary results)

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Methane (CH_4) is the third most powerful greenhouse gas. However, its warming potential is two orders of magnitude higher than of carbon dioxide and its residence time in the atmosphere is only 9.1 ± 0.9 years. It makes CH_4 a good indicator of rapid climate variations both under natural conditions and due to the anthropogenic influence.

The Elbrus ice core was drilled in 2009 on the Western Plato (43°20’53.9”N, 42°25’36.0”E) at elevation 5115 m a.s.l. It is 182 m long and is dated back to 280 ± 400 CE (Common Era). The CH_4 mixing ratios were analyzed using a continuous flow analysis (CFA) system paired with optical-feedback cavity-enhanced absorption spectroscopy. The measurements campaign was organized at Institut des Géosciences de l'Environnement (IGE), Grenoble, France. This is a first high-resolution mid-latitude CH_4 record. The record aims to better constrain the past evolution of mid-latitude methane sources.

Here we present preliminary results of the methane concentration measurements of the Elbrus ice core in high-resolution (CFA CH_4 record). We observe in situ production (max level 2900 ppb) and a baseline. We inspect a potential origin of the multiple spikes in the high-resolution record. Supposedly, either an in-situ production in the dust-rich layers occurred or a gas dissolution in the melt layers took place. However, the possibility of in-situ production during continuous gas extraction has to be further studied. The identified melt layers can serve as an indicator of interrupted stable water isotopic signal and may be supportive in the regional temperature reconstructions based on the Elbrus ice core record. A cleaned off the spikes record is inspected for the natural variability of the CH_4 baseline concentration related to the short-term climate and methane emissions variability.