Carbon and hydrogen isotopic ratios of methane emitted from wetlands and wildfire inferred from airborne observations over Alaska

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Since northern high latitude is characterized by large areas of wetlands and frequent occurrence of wildfires, the area is thought to be an important place for natural sources of atmospheric methane (CH_4). In order to obtain information on the CH_4 sources, air sampling was conducted using a small jet plane from July 28 to August 4, 2006 over Alaska. Sampling points have been selected so as to obtain both vertical profiles of CH_4 over strong source region and background region; 2 profiles were obtained over wetlands, over wildfire, and over a natural forest, respectively, and 1 profile was obtained over oil field and over the sea. Considerable high CH_4 concentration were observed near the surface over wetlands and wildfire.

Over Yukon Delta in western Alaska, which is characterized by tundra and large numbers of lakes, high CH_4 concentration and low $d^{13}C$ and dD were observed near the surface. Assuming a single mixing relationship, $d^{13}C$ and dD of CH_4 emitted from wetlands were estimated to be -63.4+-3.0 and -386+-82 per mil, respectively, which agree well with previously reported values. This results indicates that the vertical profile of CH_4 over this area is simply determined by mixing of CH_4 in background air with CH_4 emitted from wetlands.

Over wildfire at southwest of Fairbanks, high CH_4 concentration near the surface were also observed. Higher $d^{13}C$ and lower dD than those over the other sampling areas were found near the surface. If we adopted the single mixing relationship, estimated $d^{13}C$ and dD of CH_4 from wildfire were significantly lower than those obtained by direct sampling of CH_4 emitted from a furnace or biomass burning in previous studies. This would be attributed to the contribution from wetland CH_4, because a river and several ponds were located around the sampling area. In order to separate wetland CH_4 and wildfire CH_4, CH_4/CO ratio from biomass burning was used. From corrected CH_4 profiles in which wetland CH_4 was excluded, $d^{13}C$ and dD of CH_4 from wildfire were reevaluated to be -32+-4 and -183+-75 per mil, respectively. These values were within the range of data obtained by the previous studies. This result indicated that both CH_4 from wetlands and wildfire had been added to the vertical CH_4 profile in the background air, and that CH_4/CO ratio used in this estimation was reasonable.