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Characterisation of methane isotope composition over the Silesian Coal Basin, Poland.

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Methane emissions from Silesian Coal Basin (SCB), one of European regions associated with coal excavation industry constitute an important component of the continental anthropogenic flux of this gas into the atmosphere. It is estimated by different methodology that SCB is responsible for between 450 – 1350 Gg CH4 of atmospheric methane releases annually, making it one of the most significant sources of this gas in Europe. In this region, active or restructuring coal mining methane emissions may lead to elevated concentrations of this gas in near-ground atmosphere. Observed methane mixing ratio in pbl during nighttime over the specific areas of SCB is elevated by up to 50ppm with carbon isotope source ratio -46‰ to -52‰ with occasionally lighter methane (-58‰) form particular coal beds. Numbers were derived from direct measurement of samples taken from ventilation shafts (concentration 1.5% to 4% of CH4, subsequently diluted to 2ppm with zero air and measured by Picarro CRDS analyzer). Measurements of CH4 mixing ratios and isotopic composition were performed along latitudinal transects (ca. 50oN), typically extending from ca. 15oE to 20oE, covering the Upper Silesia and bordering regions on the public roads in vicinity of the mine ventilation shafts. Apart from CH4 emissions associated with coal production, other sources of anthropogenic methane are also active over SCB. These include city gas networks leakages that enrich the air by up to 5ppm (in the city centers, carbon isotope ratio on average -52‰). Most of the numerous landfills, not yet equipped with appropriate CH4 uptake installations, also contribute to substantial anthropogenic flux of this gas to the atmosphere. Values of methane mixing ratio recorded during the in-situ measurements close to the landfill sites reached 15ppm (with carbon isotope ratio -56‰ to -60‰).

The transects of methane concentration over Silesian area, assisted by analysis of its stable isotopic composition has been performed in all of the locations where active and closed mining shafts are positioned, and most of the landfills and cities under the different meteorological and synoptic conditions to provide a base for efficient future verification of methane inventory over SCB. Project will be continued with MEMO2 ITN H2020.