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Influence of orography on variability of a non-CO_2 greenhouse gases concentrations measured at Kasprowy Wierch station, Tatra, Poland

J. Necki (1), L. Chmura (2), and M. Zimnoch (1)

(1) AGH- University of Science and Technology,Faculty of Physics and Applied Computer Science, Kraków, Poland (necki@agh.edu.pl), (2) IMGW -Institute of Meteorology and Water Management, Branch in Kraków, Kraków, Poland

Kasprowy Wierch is a mountain peak in north-western Tatra mountain ridge, where meteorological station was settled in year 1936. As the station is situated in the convergence area of three large valleys it suffers from breeze wind and from frequent katabatic winds as well. Unfortunately vertical constituent of wind is not measured at the station. Prevailing wind direction pattern in this part of Europe is western circulation. However 75-years record consistently indicate south as the predominant direction of wind at Kasprowy Wierch. Two of the valleys coming toward this mountain peak are forcing the transport of air exactly from that direction.
Since 1994 trace gas analysis is performed at the station. In year 1996 automated gas chromatograph was installed at the station and data are collected till nowadays. “In situ” concentrations of CH4, N2O and SF6 are measured every 16 minutes. Since 2010 also H2 and CO are observed at the station. Especially carbon monoxide concentration may be used as a proxy for determination of cases when local emission contaminates the air coming to the station. Usually location of the station in high mountain assures large distance from sources of the observed gases. Some tracers connected with human activity like carbon monoxide or sulphur hexafluoride may indicate proximity of anthropogenic sources of N2O and CH4, which might substantially change the composition of air surrounding the station.
Valley breezes occur frequently in each mountain area. It has a large influence on air composition meas-ured at the mountain stations. It can be clearly noticed in CH4 and N2O records and at much smaller rate in SF6 concentration as well. Diurnal cycle of methane and nitrous oxide concentrations reflects substantial change of its value usually shortly after the sunrise. During the summer season a valley breeze transports to the station an air enriched in CH4 and N2O from the peat lands located along the foothill of Tatra mountains. Additionally ni-trous oxide is emitted from arable lands representing almost half of the terrain bordering with Tatra. In case of Kasprowy Wierch methane enhancement may reach even 150ppb usually in July and August. Average diurnal amplitude remains at 30ppb. Variations of nitrous oxide concentration remains is usually characterized by amplitude of 3ppb. Sulphur hexafluoride amplitude remains usually below 1.5ppt. In winter, mean diurnal amplitude of methane abundance recorded at Kasprowy Wierch decrease to 10ppb as most of the terrain including peat lands is shielded by a deep snow cover. N2O reproduces also decreased variations in opposition to SF6 which tend to represent much stronger fluctuation with impaired diurnal frequency.
Global circulation models doesn’t take to account valley breeze wind. This is one of the reasons why model results of trace gas concentration for mountainous sites are incoherent with measurements.
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