Geophysical Research Abstracts, Vol. 7, 00947, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00947
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On the impact of temperature inversions on the variability of atmospheric trace gases in TROICA experiments

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Primary data of key trace-gas species measured in the atmospheric boundary layer (ABL) by an environmental carriage-laboratory along the Trans-Siberian railway have been analysed. Expeditions are carried out since 1995 within the framework of the Russian-German project TROICA (Trans-Siberian Observations Into the Chemistry of the Atmosphere, www.troica-environmental.com). We have analysed on-line measurement data of carbon monoxide, methane, ozone and vertical temperature profiles in the lowest 600 m of ABL being available for three expeditions (TROICA-5, TROICA-7 and TROICA-8). The vertical temperature gradient in the lowest 100 m layer was taken as an indicator of surface inversions. This allowed us to investigate only surface inversions, an additional study is necessary to check the role of elevated inversions. Expeditions TROICA-5 and TROICA-7 were performed in summer of 1999 and 2001 (accordingly) and TROICA-8 in March 2004 (early spring). Under inversions, variations of the studied compounds are principally different: in many cases surface ozone is destroyed and methane and carbon monoxide are accumulated. Maximal ozone destruction under temperature inversion reached 28ppbv (TROICA-5); carbon monoxide accumulation under inversion was observed in TROICA-5 and TROICA-8. The highest accumulation of CO under inversion reached 50 ppbv (TROICA-8). During TROICA-7, inversions were not very strong and had only little response in species concentration variability. Response of methane on temperature inversions is complicated. Taking each expedition as a whole, there is no clear difference between methane concentration under inversion and without them. Most likely, methane spatial

gradients mask possible methane accumulation under temperature inversions. However, methane accumulation has been clearly observed in the emission areas, Western Siberia - the most pronounced case is TROICA-5 (forward route) where the temperature gradient change of 4 degrees C/100 m corresponds to ˜100 ppb of methane accumulation. Three principally different mechanisms controlling surface stratification of the studied species under inversion conditions will be discussed at the meeting. The work is carried out under the support of INTAS Young Scientist Fellowship (03-55-662), Russian Foundation for Basic Research (grant 03-05-64712) and INTAS (01-0016).