Geophysical Research Abstracts
Vol. 20, EGU2018-79, 2018
EGU General Assembly 2018

Laser Heterodyne Radiometry for Ground-based Monitoring of Multi-Species in the Atmospheric Column

Fengjiao Shen (1), Pascal Jeseck (2), Yao Te (2), Tu Tan (3), Xiaoming Gao (3), Eric Fertein (1), and Weidong Chen (1)

(1) Université du Littoral Cote d'Opale, Laboratoire de Physico Chimie de l'Atmosphère, Dunkerque, France (chen@univ-littoral.fr), (2) Laboratoire d'Etudes du Rayonnement et de la Matière en Astrophysique et Atmosphères, Université Pierre et Marie Curie, Paris, France, (3) Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei, China

Measurements of vertical concentration profiles of the key atmospheric trace gases, such as ozone (O_3), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and water vapor (H_2O), is extremely important for our understanding of regional air quality and global climate change trends.

In this context, an infrared laser heterodyne radiometer (LHR) [1-3] has been developed in the present work which aims at ground-based remote measurements of trace gases in the atmospheric column.

The first field test has been performed on the "Qualair" Platform of the Université Pierre et Marie Curie (Paris). The solar radiation that's undergone absorption by multi-species in the atmosphere is captured using an external heliostat installed on the roof terrace of the lab building. The Sunlight is directed to the LHR setup and mixed with a local oscillator (LO) in a fast photomixer. In the current experiment, an external cavity quantum cascade laser (EC-QCL) tunable from 1223 to 1263 cm^{-1} is used as LO. This spectral coverage allows us to cover the spectral region where the following atmospheric species exhibit stronger absorptions, such as CH_4, N_2O, H_2O, HONO, N_2O_5, etc. The beat note at radio frequency (RF) is generated from the photo-mixing. Scanning the LO frequency across a gas absorption feature allows one to restitute the absorption feature of the target molecular trace gas from the total absorption of the solar radiation in the atmospheric column.

The preliminary result of heterodyne measurement of tropospheric CH_4 in the atmospheric column will be presented and discussed.

Acknowledgments The authors thank the financial supports from the CaPPA project (ANR-10-LABX005) and the CPER CLIMIBIO program. S. F. thanks the program Labex CaPPA and the "Pôle Métropolitain de la Côte d'Opale" (PMCO) for the PhD fellowship support.

References

[1] R.T. Menzies, and R.K. Seals, Ozone monitoring with an infrared heterodyne radiometer, Science 197 (1977) 1275-1277

[2] Damien Weidmann, Tracy Tsai, Neil A. Macleod, and Gerard Wysocki, Atmospheric observations of multiple molecular species using ultra-high-resolution external cavity quantum cascade laser heterodyne radiometry, Opt. Lett. 36 (2011) 1951-1953

[3] E.L. Wilson, M.L. McLinden, J.H. Miller, Miniaturized laser heterodyne radiometer for measurements of CO_2 in the atmospheric column, Appl. Phys. B 114 (2014) 385-393