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Development of PicoSDLA laser sensors for in-situ measurements of CH4, CO_2 and H_2O in the UTLS in the frame of the TRO-pico project.

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Following water vapor and carbon dioxide, methane is the most important greenhouse gas in the Earth atmosphere. On a per molecule basis, methane is much more radiatively efficient than carbon dioxide [1]. The concentration of methane in the atmosphere has dramatically increased since the pre-industrial area. The increase of methane concentration in the atmosphere is of major interest because of it is impact on the radiative balance of the Earth and the atmospheric chemistry. Methane is released into the atmosphere by several sources, both anthropogenic and natural. It is suspected that global warming can induced additional methane release in the atmosphere by permafrost degradation. Moreover, methane is an interesting atmospheric tracer in order to study the impact of the deep convection on the tropical lower stratosphere. In the stratosphere, methane is a source of water vapour by oxidation [2, 3, 4], and consequently play a role in the budget of stratospheric water vapor.
With the help of CNES and CNRS, we developed a compact sensor for in-situ measurements of methane under meteorological balloons PicoSDLA-CH4. The compactness of this sensor permits regular in-situ soundings of methane in the middle atmosphere. This sensor is based on the use of Difference Frequency Generation (DFG) laser source emitting at 3.3 microns, for in-situ measurements of methane by direct absorption spectroscopy. This sensor was successfully test-flown during balloon campaign from Kiruna (67 °N, April 2011) [5] and will be deployed during TRO-Pico campaign from Bauru (22 °S, Brazil) this year, as well as PicoSDLA-CO_2 and H_2O sensors dedicated to in-situ measurements of CO_2 and H_2O. The major scientific objective of TRO-Pico campaign is the study of the impact of deep convection on tropical tropopause and lower stratosphere composition mainly focused on water vapour but also considering relatively long lived species.
During this presentation, PicoSDLA-CH4, CO_2 and H_2O sensors will be described as well as laboratory spectroscopic study for this application. Results from the Kiruna campaign and first results from the TRO-Pico campaign will be exposed.

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