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The French-German Climate Monitoring Initiative on global observations of atmospheric CH_4

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We report on a new French-German Climate Monitoring Initiative targeting on global measurements of atmospheric methane (CH_4). Among the greenhouse gases banned by the Kyoto protocol, CH_4 contributes most to global warming after CO_2. Questions arise whether global warming in Arctic regions might foster the melting of permafrost soils which contain significant amounts of carbon in organic form which under anaerobic conditions might be converted to CH_4 and partially released to the atmosphere. Also the development of natural wetlands which are the biggest methane source, play an important role in climate prediction. Up to now, there is very little knowledge about CH_4 sources and sinks in connection with changes in the agro-industrial era of predominant human influence or the very large deposits of CH_4 as gas hydrates on ocean shelves that are vulnerable to ocean warming. The objective of this initiative is to improve our knowledge on regional to synoptic scale methane sources, globally. This will be obtained by the measurement of the column-weighted dry-air mixing ratio of CH_4, commonly referred to XCH_4 which can be used as input for flux inversion models. As a novel feature, the observational instrument will have its own light source emitting pulsed narrow-line laser radiation, not relying on sunlight. The XCH_4 values will be provided by a lidar technique with no bias due to particles scattering in the light path, which can have strong regional variability. Using a range-gated receiver for detection of the signals scattered from the Earth surface, the lidar can distinguish surface from cloud or aerosol backscatter, permitting high-precision retrievals of XCH_4 in the presence of thin cirrus or aerosol layers. The proposed measurement approach is also capable of providing measurements in partially cloudy conditions. The emitted laser pulses can reach the surface when gaps between clouds occur due to the near-nadir view and the small lidar footprint. The instrument will also provide XCH_4 measurements above dense stratiform clouds to be used as reflective target instead of the surface. Using this observational method an unique dataset with sampling twice daily and with all-season and all-latitude coverage will be provided. In our presentation we focus on the measurement concept of XCH_4 using an active optical instrument and discuss the expected performance in connection to the needs of flux inversion experiments. Finally, we will give an overview on supporting activities related to lidar measurements of greenhouse gas concentrations from ground-based and airborne platforms.