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MERLIN : a Franco-German active space mission dedicated to atmospheric methane

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The Methane Remote Sensing Lidar Mission (MERLIN), currently in phase B, is a joint cooperation between France and Germany on the development, launch and operation of a space LIDAR dedicated to the retrieval of total methane (CH4) atmospheric columns. Atmospheric methane is the second most anthropogenic gas, contributing 20% to climate radiative forcing but also plying an important role in atmospheric chemistry as a precursor of tropospheric ozone and low-stratosphere water vapour.

For the first time, measurements of atmospheric composition will be performed from space thanks to an IPDA (Integrated Path Differential Absorption) LIDAR (Light Detecting And Ranging), with a precision (target 20 ppb for a 50km aggregation along the trace) and accuracy (target 3 ppb) sufficient to improve the constraints on methane fluxes compared to current observation networks. The very low systematic error target is ambitious compared to current methane space mission, but achievable because of the differential active measurements of MERLIN, which guarantees almost no contamination by aerosols or water vapour cross-sensitivity. As an active mission, MERLIN will deliver data for all seasons and all altitudes, day and night.

Here, we present the MERLIN mission and its objectives in terms of reduction of uncertainties on methane surface emissions. To do so, we propose an OSSE analysis (observing system simulation experiment) to estimate the uncertainty reduction brought by MERLIN. An analysis of causes of errors has been done for the MERLIN mission and is presented. The originality of our system is to transfer both random and systematic errors from the observation space to the flux space, thus providing more realistic error reductions than currently provided in OSSE only using the random part of errors. Error reductions are presented using two different atmospheric transport models, TM3 and LMDZ, and compared with error reductions achieved with the GOSAT passive mission.