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

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Résumé

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 tropo-
spheric 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 ac-
curacy (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 measure-
ments 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 uncer-
tainties 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 obser-
vation 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 us-
ing two different atmospheric transport models, TM3 and LMDZ, and compared with error
reduction achieved with the GOSAT passive mission.