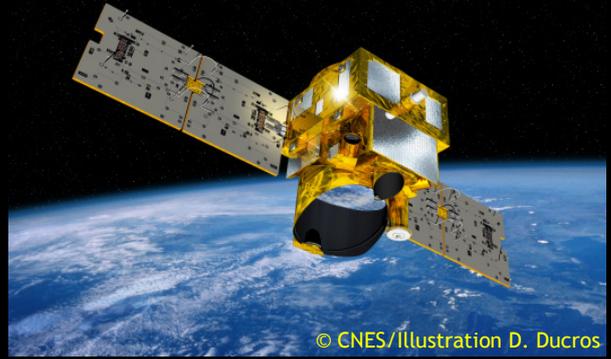


French / German Climate Mission MERLIN

Measurements of atmospheric methane from space

Climate change is one of the greatest challenges mankind has to face. Methane is one of the most powerful greenhouse gases. For a better understanding of climate change, it is necessary to apply precise space-based measurement techniques in order to obtain a global view on the complex processes that control the methane concentration in the atmosphere. CNES and DLR cooperate to develop and operate a space system dedicated to the measurements of the greenhouse gas methane. The name of the mission is MERLIN (Methane Remote Sensing Lidar Mission). It is planned to launch the satellite in the time frame of 2019 with at least 3 years of operation in space.



© CNES/illustration D. Ducros

Mission Goals:

- Global information on atmospheric methane (CH₄) concentration (methane column density) with accuracy better than 2% and with a spatial resolution of 50 km along track also under cloudy and variable sun illumination conditions.
- The main data product will be column-weighted dry-air mixing ratio of CH₄.
- Improved knowledge on contribution to the atmospheric methane amount from energy production, wild fires, wetland changes due to climate change such as melting of permafrost soils and ocean sediments (gas hydrates).
- Improved understanding of CH₄ sources and sinks and their interactions with Earth climate.
- Improved data quality concerning anthropogenic and natural methane emissions.
- Significant contribution to climate change prediction
- Contribution to control of the Kyoto protocol aims on methane emission regulation.
- Demonstrator for future satellite-based Integrated Path Differential Absorption (IPDA) LIDAR missions (LIDAR stands for Light Detecting and Ranging or "Laser Radar").
- Compliant with GCOS (Global Climate Observing System) monitoring principles.

Mission Calendar:

Launch: in the time frame of 2019

Minimum mission duration: 3 years

Orbit:

Polar, quasi circular sun-synchronous Earth orbit, with a mean orbit altitude of approx. 500 km and a Local Time of Ascending Node (LTAN) of 06:00 or 18:00.

IPDA LIDAR Principle:

An IPDA LIDAR (light detecting and ranging) is an instrument that is able to determine the total methane column density between satellite and Earth surface or cloud top height. The methane amount is calculated from different absorptions at two laser wavelengths (on-line and off-line), reflected on Earth surface or cloud tops. Earth surface or cloud top reflected laser light is used because this is much more intense than backscattered light from aerosol particles in the atmosphere. The attenuation due to atmospheric methane absorption is strong at the on-line wavelength. The off-line "reference" wavelength is selected to be only marginally affected by methane absorption.

Instrument concept:

MERLIN will be the first space-based integrated path differential absorption LIDAR instrument. It consists of a frequency stabilized high-power laser (20 Hz double pulse approx. 9 mJ pulse energy, wavelength around 1.645 μm) as transmitter, and a receiver section consisting of an off-axis telescope (\varnothing 690 mm) and a sensitive signal chain (baseline: InGaAs APD detector).

Satellite:

Satellite platform: MYRIADE Evolutions

Satellite mass: approx. 400 kg

Dimensions:

approx. 150x120x170 cm³ with stowed solar panels

approx. 150x450x170 cm³ with deployed solar panels

Satellite total power: approx. 480 W

Payload power allocation: approx. 150 W

Launcher:

Not yet defined. Co-passenger opportunity is considered.

Mission Operation:

CNES satellite control centre with S-Band downlink for housekeeping data and S-Band uplink for commanding to CNES-ground station network. For scientific data, X-Band downlink to CNES-ground station network will be used.

Mission Partners:

The MERLIN climate mission is a joint French-German cooperation, performed by the national space agencies, CNES and DLR Space Administration. Germany provides the IPDA LIDAR instrument. France contributes by its MYRIADE Evolutions satellite platform and its satellite control centre. CNES is mission prime and operates the satellite. The data processing centre is developed by France with German contribution and operated in France.

Science activities are led by two Co-Principle-Investigators from the French laboratory from CNRS and the German Institute for Atmospheric Physics from DLR, with additional support of several French and German Research Institutes.

The satellite is developed by Airbus DS SAS (France), which will provide the MYRIADE Evolutions platform. Airbus DS GmbH (Germany), with contributions from German industry and German research institutes, will build the methane IPDA LIDAR instrument. The industries are under contracts by CNES and DLR Space Administration, respectively.

The German project part is granted by the German Federal Ministry for Economic Affairs and Energy (BMWi).

Contact CNES: Bruno Millet
Centre National d'Etudes Spatiales
Toulouse Space Center (France)
Tel.: +33 (0) 5 61 28 24 00
Email: bruno.millet@cnes.fr
<http://smc.cnes.fr/MERLIN/>



Contact DLR: Dr. Matthias Alpers
German Aerospace Center
Space Administration, Earth Observation
Tel.: +49 228 447-585
Email: matthias.alpers@dlr.de
http://www.dlr.de/rd/desktopdefault.aspx/tabid-2440/3586_read-31672/