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MERLIN and MICROCARB : Preparation of 2 space missions for CO_2 and CH4

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In collaboration with the research community and with close European partnerships, the French space agency, CNES is developing or co-developing two missions to be launched by 2021, MERLIN and MICROCARB, that are dedicated respectively to the observation of atmospheric concentrations of CH4 and CO_2. Both missions are based on innovative instrumentation, microsatellites, specific algorithm inversion processes and calibration /validation approaches. Both will deliver very accurate weighted atmospheric column measurements over the globe for the two species that play a major role in climate change.

The MERLIN (MEthane Remote sensing LIdar missioN) space segment consists of the new Myriade-Evolutions platform type (range of 400 kg) developed under CNES control, and of the first IPDA (Integrated Path Differential Absorption) LIDAR (Light Detecting And Ranging) instrument developed under DLR responsibility (Germany). The MERLIN satellite will be operated at an altitude of around 500 km, on a sun-synchronous orbit, either at 06:00 or 18:00 of the local time of the ascending node. The main science objective is to bring a significant improvement on the knowledge of CH4 emissions and sinks, derived from estimates of the CH4 column-averaged dry-mixing ratio at a 50 km horizontal resolution, with a precision of $\sim$1% and a challenging targeted accuracy of 0.2%.

The MICROCARB mission is based on a compact grating spectrometer (around 60 kg) onboard a Myriade micro-satellite platform (170kg range). The satellite will fly on a sun-synchronous orbit at altitude around 650 km and at around 10h30 local time for the ascending node. The instrument will measure the reflected solar radiance in four spectral ranges in the infrared. Two bands with CO_2 absorptions, at 1.6 μm (weak absorptions) and 2.0 μm (strong absorptions), allows retrieving the quantity of molecules of CO_2. Two bands centered around 0.76 and 1.27 μm sample oxygen absorption lines and provide a proxy of the atmospheric optical path. The objective is to estimate the column averaged mixing ratio of CO_2 from these four bands with a precision better than 1 ppm and a bias better than 0.1ppm for each individual pixel (of size around 40 km2). In addition to the column averaged CO_2, the mission shall deliver secondary products on atmospheric water vapor, aerosols and vegetation fluorescence. An experimental observation mode shall allow some CO_2 imagery of targets of opportunity such as the CO_2 plume from large cities.