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The Novel Limb-imaging FTIR Sounder GLORIA-Lite

A new remote-sensing instrument, GLORIA-Lite, was developed by the Institute of Meteorology and Climate Research (IMK-ASF) at the Karlsruhe Institute of Technology (KIT), in collaboration with the ICE4 and ZEA2 institutes at Forschungszentrum Jülich(FZJ). It was launched within the TRANSAT2024 field campaign on board a large stratospheric balloon by a team of the Centre National d'Études Spatiales (CNES) from the European Space and Sounding Rocket Range (ESRANGE, Swedish Space Corporation), on June 22, 2024. The balloon ascended to an altitude of 40 km, traveling from Kiruna, northern Sweden, to Baffin Island, Canada, where it safely landed on June 26.

GLORIA-Lite is an advanced limb-imaging Fourier-Transform Infrared instrument, extending the decades-long legacy of its predecessors, GLORIA (airborne/balloon) and MIPAS (airborne/balloon). By leveraging state-of-the-art infrared detectors, customized electronics, and innovative manufacturing techniques, GLORIA-Lite achieves a significant reduction in size and weight compared to its predecessors. This miniaturization enables its deployment on transcontinental balloon flights, sharing a gondola with multiple other instruments. The alignment of the fully reflective optical system is performed during manufacturing, ensuring consistent performances over the wideband long wave spectral range of the infrared detector array. The quasi-monolithic design approach eases thermal constraints of instrument operation. The electronics controlling the instrument are developed towards further miniaturisation into a Multi-Processor System-on-Chip architecture, with the goal to process the data on the fly up to Level 1.

GLORIA-Lite is capable of analyzing infrared emissions of more than 20 different molecules and aerosols in the atmosphere. The instrument is designed to enhance our understanding of dynamic and chemical processes occurring from the middle troposphere deep into the stratosphere. In times of accelerating climate change, it is particularly important to study the impacts on the middle atmosphere and to monitor them through long-term measurement series. Additionally, GLORIA-Lite serves as a technology demonstrator for the CAIRT satellite project, a proposed mission developed by the European Space Agency (ESA). CAIRT aims to bring the advanced atmospheric monitoring capabilities to a global scale.

We will provide a detailed account of the instrument's technical development and characterization, along with the results obtained from retrieving geophysical parameters, such as trace-gas distributions, during its first flight.

Topic

Upcoming Earth observation limb and occultation instruments

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