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Balloon-borne GLORIA hyperspectral Limb and Nadir imager in the LWIR

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The GLORIA-B (Gimballed Limb Observer for Radiance Imaging of the Atmosphere - Balloon) instrument is an adaptation of the very successful GLORIA-AB imaging Fourier transform spectrometer (iFTS) flown on the research aircrafts HALO and M55 Geophysica. The high spectral resolution in the LWIR (Long Wave Infrared) allows for the retrieval of temperature and of a broad range of atmospheric trace gases, with the goal to retrieve O_3, H_2O, HNO_3, C_2H_6, C_2H_2, HCOOH, CCl_4, PAN, $ClONO_2$, CFC-11, CFC-12, SF_6, OCS, NH_3, HCN, $BrONO_2$, HO_2NO_2, N_2O_5 and NO_2. The radiometric sensitivity of the Balloon instrument is further increased in comparison with the GLORIA-AB instrument by having two detector channels on the same focal plane array, while keeping the same concept of a cooled optical system. This system improvement was achieved with minimal adaptation of the existing optical system.

The high spatial and temporal resolution of the instrument is ensured by the imaging capability of the Fourier transform spectrometer while stabilizing the line-of-sight in elevation with the instrument and in azimuth with the balloon gondola. In a single measurement lasting 13 seconds, the atmosphere can be sounded from mid-troposphere up to flight altitude, typically 30 km, with a vertical resolution always better than 1 km for most retrieved species; a spatial resolution up to 0.3 km can be achieved in favourable conditions. Temperature retrieval precision between 0.1 and 0.2 K is expected. A spectral sampling up to 0.0625 cm^{-1} can be achieved.

The first flight of GLORIA-B shall take place during the late-summer polar jet turn-around at Kiruna/ESRANGE. This flight is organised in the frame of the HEMERA project and was scheduled for summer 2020, but was ultimately postponed to summer 2021. Beyond qualification of the first balloon-borne iFTS, the scientific goals of the flight are, among others, the quantification of the stratospheric bromine budget and its diurnal evolution by measuring vertical profiles of $BrONO_2$ in combination with BrO observations by the DOAS instrument of University Heidelberg on the same platform.