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Inversion of ground-based infrared measurements to retrieve tropospheric water vapour

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This contribution introduces an experimental approach to determining tropospheric water vapour with an infrared instrument originally designed for balloon-borne limb observations.
Information about the water vapour distribution in the troposphere is required to better understand weather processes, in particular the formation and properties of clouds. Within the AtmoWater project, a data fusion approach will be used to investigate this variable in more detail using a combination of primarily geodetic observations, including InSAR and GNSS. As a horizontal complement to these vertical measurements, ground-based infrared measurements could be used.
Measurements were carried out to investigate the suitability of a new instrument for this purpose. The 'Gimballed Limb Observer for Radiance Imaging of the Atmosphere' (GLORIA) was developed in cooperation by the Karlsruhe Institute of Technology (KIT) and the Research Centre Jülich (FZJ) for the investigation of UTLS (Upper troposphere/ lower stratosphere) for operation on research aircraft or stratospheric balloons. The measuring principle is based on limb soundings with a Michelson interferometer together with an infrared camera.
For this study, the ground-based applicability of the instrument was tested. The measuring campaign took place in October 2018 on the Black Forest mountain Blauen overlooking the Upper Rhine Graben in the south-western part of Germany. The inversion of the data is carried out with KOPRA (The Karlsruhe Optimized and Precise Radiative transfer Algorithm), whereby both the water vapour content and the occurrence of other gases can be determined.
A challenge is the background signal, which differs from the cold space signal of the original geometry of GLORIA due to the existing topography and clouds on the horizon. Results of the inversions are presented and the method and measurement configuration are evaluated.