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Water vapour profiles by ground-based FTIR spectroscopy: study for an optimised retrieval and its validation

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Abstract. The sensitivity of ground-based instruments measuring in the infrared with respect to tropospheric water vapour content is generally limited to the lower and middle troposphere. The large vertical gradients and variabilities avoid a better sensitivity for the upper troposphere/lower stratosphere (UT/LS) region. In this work an optimised retrieval is presented and it is demonstrated that compared to a commonly applied method, it improves the performance of the FTIR technique. The reasons for this improvement and the possible deficiencies of the method are discussed. Only by applying the method proposed here and using measurements performed at mountain observatories can water vapour variabilities in the UT/LS be detected in a self-consistent manner. The precision, expressed as noise to signal ratio, is estimated at 45%. In the middle and lower troposphere, precisions of 22% are achieved. These estimations are confirmed by a comparison of retrieval results based on real FTIR measurements with coinciding measurements of synoptical meteorological radiosondes.

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