

INTERCOMPARISON OF ATMOSPHERIC WATER VAPOR SOUNDINGS FROM THE DIFFERENTIAL ABSORPTION LIDAR (DIAL) AND THE SOLAR FTIR SYSTEM ON MT. ZUGSPITZE

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Abstract

We present the results of a recent intercomparison study [1] based on three years of measurements of integrated water vapor performed with the differential absorption lidar (DIAL) at the Schneefernerhaus (2675m a.s.l.) and the nearby mid-infrared solar FTIR (Fourier Transform Infra-Red) instrument on the summit of Mt. Zugspitze (2964 m a.s.l.). The DIAL was developed and constructed from 2001 until 2006 [2] and started its routine operation in January 2007, recording water-vapor profiles throughout the free troposphere (3km - 12km a.s.l.) on typically 2 days a week. The solar FTIR was shown to be one of the most accurate and precise IWV sounders in recent work [3] and was taken as the reference. By calculating the FTIR-DIAL correlation (22 min coincidence interval, 15 min integration time) we derived an almost ideal slope of 0.996(10), a correlation coefficient of $R = 0.99$, an IWV intercept of -0.039(42) mm (-1.2% of the mean), and a bias of -0.052(26) mm (-1.6% of the mean) from the scatter plot. By selecting a subset of coincidences with an optimum temporal and spatial matching between DIAL and FTIR, we obtain a conservative estimate of the precision of the DIAL in measuring IWV which is better than 0.1 mm (3.2% of the mean). We found that for a temporal coincidence interval of 22 min the difference in IWV measured by these two systems is dominated by the volume mismatch (horizontal distance: 680 m). The outcome from this work is twofold: 1. The IWV soundings by FTIR and DIAL agree very well in spite of the differing wavelength regions with different spectroscopic line parameters and retrieval algorithms used. 2. In order to derive an estimate of the precision of state-of-the-art IWV sounders from intercomparison experiments, it is necessary to use a temporal matching on time scales shorter than 10 min and a spatial matching on the 100-m scale. Conclusion: The precision of the DIAL is considerably better than the requirements of climate research.

REFERENCES

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