Water vapor isotopic abundance measurement in Tibetan Plateau based on portable laser heterodyne radiometer

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Abstract: Tibet Plateau is known as the third pole of the world, the environmental changing in this area profoundly impacts on east Asian or even global climate. HDO is the stable isotopes of water vapor and is the ideal tracer of water cycle, which has been applied to atmospheric circulation and climatic studies. For monitoring the water vapor isotopic abundance in Tibetan Plateau and provides reliable information for environmental and climatic studies, a portable laser heterodyne radiometer was operated at Golmud (Qinghai Province) in summer 2019. The radiometer adopted a narrow linewidth 3.66 μm DFB laser as the local oscillator and performed high resolution (~0.009 cm⁻¹) and high signal-to-noise ratio (~160). Furthermore, the absorption spectra of atmospheric HDO and H₂O were obtained and the retrieval algorithm of water vapor isotopic abundance based on LBLRTM was discussed. The optimal estimation method was chosen for retrieving, the ratio of HDO/H₂O at Golmud is 185 (3) Forward model is LBLRTM (Line-By-Line Radiative Transfer Model).

Introduction

◆ The abundance of the water isotopic composition are useful for the study of aspects of the hydrological cycle, as well as for monitoring global and regional climate change.
◆ The study of the isotopic composition of water vapor in the atmosphere can identify the source region and analyze climate change.
◆ The variation of the abundance also releases the degree of ocean pollutions, it is helpful to find the pollution sources.
◆ The laser heterodyne radiometer and the optimal estimation method are suitable for the measurement of HDO/H₂O ratio.

Methods and Materials

◆ Measurement Instrument
(1) Laser Heterodyne Radiometer (LHR).
(2) High sensitivity and resolution.
(3) Little volume, easy operation and low cost.

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