Millimeter-wave observations of water vapor isotopomer (H218O) from Atacama highland, Chile

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Stratospheric water vapor plays an important role in chemistry and radiative energy balance in the middle atmosphere. It is well known that isotopically heavy water is preferentially depleted when it enters into the stratosphere through the tropical tropopause because of mass-dependent Rayleigh process. Since the time and spatial variations of the isotopic ratio of water vapor reflect the transportation and chemical processes of stratospheric water vapor, systematic observations of the water vapor isotopomers should provide valuable information that leads us to better understanding of the mechanism of long-term variation of stratospheric water vapor. Thus, we are making continuous observations of rare isotopic water vapor, $H_2{}^{18}O$ by measuring its rotational line emission at 204.41GHz (J=3-2, K_{-1}=1-2, K_{+1}=3-0) with a millimeter-wave spectroscopic radiometer since August, 2006 from the Atacama highland (23.0S, 67.7W, 4,800m Alt.), Chile. The radiometer is equipped with a superconductive mixer receiver with a double-side-band receiver temperature of ˜200K and an acousto-optical spectrometer (AOS) covering 1GHz bandwidth at 1MHz frequency resolution.

We retrieved the vertical profiles of $H_2{}^{18}O$ volume mixing ratio (VMR) between 30km and 70km based on the radiometer data obtained from September to the end of December in 2006 and compared them with the $H_2{}^{16}O$ data obtained by AURA-MLS (Ver1.5). Through the four months, the VMRs of both $H_2{}^{18}O$ and $H_2{}^{16}O$ were almost constant at 50km and 60km, whereas the VMRs monotonically changed at 40km; the $H_2{}^{18}O$ VMR increased by ˜4%/month but the $H_2{}^{16}O$ VMR decreased by ˜0.9%/month. This suggests that some isotopic exchange reactions between water and ozone/oxygen molecules may be preferentially enhanced and increase the relative abundance of $H_2{}^{18}O$ around 40km from spring to summer above Atacama.