Since the discovery of the heavy isotope enrichment of ozone formation in the stratosphere in 1981, considerable progress has been made in understanding the processes that control the isotope enrichment by using mass spectrometric observations, stratospheric observation using infrared spectrometric techniques, laboratory measurements, and RRKM-based theory. It is important to observe symmetric and asymmetric ozone isotopes separately with enough accuracy to understand the mechanism of the ozone isotope enrichment for the ozone formation chemistry. In general, spectroscopic method, such as balloon-born infrared observation, is able to observe both of the symmetric and asymmetric ozone isotopes separately, but the accuracy is not enough to discuss ozone isotope enrichment as compared with mass spectrometric method.

At present, a new generation of submillimeter-wave spectrometers observed for the stratosphere, provide new opportunities for the measurements of the stratospheric molecules, such as ozone isotopes. The Sub-Millimeter Radiometer (SMR) onboard the ODIN mini-satellite, launched in February 2001, observes thermal radiation originating from the Earth's limb in the 500GHz region. NASA's EOS Aura Mission will be launched in June 2004, employing heterodyne instruments at millimeter, sub-millimeter, and far infrared. Both sensors use standard Schottky diode detectors. The JEM/SMILES instrument (Japanese Experiment Module/Submillimeter Limb Emission Sounder) on board the International Space Station will employ for the first time the up to 10 times more sensitive SIS (Superconductor-Insulator-Superconductor) detector technology in space. The single scan performance of a state-of-art SIS mixer receivers, such as SMILES provides a opportunity factor of ten improvement in receiver noise temperature compared to standard Schottky diode receiver, such as ODIN/SMR. This implies a 100 times shorter integration time according to the standard radiometer formula. Such sensitivity is ascribed to a SIS mixer, which is operated at 4.5 K in a dedicated cryostat combined with a mechanical cooler.

We will report the results for the observation and the simulation of normal, asymmetric-18, and asymmetric-17 ozone isotopes by using the air-borne and the space-station-born submillimeter-wave heterodyne receiver systems with SIS mixers. The observation frequency bands are around 625 GHz and 650 GHz for lower and upper sidebands, respectively. The frequency resolution of the acousto-optic spectrometer (AOS) is assumed to be about 1.8 MHz. In the analysis to obtain the height profiles of molecular abundances in the stratosphere, an inversion method called the optimal estimation method proposed by Rodgers were used with forward model calculations with line-by-line radiative transfer calculations. The part of the pressure broadening parameter of Ozone is given by the laboratory measurements\(^1\). The accuracy obtained for asymmetric-18 ozone is found to be enough to discussed the ozone isotope enrichment with a height resolution of 5km. The ozone isotope enrichment in the northern pole region will be discussed in the present paper.

\(^{1}\) H. Habara, M. Yamada, and T. Amano, \textit{private communications}, 2002,