Profile retrieval of the stratospheric ozone and nitrogen dioxide from the spectra observed with balloon-borne optical ozone sensor

Isao Murata[1], Katsuyuki Noguchi[2], Andreas Richter[3], Alexei Rozanov[3], and John P. Burrows[3]

[1]*Graduate school of Environmental Studies, Tohoku University*
[2] *Division of Natural Sciences, Nara Women's University*
[3] *Institute of Environmental Physics, University of Bremen*

We have developed a balloon-borne optical ozone sensor and have observed the vertical distribution of upper stratospheric ozone since 1994 using a thin-film high-altitude balloon at Sanriku and Taiki, Japan. The sensor measured solar ultraviolet radiation in ozone Hartley band absorption at wavelength of 300 nm, and vertical ozone distributions higher than 15 km were obtained with 1 km resolution. Recently, we developed a new sensor with small spectrometer to measure also other species such as NO_2 and the measurement was carried out on September 5, 2016. The solar absorption spectra between 280 and 500 nm were measured with 0.7 nm resolution every two seconds. The spectrometer was put between two cold insulators with freezing point of $5^{\circ}C$ to keep the temperature stable. A spherical mirror and a Teflon diffuser were set just before the optical fiber inlet to measure the solar spectra even when the solar zenith angle (SZA) is large (SZA<90). We utilized a program based on the DOAS method to retrieve the NO_2 number density from 460-490 nm. Slant columns between 17.5 - 44.5 km were successfully derived as 1.08×10^{20} [molecule / cm^2] for O_3 with error of 3.6% and 4.94×10^{16} [molecule / cm^2] for NO_2 with error of 9.9%. We tried to derive the vertical profile of NO_2 from the difference of the slant columns with altitude but the errors due to random noise were too large. We will perform data selection from raw spectra to eliminate noisy spectra and try the retrieval again.