

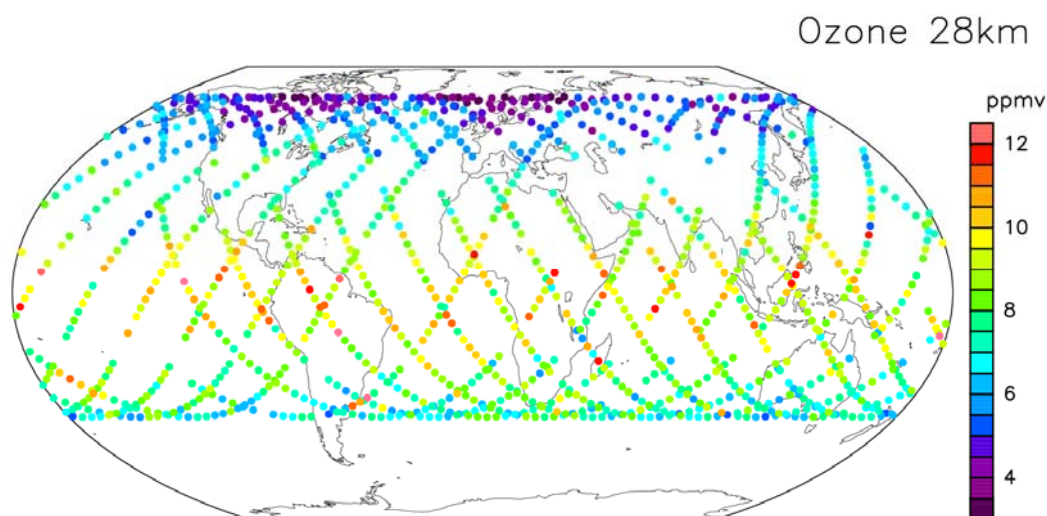
First Observation Data from the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES)

The first observation data from SMILES (Superconducting Submillimeter-Wave Limb-Emission Sounder), an external experiment attached to the Exposed Facility of the Japanese Experiment Module, Kibo, on the International Space Station (ISS), has been obtained.

SMILES, developed under the cooperation of the Japan Aerospace Exploration Agency (JAXA) and the National Institute of Information and Communication Technology (NICT), carries the first spaceborne mechanical cryocooler. With its 4-K supercooled superconducting detector, SMILES is able to perform higher precision observation of the Earth's atmospheric constituents than ever before. At present, the initial checkout of SMILES components resulted in no problem, so it can be reported that all components, including the cryocooler and superconducting detector, are in a normal state.

The following figure shows global distribution of ozone concentrations observed by SMILES at the altitude of 28 km on October 12 (JST). [The unit of measurement is "ppmv" (parts per million by volume)]

According to this figure, it can be seen that ozone amounts are larger around the equatorial region than at higher latitudes. This shows the characteristics of stratospheric ozone in its global distribution; it is consistent with the results of previous observations performed by other satellites.



Please note that the sample of SMILES observation shown in this release is still unvalidated. JAXA and the NICT will continue efforts for initial checkout of SMILES instruments, as well as a quality check and initial calibration/validation of the observation data using ground-based experiment data and existing satellite observation data for more than half a year.

**Comments from Prof. Masato Shiotani of Kyoto University
(SMILES Principal Investigator)**

SMILES, aboard the ISS, has started its atmospheric observation, after its selection as a mission on the JEM Exposed Facility in 1997. I appreciate the efforts of those involved in this mission.

For Japan, it now becomes possible to resume spaceborne observation related to the upper atmosphere, which has been absent for around a decade.

I expect SMILES observation results to contribute to ozone-layer issues as well as air quality problems.

Related Links:

<http://smiles.tksc.jaxa.jp/> (SMILES website in JAXA)

<http://iss.jaxa.jp/en> (ISS page in JAXA)

<http://smiles.nict.go.jp/> (SMILES website in NICT)

Fig. 1 Global Distribution of Atmospheric Ozone (Same figure as the one shown in the body of the text)

The global distribution of atmospheric ozone concentrations observed with SMILES at the altitude of 28 km on October 12. It can be seen that ozone amounts are larger around the equatorial region than at higher latitudes.

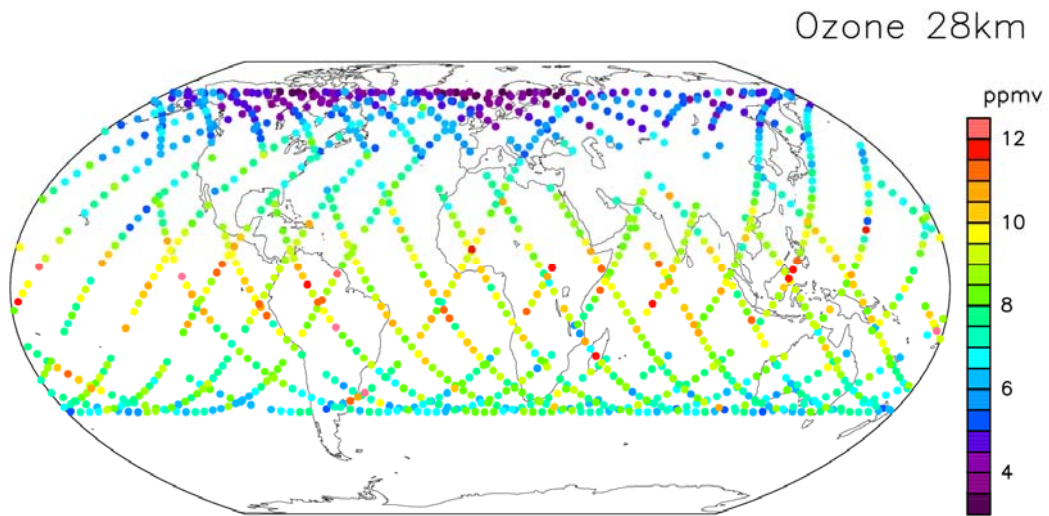


Fig. 2 Latitude–Altitude Distribution of Ozone

Vertical distribution of ozone between 38 deg south and 65 deg north, based on the zonal-mean values of the SMILES ozone data on October 12. [The unit of measurement is ppmv (parts per million by volume)]

It was found that the peak of ozone (colored with red and pink) is around the altitude of 30 km. This clearly shows that SMILES observation captures the existence of the “ozone layer” in the stratosphere.

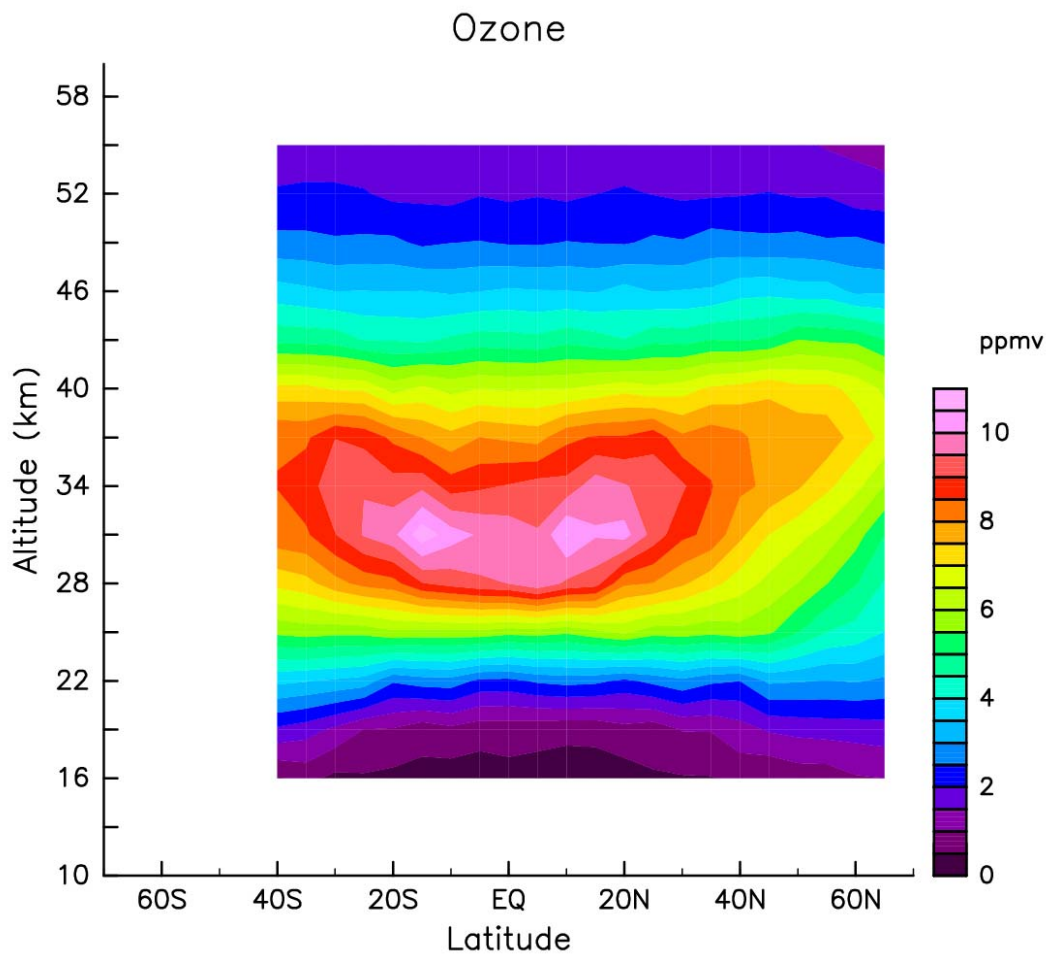
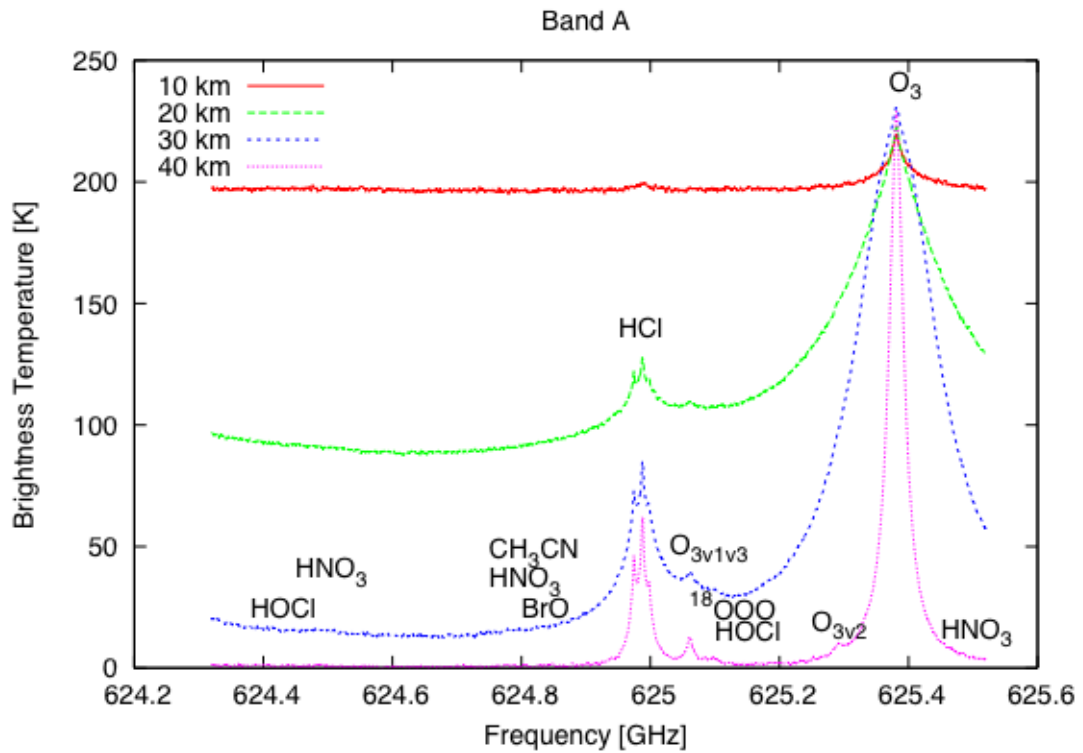


Fig. 3 Radiation Spectrum in Submillimeter Region

The radiation spectrum from Earth's atmosphere is directly measured with SMILES instruments. The measurement data are utilized to calculate the results shown in Fig. 1 and 2. We can clearly see several spectral peaks in relation to the amount of various atmospheric constituents associated with stratospheric ozone depletion.



Overview of the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES)

SMILES is an atmospheric observation instrument that measures weak submillimeter-waves emitted from atmospheric minor constituents with its detector. The detector carries a superconducting mixer cooled down to 4 K (-269 deg C) by a mechanical cryocooler. By supercooling the detector, its measurement noise is reduced to nearly the theoretical limits, which results in improvement of measurement performance. SMILES is expected to make observations one-digit more precise than other existing satellite-borne sensors. It is also anticipated that SMILES will measure atmospheric constituents that have been difficult to detect with a higher precision.

After the ongoing initial checkout, SMILES will advance to the operational observation phase. In this phase, SMILES will perform observation on about 100 points per each track of the International Space Station (ISS), that is, about 1600 points per day, barring any restrictions due to ISS operation.

As a result of processing the observation data, distributions of ten kinds of atmospheric constituents including ozone will be revealed, which will contribute to various issues of atmospheric science.

SMILES is able to contribute to various atmospheric science issues. These include inorganic chlorine chemistry (ClO/HCl ratio, HOCl production, background ClO distribution, etc.), the bromine budget, which will become a key point in the chemical reaction during the period of stratospheric ozone recovery, and the "HOx dilemma" (the disagreement of stratospheric/mesospheric HOx number density observed by satellites and the results of calculation by atmospheric photochemical models). These issues are related closely to stratospheric chemistry, including the "ozone layer" problem.

The trend of the "ozone layer", which is purported to recover gradually, is still the question under discussion. In addition, changes in stratospheric ozone and global warming seem to interact with each other, so it is important to consider treating not only individual components such as ozone depletion and global warming but also integrated problems of the Earth's atmosphere.

Therefore, considering its contribution to major issues of Earth's atmospheric environment, SMILES observation is very meaningful.

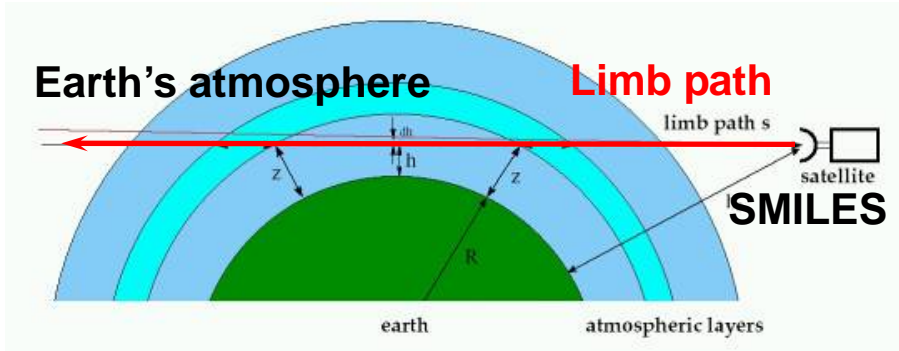


Fig. 1 Geometric Image of SMILES Observation