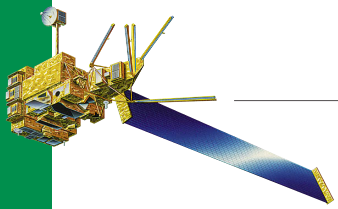
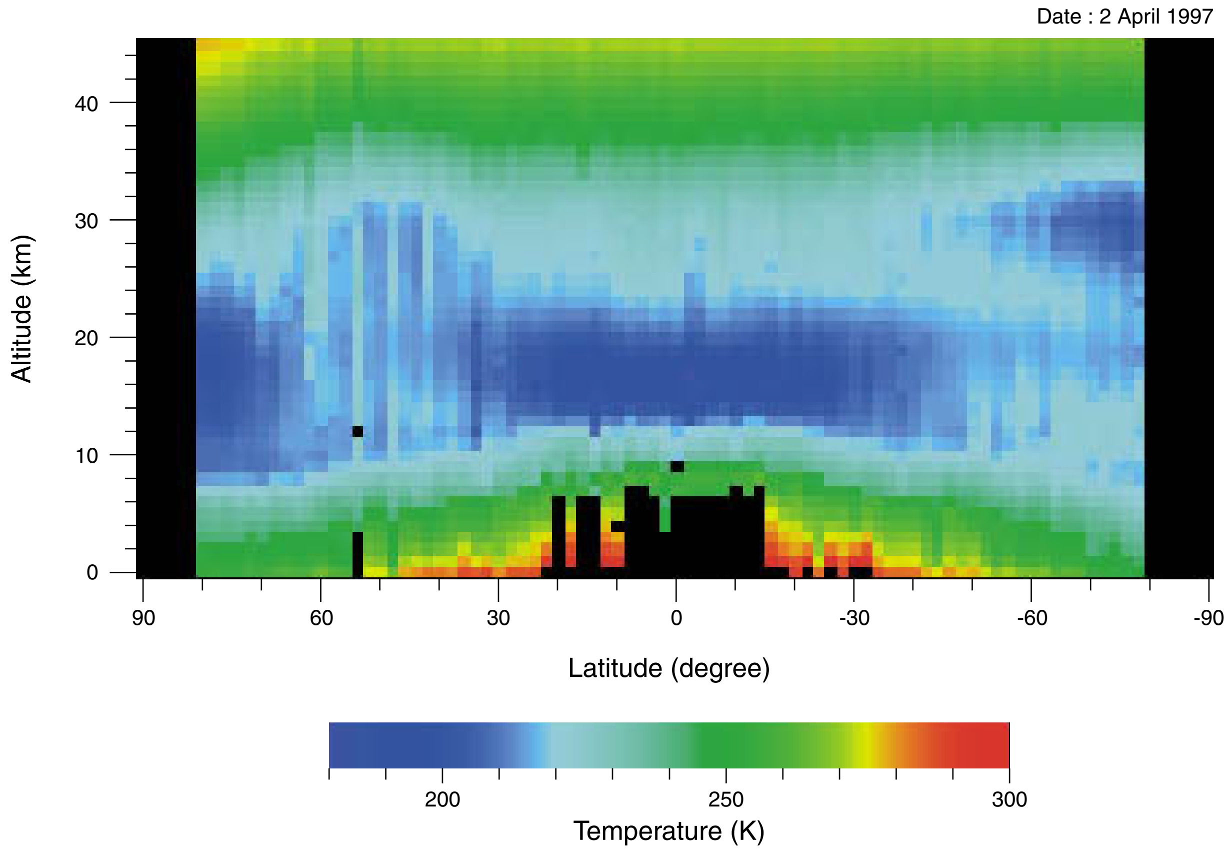
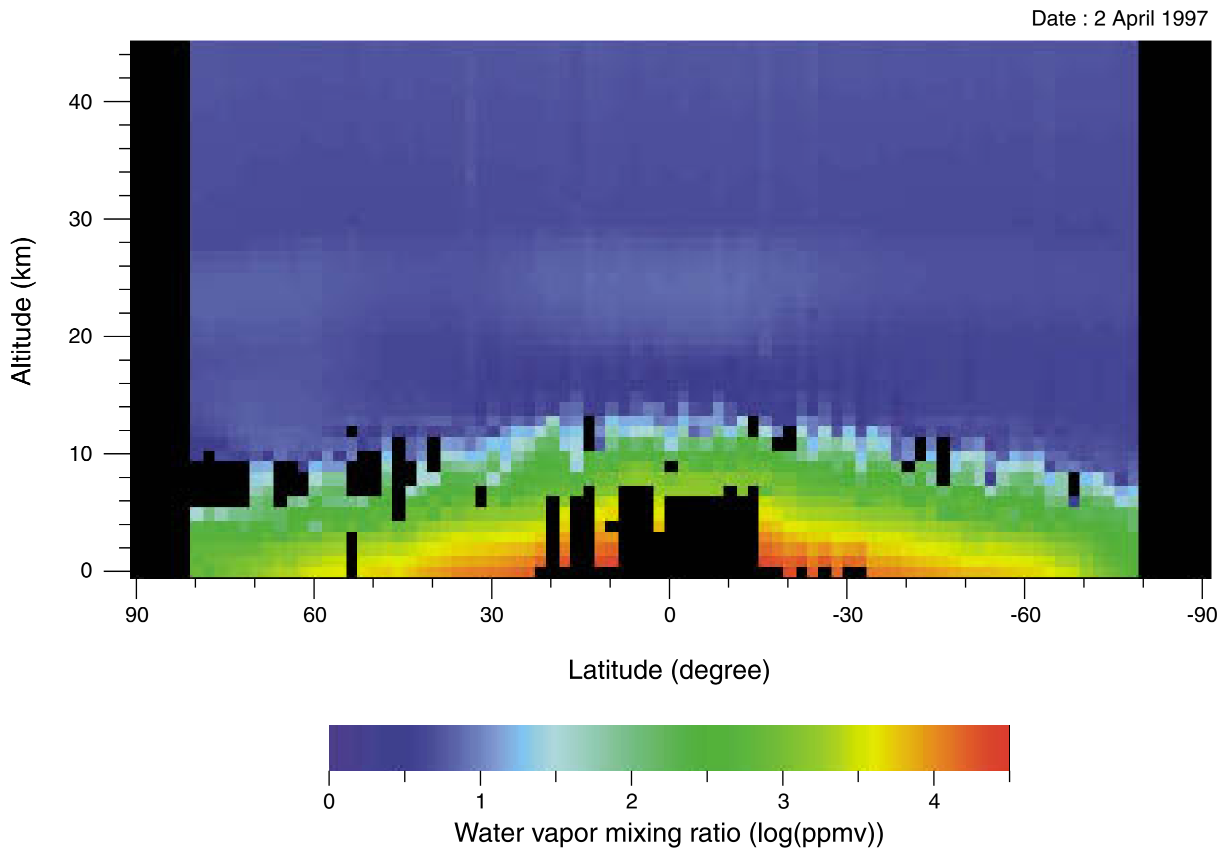


Atmospheric Temperature and Water Vapor





Provided by NASDA/MITI/NIRE

Atmospheric Temperature and Water Vapor

Global observation data on vertical distributions of atmospheric temperature and humidity (water vapor concentration) along with winds are critical in improving the accuracy of numerical weather forecasts. Furthermore, understanding of the physics of atmospheric temperature and water vapor variations is essential in the research of climate changes, leading to a careful watch of the global warming phenomena. Water vapor evaporation and convective activity will be enhanced by global warming, increasing water vapor content in the troposphere. Global warming will be intensified accordingly as a consequence of the augmented greenhouse effect of water vapor.

The IMG instrument on board ADEOS measured the atmosphere at the nadir with a horizontal interval of about 90 kilometers (km) along the orbital track, enabling us to infer the vertical distributions of atmospheric temperature and water vapor. Although it cannot measure the atmosphere below thick clouds, it provides a valuable data set to supplement the data gap over the ocean where radiosonde data are not available.

The vertical distributions of atmospheric temperature and volume mixing ratio of water vapor (*1) retrieved from the IMG data are exhibited in the figures as meridional diagrams in terms of latitude and altitude. They are obtained by taking a longitudinal (east-west zonal direction) mean of the global data measured on 2 April 1997. The dark portion located in the lowest atmosphere near the equator indicates the region where the retrieval was not successful due to cloud cover.

You can see several well-known characteristic features including that the atmospheric temperature decreases with altitude in the troposphere from the Earth's surface to the tropopause (*2), that it increases with altitude in the stratosphere over the tropopause, and that the tropopause is higher in low latitudes than in high latitudes. In early April, the atmospheric temperature is generally lower in the northern hemisphere (NH) than in the southern hemisphere (SH). A region of relatively low temperature is seen at altitudes 10 to 20 km in latitudes above 70 degrees in NH. The figure clearly demonstrates that the anomalous winter condition in 1997 lasted until April at higher latitudes in NH. The atmospheric temperature derived from the IMG data was validated with those from radiosonde data, and agrees within an error of 2 to 3 degrees Kelvin.

The figure for the atmospheric water vapor distribution on 2 April 1997 shows the troposphere is much richer in water vapor than the stratosphere, and that the water vapor concentration in the troposphere is larger in lower latitudes than in higher latitudes. The figure also shows that the NH is poorer in tropospheric water vapor than the SH. This dry NH is a manifestation of the long lasting 1997 winter. It should be noted that the water vapor concentrations given here have not been fully verified.

*1 Volume mixing ratio of water vapor: Ratio of concentrations by volume between water vapor and the whole atmosphere at a certain altitude. The unit is parts of per million by volume (ppmv).

*2 Tropopause: The boundary between stratosphere and troposphere.