

Overview of the SOWER Campaigns 2006 and 2007: Dehydration and Transport in the Tropical Tropopause Layer and Lower Stratosphere during the Boreal Winter

H. Vömel¹, F. Hasebe², M. Shiotani³, M. Fujiwara², T. Shibata⁴, S. Ogino⁵, N. Nishi³, S. Iwasaki⁶, S. Sarasprya⁷, and N. Komala⁸

¹Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309; 303-497-6192, Fax: 303-497-5590, E-mail: Holger.Voemel@colorado.edu

²Hokkaido University, Sapporo, Japan

³Kyoto University, Kyoto, Japan

⁴Nagoya University, Nagoya, Japan

⁵JAMSTEC, Yokosuka, Japan

⁶NDA, Yokosuka, Japan

⁷Bandung, Indonesia

⁸LAPAN, Bandung, Indonesia

The amount of stratospheric water vapor is largely controlled by dehydration processes in the tropical tropopause layer. However, these processes are poorly understood. The Soundings of Ozone and Water in Equatorial Regions (SOWER) project, which has been ongoing since 1998, conducted two campaigns in January 2006 and in January 2007. Cryogenic Frostpoint Hygrometer (CFH) water vapor and ozone sondes were launched at one equatorial site in the Western Pacific in January 2006 and coordinated at three equatorial sites in January 2007. At all sites lidar observations provided simultaneous cirrus cloud backscatter ratio data. The observations show large differences between the two years, related to QBO and ENSO. Compared to January 2006, the tropopause is warmer and wetter in 2007 and the vertical ascent of the seasonal water vapor maximum is slower. The observations show significant differences between the three sites, although less than the interannual difference. The combined cirrus and relative humidity (RH) observations show that large RH values are observed within clouds as well as outside of clouds. The highest RH values were observed in Jan 2006 and are related to equatorial stratospheric waves. RH over ice reached 190% at a temperature of 180 K in the onset of a cirrus cloud at the cold point. Large RH over ice values were also observed above the cold point but in absence of a cirrus cloud.

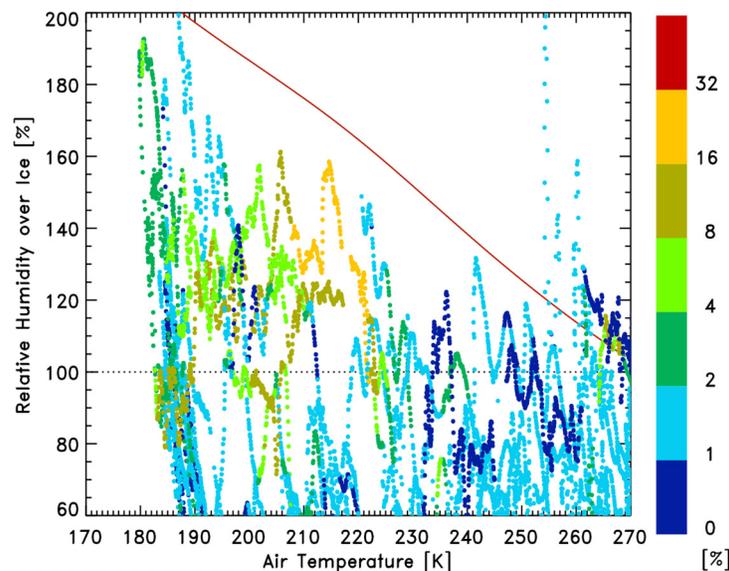


Figure 1. Relative humidity as a function of temperature observed by the CFH. The color coding indicates the backscatter ratio observed by simultaneous lidar measurements. The red line shows saturation over liquid water.