

# Influences of the Asian Monsoon on Upper Troposphere and Lower Stratosphere (UTLS) Water Vapor, Ozone and Ice Particles: New Results from Kunming, China

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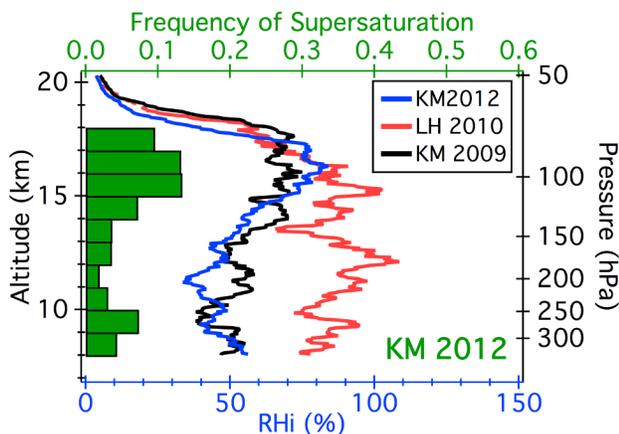
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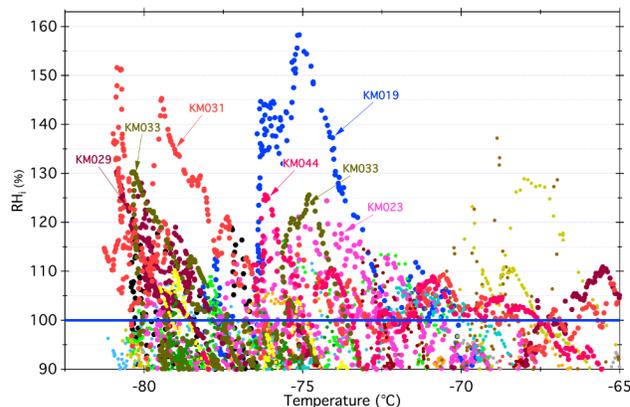
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An intensive 3-week campaign of nearly 40 balloon launches at Kunming, China (25°N, 103°E) was conducted in August 2012 during the Asian monsoon. The balloons carried radiosondes, ozonesondes, frost point hygrometers and Compact Optical Backscatter Aerosol Detector sondes that made high-resolution, *in situ*, vertical profile measurements from the surface to about 28 km. These observations present an exceptional opportunity to study the impacts of monsoon-related convective activity on the vertical distributions of water vapor, ozone and ice particles in the UTLS.

Observations by satellite-borne sensors have demonstrated that deep convection within the Asian anticyclone can rapidly loft wet boundary layer air into the UTLS. Kunming is located near the southeastern edge of the climatological anticyclone where air masses can detrain from convection in the upper troposphere and enter the tropical lower stratosphere via isentropic transport. We employ our recently acquired set of high-resolution vertical profile measurements to examine the frequency and degree of water vapor supersaturations and the relationship between saturation ratios and ice particles in the upper troposphere. The results will be compared to those from two previous balloon-based *in situ* measurement campaigns at Kunming (2009) and Lhasa (2010).



**Figure 1.** Probabilities of finding supersaturated air masses at different altitude levels over Kunming, China during August, 2012 (green bars). Blue, red and black curves represent the mean vertical profiles of relative humidity (with respect to ice) measured over Kunming (2012), Lhasa (2010) and Kunming (2009), respectively.



**Figure 2.** Relative humidity (with respect to ice) as a function of ambient temperature measured over Kunming, China during August 2012. Supersaturations ( $RH_i > 100\%$ ) were observed during many of the balloon flights with some exceeding 40% ( $>140\%$   $RH_i$ ).