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Interactive comment on "Commentary on "Measurements of ice supersaturations exceeding 100% at the cold tropical tropopause" by E. Jensen et al." *by* D. M. Murphy

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As pointed out in the interactive comment by Dan Murphy, Figure 2 in the original commentary gave an erroneous indication of the magnitude of the ice saturation ratio dependence on roll angle. In fact, the variation of mean ice saturation ratio with roll angle is relatively weak (see Figure 1), with an amplitude of only about 0.3 and a broad peak at roll angles greater than zero, unlike the sharp peak at roll angles near 2 indicated by Figure 2 in the original manuscript.

Further analysis of the roll measurements indicates that on each of two flights (29

January and 2 February), the aircraft spent much of the flight with a mean roll of 1–2 degrees even during straight and level flight. The autopilot must have compensated with a small amount of yaw to maintain heading. These flights also happened to be those during which coldest air and highest ice supersaturations were encountered. If we omit these flights from the ice saturation versus roll statistics (green curve in Figure 1), then the mean ice saturation ratio at 2 degrees roll angle is reduced by about 20%, and the highest mean ice saturations occur at larger roll angles than those measured during the anomalously high ice supersaturation measurements discussed by Jensen et al. (2005).

The particular high supersaturation time period focused on in Jensen et al. (2005) also shows little or no correlation between roll angle and either temperature or ice saturation (Figure 2). Below the tropopause, the temperature gradient remains steady in spite of large variations in roll angle. Further, the modulations in ice saturation ratio below the tropopause, which might be associated with roll angle variations, are relatively small (less than 0.15). Hence, the measurement of supersaturations greater than 2 that far exceed expectations (no larger than about 1.6) cannot be attributed to roll angle effects.

References

Jensen, E. J., Smith, J. B., Pfister, L., Pittman, J. V., Weinstock, E. M., Sayres, D. S., Herman, R. L., Troy, R. F., Rosenlof, K., Thompson, T. L., Fridlind, A. M., Hudson, P. K., Cziczo, D. J., Heymsfield, A. J., Schmitt, C., and Wilson, J. C.: Ice Supersaturations Exceeding 100% at the Cold Tropical Tropopause: Implications for Cirrus Formation and Dehydration, Atmos. Chem. Phys., 5, 851–862, 2005.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 2463, 2005.

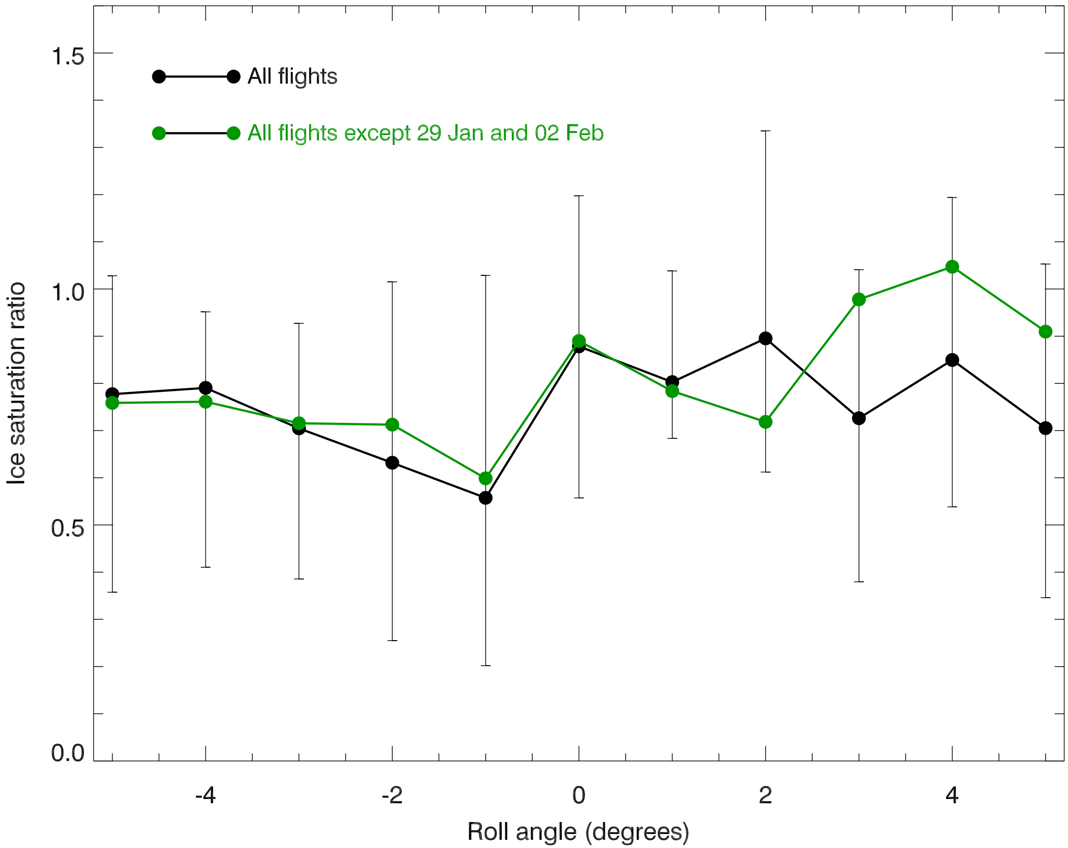

Figure 1: Ice supersaturation based on the JPL laser hygrometer water vapor measurements is plotted versus roll angle. Data points were sorted into 1 degree roll angle bins. The black curve includes all measurements made in the upper troposphere during the mission, and the green curve excludes the two flights when the aircraft flew with a systematic 1–2 degree roll.

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Interactive Comment

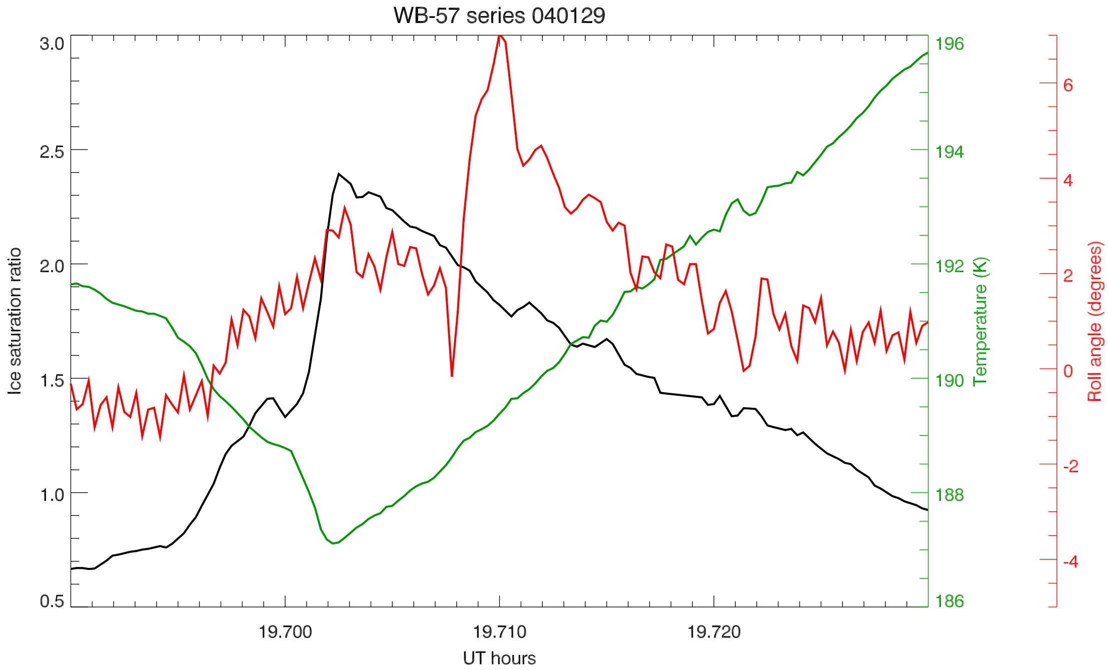

Figure 2: Time series of temperature, ice saturation ratio, and roll angle are shown for the high supersaturation time period focused on by Jensen et al. (2005). In the upper troposphere where the temperature gradient is expected to be steady, there is no evidence for significant dependence of either temperature or ice saturation ratio on roll angle.

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