Comments on "Aircraft-Induced Hole-Punch and Canal Clouds: Inadvertent Cloud Seeding"

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I congratulate Heymsfield and colleagues for the detailed study of aircraft-induced hole-punch and canal clouds (Heymsfield et al. 2010). They hypothesized that latent heat produces an updraft–downdraft mechanism that partially explains the growth and circular nature of the hole-punch clouds. The mechanism was confirmed theoretically in their *Science* article (Heymsfield et al. 2011) and the mechanism was highlighted in the *Physics Today* "Back Scatter" page (Heymsfield 2011).

For the sake of completeness and historical accuracy, I would like to point out a few errors and omissions in the *BAMS* article. The authors wrote of a photograph of a hole in a cloud published in the August 1968 *Weatherwise* that generated considerable interest in the U.S. meteorological community and set off a round of speculation as to its cause. They wrote that proposed explanations were published in the February 1969 *Weatherwise* and following issues. There, indeed, were explanations in the February 1969 issue but no explanations in the following issues. The explanations were confined to three consecutive issues—October and December 1968 and February 1969.

In December 1968, I proposed the same mechanism elucidated by Heymsfield et al. (2010) when I wrote in the December 1968 issue of *Weatherwise*, "Another mechanism, however, could explain the circular hole. A point-source nucleation with a rapid release of latent heat produced an updraft in the thin, stable cirrocumulus layer. To compensate for the updraft the surrounding air subsided. This subsidence could cause a circulation. The ice crystal zone propagated radially outward somewhat, but the sharply defined edge was probably caused by subsidence" (Hindman 1968, p. 241). The authors either overlooked or were unaware of this explanation.

Additionally, they overlooked a thorough paper by Johnson and Holle (1969). The Johnson–Holle article carefully developed a three-step process forming the "hole-punch" clouds, the third step being my updraft–downdraft mechanism. Heymsfield et al. (2010) could have easily overlooked this reference because the *BAMS* online archive starts at volume 51.

Finally, I submit that the authors' statement in their *Science* article, "It is plausible that a small-scale and persistent updraft could develop in the ice region with compensating downdrafts on the outside edges, causing the water cloud to erode by evaporation (A. J. Heymsfield et al., *BAMS*, **91,** 753, 2010)" (Heymsfield et al. 2011, p. 80) should have been referenced "Hindman (1968), Johnson and Holle (1969), and Heymsfield et al. (2010)."

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