

## ***Interactive comment on “Ice particles in the upper anvil regions of mid-latitude continental thunderstorms: the case for frozen-drop aggregates” by J. L. Stith et al.***

**V. Shcherbakov (Referee)**

valery.shcherbakov@moniu.t.univ-bpclermont.fr

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Although chain-like aggregate ice crystals had been reported in earlier works, the importance of small chain-like frozen-drop aggregates was demonstrated for the first time by Gayet et al. (2012). Very high values of Ice Water Content (IWC) along with quite small effective size of particles were experienced by Gayet et al. (2012) during the cloud penetration length over 36 km long. Moreover, the high IWC was accompanied by the rather weak radar echo. Such features revile importance of chain-like frozen-drop aggregates for a range of climate and remote-sensing problems as well as for flight safety.

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Thus, the work under reviewing addresses a critical issue. It reports the results of measurements that were made in the upper regions of two anvils from storms that occurred on 6 June 2012 in Eastern Colorado. The main attention is paid to the occurrence and morphology of frozen drop aggregates.

I recommend that the paper be published in ACP after minor revisions.

Specific comments: The work under reviewing suffers from the lack of data on the relative humidity with respect to ice, which is one of key parameters to give a comprehensive interpretation of the reported observations. It is mentioned on page 27023 that the standard measurements of the NSF/NCAR G-V included chilled mirror and optical absorption humidity instruments. In my opinion, the authors have to add such kind of data into the revised manuscript.

Fig.3 “A portion of the 22:15:12 GOES-13 visible satellite image is overlaid on the radar image ... “. I wonder if it would be better to overlay with a GOES-13 infrared satellite image, which is able to highlight clouds at the G-V flight altitudes.

Page 27031. It is written that “Many of these cases are expected to be studied in depth in future work ... “. I may suggest that the future work will include some analysis of IWC-Z relationships like Fig. 9 by Gayet et al. (2012).

Page 27036. The reference Cotton et al. (2012) is not correct. It has to be: Q. J. Roy. Meteor. Soc., 139, 1923–1934, doi:10.1002/qj.2058, 2013

Page 27037. The reference Lawson et al. (2003). It would be convenient for a reader, if the text, i.e., pages 707–710, were available at the site [www.specinc.com](http://www.specinc.com) (not only the presentation at <http://www.specinc.com/selected-presentations>).

References. Gayet, J.-F., Mioche, G., Bugliaro, L., Protat, A., Minikin, A., Wirth, M., Dörnbrack, A., Shcherbakov, V., Mayer, B., Garnier, A., and Gourbeyre, C.: On the observation of unusual high concentration of small chain-like aggregate ice crystals and large ice water contents near the top of a deep convective cloud during the CIRCLE-2

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experiment, *Atmos. Chem. Phys.*, 12, 727–744, doi:10.5194/acp-12-727-2012, 2012.

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