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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The breakup of levitating water drops observed with a high speed camera" *by* C. Emersic and P. J. Connolly

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We'd like to thank the reviewer for their constructive feedback. Our responses are below:-

1. a) Further additions have been made to the introduction in light of feedback by the other reviewers. The most important research is now covered.

b) We have made this point clearer now in our list of objectives in the introduction.

c) We've elaborated as requested.

2. Initially, we also shared the same concern that droplets colliding in the manner produced by our wind tunnel produced a different physical process to that of the Low and

List experiments. Unfortunately, we lack control over drop sizes and so it's not possible for us to directly experimentally compare with the Low and List drop-pair sizes either. However, we've re-examined the collisional kinetic energy (CKE) of our drop collisions using the equation presented in the Low and List paper and compared them to the values expected if the collision had occurred in nature at their terminal velocities. We found that the values are similar (within an order of magnitude), to the limits of the sensitivity our measurements allowed. Thus we are probably energetically consistent with those collisions occurring in nature. Differences between our observations and those of others are likely due to larger drops being used. Significant variation in oscillation behaviour and lengths of time before breakup after a collision-coalescence event, despite some similar pre-collision conditions, leads us to conclude that for larger drops, the direct importance of collisional kinetic energy to the resulting breakup drop-size distribution is in question. Once the drop configured itself where it became clear a given breakup mode will occur, the resulting fragments for that breakup type followed a similar distribution on average (see the videos at http://youtu.be/3lxOFufnQZg). Our observations suggest that either collisional kinetic energy or earlier drop interaction history may not necessarily be directly important to the resulting post-breakup fragment distributions in our experimental setup, and that they may only be indirectly important through possibly influencing the eventual breakup type. Only the breakup type itself seems to directly determine the resulting drop-size distribution. Whether this is true for other types of experimental approach is open to debate and further study. This is made considerably clearer in the revised manuscript.

3. a/b) In our research, we observed only three distinct types of breakup. We did not record all collisions, so it's probably coincidence that we used so many bag breakups in our analysis. We are not able to determine the likelihood of a particular breakup type in general, and this was not part of our objective. However, we later realised since review that we're comparing our bags to others' disc breakups and this is not appropriateâĂŤthey are completely different breakup modes (and so arguably Low and List should not have combined datasets, albeit only having 3 bags). We have made

significant changes throughout the manuscript to account for this.

c) See 2.

d) Yes, we divide all bins by the sum of all bins (so that it represents a percentage).

e) Since initial review, we have discovered two errors in the code which have now been rectified; the manuscript has consequently been altered where necessary. We have compared the results to the Low and List distributions and confirmed that there are no further numerical errors in the code. We realise that the bin size used in generating the Low and List lines are coarse and we have added additional new high resolution line plots in Figure 3.

f) Yes, the negative values you noted based on their approximations for fragment number are non-physical for the larger sizes we used. It is worth noting though that Low and List impose a minimum value of 2 to the outcome of that equation to ensure that on breakup there are always at least the two parent drops resulting. We decided to inspect this area a little since review and constructed our own approximations to fragment number that fit both our newly observed data and the original observed data of Low and List. Additional plots in figure 3 show the outcome, and our approach and discussion is now in the revised manuscript.

g) Yes, it was a difficult coding challenge. As requested by McFarquhar in review, we have now implemented the McFarquhar parameterisations for comparison and updated the manuscript discussion.

h) See e)

3.2. We have amended this as requested in section 3.2.

4. We have significantly restructured the paper (including appendices) in the additional time to be more as originally desired, to fix errors, remove unnecessary known repetition and to satisfy other requests by the reviewers.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 11739, 2011.