Response to the referee comments on the manuscript:

Title: Growth of ice particle mass and projected area during riming
By: Erfani, Ehsan; Mitchell, David
Article reference: acp-2016-455, revised submission

We wish to thank the referees for their detailed and helpful comments on our paper. As you will see below we have responded to all of the comments with revisions designed to address the concerns of the referees. In the following response, the original referee comments appear in black and our responses appear in blue and are labeled "Author response:"

Referee comments:

Anonymous Referee #1:

There is no comment from referee #1

Anonymous Referee #2:

1. Equations 6-8 are similar to the method of Morrison and Milbrandt (2015) and this needs to be pointed out.

Author response: The reason for such similarity between our work and Morrison and Milbrandt (2015) is that they used our preliminary results of SCPP data analysis (Mitchell and Erfani, 2014) to develop their model, in addition to observations of Rogers (1974). This is explained in page 14, starting at line 21:

"All these observations are in agreement with the experiment of Rogers (1974) in which β was similar for unrimed and rimed snowflakes. The results of Rogers (1974) were used in the modeling work of MG08 and Morrison and Grabowski (2010) to support the assumption that riming does not change β for planar ice crystals. Morrison and Milbrandt (2015) used a similar assumption based on the observations of Rogers (1974) and Mitchell and Erfani (2014), and they explained that the reason for the conservation of β during riming is the fact that D does not significantly change by riming while m does increase significantly."

2. In sections 5.2 (Hexagonal columns) and section 7 (conclusions) it should be pointed out that Jensen and Harrington (2015) calculate collision efficiencies for prolate ice based on aspect ratio, which could be used in model.

Author response:

We added explanations to clarify this.

Sect. 5.2, page 23, starting at line 9:

"To the best of our knowledge, there is not any practical E_c equation for such crystals in the literature, suitable for use in cloud resolving models, except for the study of JH15 that calculated E_c for prolate spheroids based on their aspect ratios."

Sect. 7, page 28, starting at line 15:

"Prior to this work, there was only one rigorous practical method for calculating the droplet size-dependence of E_c for use in models. As described in JH15, this method when applied to prolate spheroids modified the equation from Beard and Grover (1974) for spherical raindrops in steady flow, and calculated E_c between a cloud droplet and a prolate spheroid based on the spheroid aspect ratio."

3. In section 7 (conclusions) line 10, would models that use multiple categories still use multiple categories if they implemented your method? This is not clear.

Author response:

This is now addressed under conclusions, page 28, starting at line 12:

"By using the method introduced in this study, models may still use multiple categories (e.g. ice crystal, rimed particle, graupel), but within each category the rimed mass fraction can gradually increase, thus preventing an abrupt change in ice particle attributes between categories."

The table needs units.

Author response: Units are added to the table.