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Interactive comment on “A scale and aerosol aware stochastic convective parameterization for weather and air quality modeling” by G. A. Grell and S. R. Freitas

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Response to reviewer #2:

We thank the reviewer for his suggestions. Specific responses are given below.

Responses to the general suggestions:

A) As mentioned in section (2) we were not planning on doing a major review on existing methods, but only intended to describe approaches that were easily implemented in our parameterization. The G3d scheme is widely used, including in operational applications at NCEP in the Rapid Refresh - a modeling system with an

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hourly update cycle based on the Weather Research and Forecast (WRF) model, <http://rapidrefresh.noaa.gov> - and at the Center for Weather Forecasting and Climate Studies in the Brazilian version of the Regional Atmospheric Modeling System (B-RAMS). With the continuous improvement in resolution and additionally the increasing interest in chemical weather forecasting we decided to take a closer look at possible further development options, which this paper reports on. Nevertheless we added the three references mentioned by the reviewer at the end of section 2 as well as in the second paragraph of the introduction.

B) Unfortunately Fig. 3 – the 1d test – is somewhat misleading sine it depends strongly on the provided sounding. We feel that the 1d tests are necessary to see the qualitative behavior of the parameterization at different resolutions, without the complex interactions that happen in an NWP model. What the 1d tests show – which is precisely what we like to see – is the decrease of the magnitudes of the parameterized tendencies, which will lead to an increase of the resolved tendencies for the explicit microphysics (see also Fig. 7 for the 3d comparison). It also shows the “planned” transformation to a more shallow precipitating convection parameterization at the highest resolution. This “planned” transformation is described in section 4. It must also be mentioned that in 3-d tests the convective parameterization will be automatically turned off if relative humidity is near saturation (95%) and vertical velocity is upward anywhere below the level of free convection. For the test sounding given in Fig. 2 we have an upward vertical velocity which is explicitly used in two of the ensemble closures. In a 3-d model run, the scheme would most likely be turned off for this grid box with the given sounding at high resolution ($dx=1\text{km}$), if forcing is present. The reasons we prefer GF over G3d is it provides a smooth transition, it is easier to implement (no parallel communications), it is also computationally more efficient and it is at least of the same performance level. It also allows initial research into the impacts of aerosols when implemented into a convective parameterization – an area that has gotten little attention as of now.

Reponses to the individual suggestions:

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- C) The sentence has been modified.
 - D) Checked the paper for erroneous use of 'increase (decrease)' resolution. Replaced the 2 mentioned occurrences.
 - E) We added sentence on page 23860 for clarification.
 - F) The sentence has been changed.
 - G) This was changed in the document.
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