

***Interactive comment on “Ensemble forecasting with a stochastic convective parametrization based on equilibrium statistics” by P. Groenemeijer and G. C. Craig***

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Author comment to Anonymous referee #1

Dear Referee #1,

We very much appreciate your constructive comments of and will here address your "specific comments":

1. We agree with the author that the manuscript can be improved by including a discussion of the literature the referee cites, and will include a discussion along the lines of what is suggested. We would like to thank the referee for the effort put in this comment.

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2. Good suggestion to add a discussion of this. The magnitude of variability introduced to an ensemble can of course always be tuned to remove any underdispersiveness, but only at the expense of accuracy. We hope that by accounting for various sources of uncertainty, ensemble spread can be increased without sacrificing accuracy. An important advantage of stochastic schemes is that they introduce variability throughout the integration, which may help to attain sufficient ensemble spread later on, while starting off with perturbations to the initial state that aren't unrealistically large.

3. This is an interesting point, which we will be happy to include. Because our stochastic perturbations decay with the cloud lifetime, we hadn't given much thought to more persistent effects. We are considering how to further investigate the upscale effects that appear to be occurring for example in Fig. 4, and the results of Reynolds et al. suggest we should also be thinking about upscale in time.

4. We have not studied this systematically. In one particular case, 25% more convective precipitation and 7% less large-scale precipitation occurred when averaging was switched off. The averaging area was not based on sensitivity studies, but rather by the theoretical argument that mass flux must be balanced over a "large" ensemble of clouds, a prerequisite only marginally met (with typically 10 - 100 clouds) at the highest practical average area we could practically use, i.e. 25 points.

5. The reviewer is hinting at varying the mean cloud radius spatially, for which we do not see any practical problems. Any method devised to account for this needs to be supported by observations, for example from visible satellite imagery. An approach could be to calculate the lifted condensation level from the model data from which to estimate the mean cloud radius for use in the convective scheme.

6. Yes, OK. This is 16 hours.

7. Yes, this is the weakly forced W1 case. We will add the numbers.

8. We will mention this. The number is 74%.

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9. On reflection, the suggestion to rephrase the goal in a general way is a good one. It's entirely possible that the greatest benefit from an adaptive ensemble would come in cases where the forecast pdf is multi-modal, or otherwise strongly non-Gaussian. Thinking only in terms of variance is probably too narrow.

10. Yes, we have looked at that. The internal variance for a variable like geopotential height at 500 hPa is much smaller than the total variance. The percentage of total variance attributable to the stochastic scheme ranges from 0.042% to 1.6% after 48 hours of simulation, with the lowest values for case S1, the highest for case W2. The temperature at 850 hPa as another parameter, is slightly more sensitive to the stochastic scheme, with the percentage attributable to the stochastic scheme ranging from 0.59% to 10.5%, with the lowest value again for case S1, the highest for case W2.

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 30457, 2011.

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