**Atmospheric
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Interactive
Comment

Interactive comment on "An analysis of cloud overlap at a midlatitude atmospheric observation facility" *by* L. Oreopoulos and P. M. Norris

Anonymous Referee #1

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General Comments

This is an interesting and informative paper that complements existing cloud overlap statistics using higher resolution vertical profiles of cloud and total water content. It is well written and contains information that may be used to improve the treatments of radiation transfer in Global Climate Models (GCMs).

Scientific Comments

Isn't there a fundamental mismatch between the scales used in the paper and those that are appropriate for the radiation calculations in a GCM that uses an atmospheric time step of 30-minutes and calls its radiation code to begin each time step (CM2.1 for example)? Even though the geometric grid spacing of a GCM is 75-300 km, the

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relevant distance scale for overlap statistics would seem to be much smaller. Assume that the 30-minute temporal resolution for a GCM radiation calculation is coupled with a 10 m/s wind velocity. This results in a distance scale of 18-km and if the wind speed is elevated to 40 m/s the relevant distance scale is 72-km. These scales are smaller than the geometric grid spacing in most GCMs and the corresponding scales computed considered in the paper. It seems to me that the distance scale that should be used to compute the relevant cloud overlap statistics would vary according to the model time step for radiation transfer calculations in a given GCM (and the accompanying wind speed) rather than the geometric grid spacing and be applied over the entirety of the geometric grid to represent cloud overlap. I am interested in the author's opinion on the relationship between the GCM time step and the appropriate time scale for compilation of overlap statistics.

How did you treat precipitation in the MICROBASE profiles? Precipitation may produce a noticeable cloud radar return, but have a smaller impact on the radiation transfer than cloud droplets.

Suggestion for future work: It would be interesting to identify obvious frontal situations and convective situations and compute overlap statistics (conditional sampling). Such an analysis may help in the interpretation of the ensemble results.

Technical Comments

Page 599, line 6: typo (condensate) Page 600, line 10âĂŤprefer "estimate the profiles..." rather than "determine the profiles..."

What is a "valid cell"? Page 601 line 16: I am assuming that you mean that there could be instances when a MICROBASE retrieval is not available.

Page 602, last line; you should move the sentence regarding the definition of the rank correlation ahead in the discussion. Page 604, line 5; stipulate radiative fluxes Page 607, line 4; "Apparently the low and high clouds of summer multi-layer cloud systems

are more anticorrelated than in winter". I would expect this structure to be observed in the summer because there is a preponderance of distant active convection over the Rockies that produces cirrus anvils that advect over the SGP. These anvil cirrus are not associated with local convection leading to the observed anticorrelation. Page 608, lines 20-30; The alpha histogram resembles a Wiebull distribution (and probably others). Have you fitted this curve with some candidate distributions? Page 610, line 21; "which tends to be dominated by stability"—I suggest: "tends to be more stratified".

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 597, 2011.