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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigating relationships between aerosol optical depth and cloud fraction using satellite, aerosol reanalysis and general circulation model data" *by* B. S. Grandey et al.

Anonymous Referee #1

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Review of "Investigating relationships between aerosol optical depth and cloud fraction using satellite, aerosol reanalysis and general circulation model data" by Grandey et al.

This study reports on relationships between AOD and cloud fraction using a variety of tools with the goal to identify factors controlling these relationships. The study makes use of satellite data and modeling and follows upon previous work of somewhat similar nature by the authors. The topic of this manuscript is of high interest to this journal and addresses a critically important issue, specifically the effect of errors and actual processes on aerosol-cloud fraction relationships. The manuscript discusses the relative roles of several factors (retrieval/model errors, wet scavenging, cloud lifetime effect, and aerosol swelling via hygroscopic uptake). Many important results are presented, including that positive AOD-cloud fraction relationships are more due to aerosol swelling rather than lifetime effects (in the ECHAM5-HAM Model). Also, wet scavenging may lead to negative relationships in the tropics. The methodology is of high quality, the paper is concise and written well, and the conclusions are well-supported by the analysis. I support publication of this work but would like to ask the authors to at least discuss the parameter “aerosol index (AI)”, which is ignored in favor of aerosol optical depth. Many studies have shown that AI may be a better parameter to represent CCN concentration than AOD; therefore, using AI may be more meaningful in a study of this nature as it accounts for the size distribution of aerosol to some degree. The authors should address this issue in light of what recent literature suggests regarding AI’s benefits over AOD.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30805, 2012.