ANNUAL REPORT FOR NASA GRANT NNX12AC41G ("Remote Sensing of Cloud Properties and Support Imagery During SEAC4RS with the Enhanced MODIS Airborne Simulator (eMAS") FOR THE PERIOD 15 JANUARY 2012 TO 14 JANUARY 2013. PRINCIPAL INVESTIGATOR: Robert E Holz, UNIVERSITY OF Wisconsin Madison.

1. SUMMARY OF WORK DONE

During this period work has concentrated on preparations for the SEAC4RS field campaign, which was delayed one year from its initial plans. This included developing a new fast radiative transfer model for eMAS and development of collocation algorithms to collocate CPL with eMAS. We also put effort into planning for personnel deployment which is now delayed until 2013. We have been actively involved in the science planning for the experiment including attendance and participation during the spring planning meeting and frequent internal PI meetings to discuss eMAS status.

3. FUTURE WORK

In the next year, I will actively participate in the SEAC4RS field campaign in southeast Asia, and contribute to mission planning and deployment prioritization.

Robert E Holz
Principal Investigator
November 30, 2012

cc: S. Platnick, NASA Goddard Space Flight Center
H. Maring, NASA Headquarters
CU Office of Contract and Grants

APPENDIX: PUBLICATIONS

(i) Kalesse, H., K. S. Schmidt, R. Buras, M. Wendisch, B. Mayer, C. Emde, P. Pilewskie, M. D. King, L. Tian, G. Heymsfield, and S. Platnick, 2012: The impact of crystal shape and spatial variability of ice cloud optical thickness and effective radius – A TC^4 case study. *J. Geophys. Res.*, in preparation.

ABSTRACT

We evaluate the relative importance of three-dimensional (3D) effects and ice crystal shape of spatially heterogeneous ice clouds on the remote sensing of optical thickness and effective radius. In current ice cloud retrievals, the single scattering properties of ice crystals have to be assumed a-priori. Likewise, the effects of spatial cloud heterogeneity are ignored. Both simplifications introduce errors in the retrievals. Our study is based on 3D and independent pixel approximation (IPA) radiative transfer calculations. Model input is a cloud case generated from data collected during the NASA Tropical Composition, Cloud, and Climate Coupling (TC4) experiment. First, we calculated spectral upwelling reflectance fields from the input cloud as sensed by sensors from space or aircraft. We then retrieved the ice cloud optical thickness and effective radius that would be obtained in standard satellite techniques under the IPA assumption. The ratios between retrieved and original fields are used as a metric for cloud heterogeneity effects on retrievals. Second, we used different single scattering properties (ice crystal habits) in the retrievals. To isolate ice crystal habit effects, the net horizontal photon transport was disabled in this part of the study. Here, the ratios between retrieved and original values of optical thickness and effective radius serve as metric for habit effects. When comparing the two metrics, we found that locally, both can be of the same magnitude (up to about 50% under- and 30% overestimation), with different dependencies on ice cloud optical thickness, and effective radius. On domain average, shape effects bias the retrievals more strongly than 3D effects.