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Evaluation of the West African monsoon vertical cloud structure in high-resolution models using CloudSat and CALIPSO

Thorwald Stein[†]; Robin Hogan; Julien DelanoÎ; Douglas Parker; Grenville Lister
[†] University of Reading, United Kingdom
Leading author: t.h.m.stein@reading.ac.uk

Five years in orbit, CloudSat and CALIPSO have observed the global vertical cloud structure through the seasons multiple times, encompassing El Niño and La Nina events as well as numerous intraseasonal systems. The radar and lidar aboard these instruments allow us to identify individual cloud layers and to build up their statistics of occurrence in relation to dynamical systems influencing the global climate. Our work focusses on the cloud statistics of the West African summer monsoon, which locally accounts for most of the annual rainfall and is a region of high uncertainty in the most recent IPCC assessment report, with some models predicting a wetter climate and others predicting a drier. The identification of individual cloud types such as cirrus, congestus, and altocumulus in the observations presents a new benchmark for climate models to be tested against. We present the cloud structures over West Africa from the UK Met Office Unified Model, run over a limited area at different horizontal resolutions for the Cascade project. Using a 40-day run at 4km resolution, we study the occurrence of different cloud types in the model and evaluate their vertical positioning against CloudSat observations. Several deficiencies of the model cloud representation are highlighted and related to potential errors in climate feedback from clouds.