Geophysical Research Abstracts
Vol. 15, EGU2013-10209, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Formation and maintenance of nocturnal low-level stratus over the southern West African monsoon region during AMMA 2006

Robert Schuster (1), Andreas Fink (1), and Peter Knippertz (2)

(1) Institute for Geophysics and Meteorology, University of Cologne, Cologne, Germany (schuster@meteo.uni-koeln.de), (2) School of Earth & Environment, University of Leeds, Leeds, UK

The southern parts of West Africa, from the coast to about 9°N, are frequently covered by an extensive deck of shallow, low (200 – 400 m above ground) stratus or stratocumulus clouds during the summer monsoon season as shown by recent studies based on ground observations and new satellite products. These clouds usually form at night in association with a nocturnal low-level jet (NLLJ) and can persist into the early afternoon hours until they are dissipated or replaced by fair-weather cumuli. Recent work suggests that the stratus deck and its effect on the surface radiation balance are unsatisfactorily represented in standard satellite retrievals and simulations by state-of-the-art climate models. Here we use high-resolution regional simulations with the Weather Research and Forecast (WRF) model and observations from the African Monsoon Multidisciplinary Analysis (AMMA) 2006 campaign to investigate (a) the spatiotemporal distribution, (b) the influence on the radiation balance, and (c) the detailed formation and maintenance mechanisms of the stratiform clouds. The model configuration used for this study has been determined following an extensive sensitivity study.
The main conclusions are: (a) At least some configurations of WRF satisfactorily reproduce the diurnal cycle of the low cloud evolution. (b) The simulated stratus deck forms after sunset along the coast, spreads inland in the course of the night, and dissipates in the early afternoon. (c) The average surface net radiation balance in stratus-dominated regions is 35 W m-2 lower than in those with less clouds. (d) The cloud formation is related to a subtle balance between “stratogenic” upward (downward) fluxes of latent (sensible) heat caused by shear-driven turbulence below the NLLJ, cold advection from the ocean, forced lifting at the windward side of orography, and radiative cooling on one hand, and “stratolytic” dry advection and latent heating on the other hand. Future work should focus on the influence of the stratus on energy and moisture budgets and on the West African monsoon system as a whole.