EMS Annual Meeting Abstracts
Vol. 21, EMS2024-909, 2024, updated on 22 May 2025
https://doi.org/10.5194/ems2024-909
EMS Annual Meeting 2024

Stratocumulus variability in global storm-resolving models

Ian D'Amato Dragaud[1], Jakub Nowak[2], Piotr Dziekan[2], Junhong Lee[3], Juan Pedro Mellado[1], and Bjorn Stevens[3]
[1]Meteorological Institute, Universität Hamburg, Hamburg, Germany (ian.dragaud@uni-hamburg.de)
[2]Institute of Geophysics, University of Warsaw, Warsaw, Poland
[3]Max Planck Institute for Meteorology, Hamburg, Germany

Stratocumulus clouds are important for the Earth's planetary albedo and play a central role in determining Earth's sensitivity to forcing. Recent global-coupled simulations at kilometer-scale resolution in the atmosphere and the ocean, conducted in the framework of the H2020 nextGEMS project, offer opportunities to study cloud processes, their environmental factors, and the possibility of using observations to verify them. We investigate the representation of stratocumulus clouds by the ICON and IFS models and it allows us to compare both model strategies. The former uses less parameterizations to better understand process interactions and the latter considers shallow and deep convection schemes and more sophisticated parameterizations, which allows for better tuning. The results of this study show the value of both. The four-year simulations were assessed in terms of the top-of-atmosphere (TOA) albedo and the vertical structure of the atmospheric boundary layer in the coastal and offshore regions of Namibia, Peru and California. We used satellite data from the CERES-EBAF TOA dataset as an observational reference for the albedo. Both simulations reproduced the mean horizontal distribution and seasonal cycle of TOA albedo and the typical vertical structure of the low atmosphere. However, we found some discrepancies. IFS represented the stratocumulus regions slightly displaced towards the southwest, and lower albedo over the coastal regions in comparison with CERES. ICON represented too much cloud liquid water and uses a cloud inhomogeneity factor to reduce the albedo. Analysing the modeled cloud variability in space and time we found that ICON correctly reproduced the observed diurnal variation and the decrease in cloud depth towards the coast. However, the model simulated a more cellular than stratiform character of the cloud field, compared with satellite images.