Geophysical Research Abstracts
Vol. 20, EGU2018-13811, 2018
EGU General Assembly 2018

The DACCIWA Model Evaluation Project: Representation of the Meteorology of Southern West Africa in State-of-the-Art Weather, Seasonal and Climate Prediction Models

Anke Kniffka (1), Angela Benedetti (2), Peter Knippertz (1), Tanja Stanelle (3), Malcolm Brooks (4), Konrad Deetz (1), Marlon Maranan (1), Philip Rosenberg (5), Gregor Pante (1), Richard Allan (6), Peter Hill (6), Bianca Adler (1), Charles Yorke (8), Andreas Fink (1), Norbert Kalthoff (1), Christine Chiu (7), Bernhard Vogel (1), Paul Field (4), and John Marsham (5)

(1) Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Karlsruhe, Germany (anke.kniffka@kit.edu), (2) European Centre for Medium-Range Weather Forecasts, Reading, (3) Eidgenössische Technische Hochschule Zürich, Institute for Atmospheric and Climate Science, Zürich, Switzerland, (4) Met Office, Exeter, United Kingdom, (5) University of Leeds, School of Earth and Environment, Leeds, United Kingdom, (6) University of Reading, Department of Meteorology, Reading, United Kingdom, (7) Colorado State University, Department of Atmospheric Science, Fort Collins, Colorado, USA, (8) Ghana Meteorological Agency, Accra, Ghana

DACCIWA (Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa) is an EU-funded project that aims to determine the influence of anthropogenic and natural emissions on the atmospheric composition, air quality, weather and climate over southern West Africa. DACCIWA organised a major international field campaign in June-July 2016 and involves a wide range of modelling activities. Within the scope of DACCIWA, the representation of the atmospheric and dynamic conditions in southern West Africa was evaluated as they are represented in weather forecast, seasonal and climate prediction models. The evaluation was conducted in a two-stage process: First the quality of numerical weather forecasts during the two-month field campaign was analysed; in a second step the evaluation was extended to long-term predictions from seasonal and climate models.

In the first part, the predicted fields of the main variables that determine the thermodynamic and dynamic state of the atmosphere were evaluated with measurements from various satellite sensors, synoptic stations and radiosonde measurements from the DACCIWA field campaign. Predictions from five different models were selected for the process, some are operational from centres such as the European Centre for Medium-Range Weather Forcasts (ECMWF), UK MetOffice and the German Weather Service including full data assimilation, and some models were specifically run for the planning and the post-analysis of the field campaign using higher resolutions (e.g. WRF, COSMO, ICON). Results reveal a generally good agreement between models and measurements for temporally averaged state variables; more noticeable deviations occur in the day-to-day variations, e.g. outgoing longwave radiation is biased by approx. 11 W/m^2 while the centred root mean square error (CRMSE) is about 10 – 24 W/m^2. The models possess satisfactory skill for some meteorological variables (e.g. representation of low-level jet) but more substantial problems occur with coastal features, precipitation and variations in cloudiness, boundary-layer evolution with correlations for 2m-temperature of 0.3 at best.

In the second part, the performance of climate and seasonal models deployed in DACCIWA was assessed together with models that participated in YoTC (Year of tropical Convection) and CMIP5 (Coupled Model Intercomparison Project Phase 5). Multi-year model climatologies were compiled and compared against satellite data and synoptic records, some of which digitised from written records in the framework of DACCIWA. Parameter choice and spatial averaging were consistent with the first part, allowing an assessment of the impact of short-term errors on long-term simulations. Results reflect the more extensive use of parameterisations of physical processes in climate prediction models leading to large discrepancies in all models: precipitation amounts tend to be too small, the diurnal evolution of the meteorological state variables in the boundary layer is often ill-represented and biases even occur at higher levels (e. g. strength of the Tropical Easterly Jet). All differences together lead to radiation budgets at the top of the atmosphere exhibiting different signs.