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Forecasting the atmospheric composition of southern West Africa with COSMO-ART during the DACCIWA measurement campaign

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The Dynamics-aerosol-chemistry-cloud interactions in West Africa (DACCIWA) project (Knippertz et al., 2015) investigates the influence of anthropogenic and natural emissions on the atmospheric composition over Southern West Africa (SWA). Between 1 June and 31 July 2016 the DACCIWA measurement campaign took place in SWA, including ground based and airborne observations.
By using the regional scale comprehensive model system COSMO-ART (Vogel et al., 2009), operational numerical forecasts of the atmospheric composition including aerosols and gas phase compounds were conducted between 8 May and 31 July 2016. The forecasts cover the domain 25°W to 35°E and 20°S to 30°N with a grid mesh size of 28km and a lead time of 57h.
The primary assignment of the forecasts was to support the DACCIWA aircraft campaign (27 June to 17 July 2016) in terms of the decision making of the flight routes of the research aircrafts. Visualizations of the forecast results were daily uploaded to the public available server dacciwa.sedoo.fr. Apart from the support of the DACCIWA measurement campaign, the COSMO-ART model dataset is highly valuable for identifying time periods feasible for post-campaign case study simulations, the extensive validation of COSMO-ART with observational data and the derivation of model climatologies to raise knowledge in meteorological and the atmospheric composition characteristics of SWA.
The presentation will show validation results of the COSMO-ART forecasts with ground based and airborne measurements from the DACCIWA campaign as well as remote sensing observations.
COSMO-ART well reproduces the diurnal cycle of the observed ozone concentration at Savé site and shows very good agreement of mineral dust AOD compared to CAMS model results whereas the anthropogenic aerosol seems to be overestimated by COSMO-ART compared to MODIS AOD and AERONET observations.
We will present model climatologies of the NLLS characteristics and the spatial structure of the pollution plumes from the megacities along the coast of the Gulf of Guinea.
The time period 25 June to 5 July 2016 was selected for a case study with COSMO-ART. For this time period the simulations were repeated with a grid mesh size of 5km by keeping the domain size nearly equal to the forecast domain described above but without parameterizing the convection. We will show selected results by focusing on the differences in the pollution plume structures compared to the COSMO-ART 28km simulations.

Knippertz, P., Coe. H., Chiu, J. C., Evans, M. J., Fink, A. H., Kalthoff, N., Liousse, C., Mari, C., Allan, R. P., Brooks, B., Danour, S., Flamant, C., Jegede, O. O., Louhou, F., Marsham, J. H., 2015: The DACCIWA Project: Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa, BAMS September 2015, 1451-1460

Vogel, B., Vogel, H., Bäumer, D., Bangert, M., Lundgren, K., Rinke, R., Stanelle, T., 2009: The comprehensive model system COSMO-ART - Radiative impact of aerosol on the state of the atmosphere on the regional scale, Atmos. Chem. Phys., 9, 8661-8680.