A 5 year programme on weather, climate and air pollution in West Africa

DACCIWA Newsletter

8th Edition
February 2019

TOPICS THIS ISSUE

COORDINATOR'S EDITORIAL

Dear Reader,

the DACCIWA project has now officially ended. A final scientific meeting was successfully held in Yamoussoukro (Ivory Coast) on October 15–17 2018. One of the key outcomes of the project is a dedicated document that summarises all policy-relevant findings in an easy-to-understand way and gives concrete recommendations to policymakers. The content of this document was presented at stakeholder events in Abidjan, Accra, Lomé and Brussels in October and November. We are currently finalising a similar document targeted at operational stakeholders, e.g. national weather services.

The five years of DACCIWA have been a fantastic, exciting and rewarding time. The many researchers involved in the project have significantly advanced what we know about the air quality, weather and climate of southern West Africa. More than fifty papers have been published and there are still many to come in the next months. Most of these are appearing in the dedicated DACCIWA Special Issue in Atmospheric Chemistry and Physics. Through the large field campaign in June-July 2016 a rich and unique observational resource has been created that is now freely available to the research community.

If you missed previous newsletters, you can find them on our webpage www.dacciwa.eu, together with much more information on the project and the involved partners.

Thank you for your continued interest in DACCIWA!

Peter Knippertz, project coordinator

FINAL PROJECT MEETING IN YAMOUSSOUKRO (CÔTE D'IVOIRE)

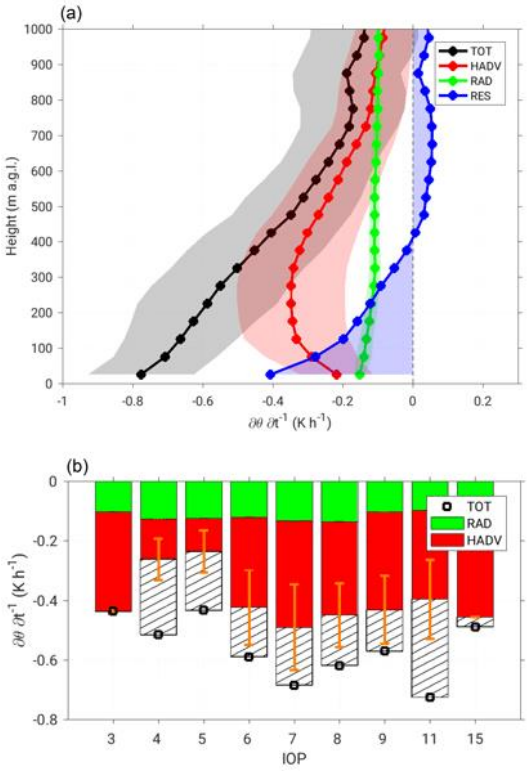
On 15–17 October 2018, the final project meeting was successfully held in Yamoussoukro (Côte d'Ivoire at the Institut National Polytechnique Félix Houphouët Boigny - INPHB), organized by Université Félix Houphouët Boigny (Abidjan Côte d'Ivoire - UFHB) and the coordinating beneficiary Karlsruhe Institute of Technology. Seventy-seven scientists participated in the meeting, including a large fraction of African scientists from DACCIWA beneficiaries and collaborators as well as students from INPHB and UFHB. The results and conclusions of the DACCIWA project were presented in talks and there was ample discussions about their implications and possible further research in follow-up projects (see group picture above).

Recent DACCIWA Publications

Nocturnal low-level clouds in the atmospheric boundary layer over southern West Africa: an observation-based analysis of conditions and processes

This study deals with nocturnal stratiform low-level clouds that frequently form in the atmospheric boundary layer over southern West Africa. The study uses observational data from 11 nights to characterize the clouds and intra-night variability of boundary layer conditions as well as to assess the physical processes relevant for cloud formation. The study finds that cooling is crucial to reach saturation and a large part of the cooling is related to horizontal advection of cool air from the Gulf of Guinea.

Adler et al., 2019: Atmos. Chem. Phys., 19, 663-681, https://doi.org/10.5194/acp-19-663-2019, 2019

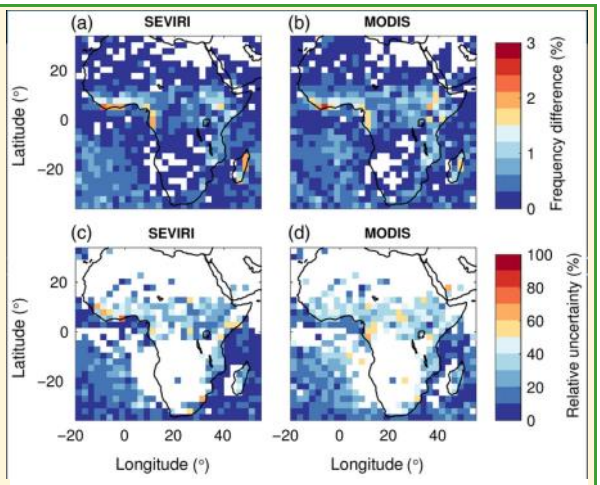


(a) Mean profiles of potential temperature tendency (TOT), the contributions by horizontal advection (HADV) and radiative flux divergence (RAD) and the residual (RES = TOT − HADV − RAD) between 17:00 UTC and the end of the jet phase (averaged for all IOPs)(b). The values are averaged up to the height where TOT decreases below 1/e of the maximum cooling.

Spatiotemporal variability of warm rain events over southern West Africa from geostationary satellite observations for climate monitoring and model evaluation

This article presents the spatio-temporal variability of warm rain events over southern West Africa (SWA) during the summer monsoon season for the first time, using Spinning Enhanced Visible Infrared Radiometer (SEVIRI) observations on the Meteosat geostationary satellites. The delineation of warm rain events is based on the principle that precipitating low-level clouds are associated with either sufficient water content or large cloud droplet size. Capitalising on the ability of space-borne radar to resolve vertical cloud structures and detect the presence of precipitation, the delineation is trained by collocated SEVIRI and CloudSat observations

Young et al. 2018: Q J R Meteorol Soc. 2018;144:2311–2330. https://doi.org/10.1002/qj.3372



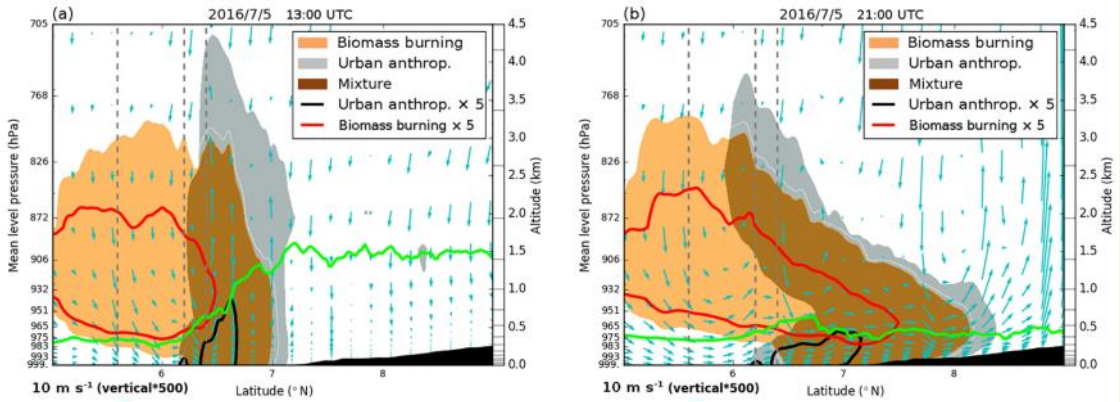
Warm rain frequency difference (a, b) and relative uncertainty (c, d) for SEVIRI (a, c) and MODIS (b, d). The frequency difference in (a) and (b) is the difference between warm rain frequencies derived from the 5th and 95th percentiles of optimal E for the "rain certain" criteria. The relative uncertainty (%) in (c) and (d) is the frequency difference in (a) and (b), divided by the respective warm rain frequencies.

Recent DACCIWA Publications

Diurnal cycle of coastal anthropogenic pollutant transport over southern West Africa during the DACCIWA campaign

This article presents a detailed analysis of anthropogenic and biomass burning pollutants over the Gulf of Guinea coastal region, using observations from the DACCIWA field campaign and modeling. The novelty is the focus on how these two pollution sources are mixed and transported further inland. It is shown that during the day pollutants are accumulated along the coastline and transported northward as soon as the daytime convection in the atmospheric boundary layer ceases (16:00 UTC)

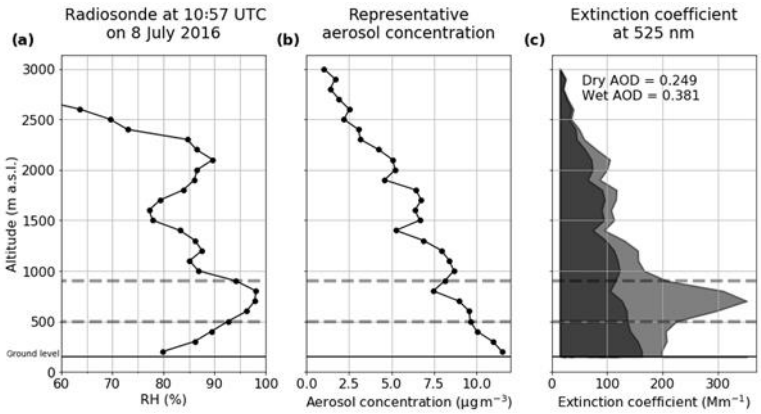
Deroubaix et al., 2019: Atmos. Chem. Phys., 19, 2019 https://doi.org/10.5194/acp-19-473-2019



Meridional–vertical transect of concentrations of urban anthropogenic (in gray) and biomass burning (in brown) numerical tracers on 5 July 2016 at 13:00 UTC (a) and at 21:00 UTC (b).

The radiative impact of out-of-cloud aerosol hygroscopic growth during the summer monsoon in southern West Africa

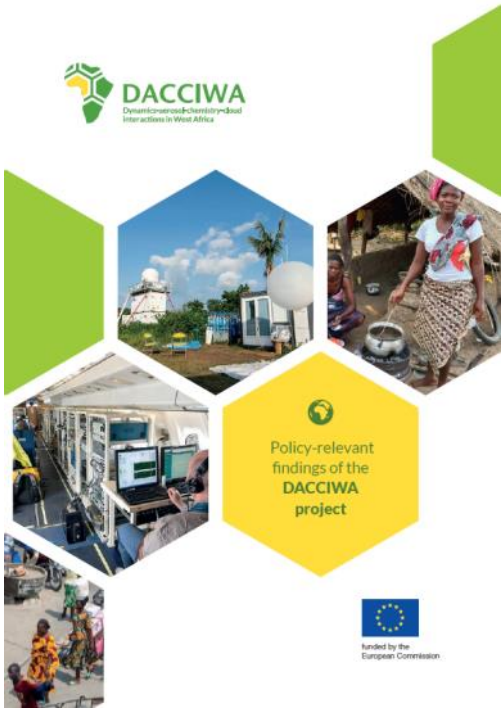
As the population in West Africa grows and air pollution increases, it is becoming ever more important to understand the effects of this pollution on the climate and on health. Aerosol particles can grow by absorbing water from the air around them. This paper shows that during the monsoon season, aerosol particles in the region are likely to grow significantly because of the high moisture in the air. This means that climate effects from increasing pollution will be enhanced.



(a) Relative humidity and (b) aerosol concentrations used to calculate aerosol optical depth and (c) the profile of dry and wet calculated extinction coefficients for the relative humidity profile on 8 July.

Haslett et al., 2019: Atmos. Chem. Phys., 19, https://doi.org/10.5194/acp-19-1505-2019, 2019

DACCIWA Policy Brief



The document comprises the key results of the DACCIWA project and its implications for policy makers with easily understandable messages for non-experts. The document is aimed at different stakeholders such as African Governmental, the EU Commission, National Governments, Non-Governmental Organizations and civil society.

The following topics are discussed and explained in the document:

- **Key findings**
- **Implications for policy**
- **Field campaigns**
- **Air pollution concentration and sources**
- **Health impacts**
- **Emissions**
- **Pollution impacts on weather and climate**
- **Long-term outlook**
- **Observations and models**

Please download the document from the following site: https://zenodo.org/record/1476843

DACCIWA Policy Brief Meetings

The policy brief described above formed the basis of targeted workshops summarising the results of the different aspects of the project with a focus on policy implications in the southern West Africa region for the present and future to engage with a range of stakeholders.

Four such workshops took place, three of which in southern West Africa and one in Brussels:

- **Accra, Ghana: 12 October 2018**
- **Abidjan, Côte d'Ivoire: 18 October 2018**
- **Lomé, Togo: 19 October 2018**
- **Brussels, Belgium: 15 November 2018**

In Africa stakeholders from local ministries and embassies took part in the meeting and in the lively discussions. In Brussels the results were presented to members of the European Commission and other stakeholders.

Accra Meeting at Erata Hotel

DACCIWA Policy Brief Meetings

Abidjan Meeting at the EU delegation

Abidjan press coverage:
RTI1 Evening news (starting at minute 20)
Article Fraternité Matin

Lomé Meeting at the German Embassy

Lomé press coverage: SAVOIR NEWS

DACCIWA session at European Geosciences Union General Assembly 2019

EGU 2019 Session AS4.22

Fri, 12 April 2019, 08:30-10:15, PICO spot 5a

https://meetingorganizer.copernicus.org/EGU2019/session/30256

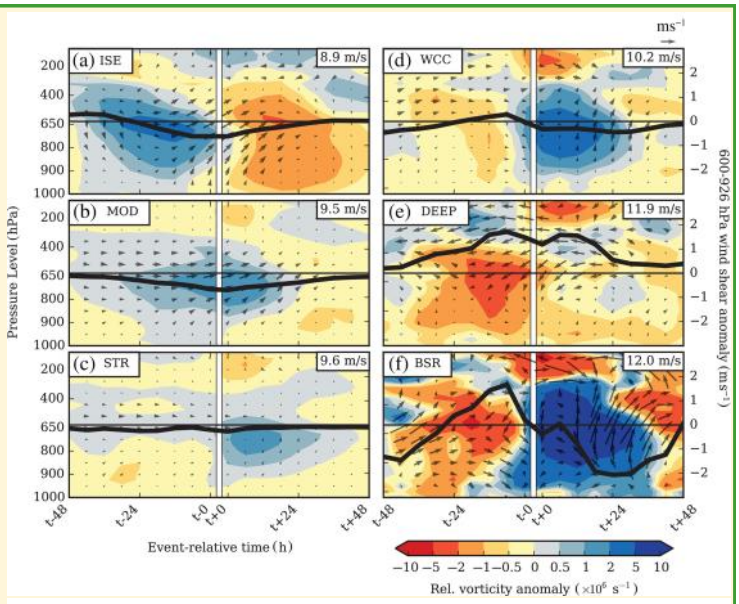
Atmospheric composition, weather and climate in Sub-Saharan AfricaPICO session

Convener: Peter Hill; **Co-conveners:** Joel Brito , Luis Garcia-Carreras , Peter Knippertz
This session is open to a wide range of contributions on atmospheric sciences in Sub-Saharan Africa, with a focus on tropical regions.

Recent DACCIWA Publications

Rainfall types over southern West Africa: Objective identification, climatology and synoptic environment

Combining Tropical Rainfall Measuring Mission–Precipitation Radar (TRMM-PR) rainfall system identification with infrared-based cloud tracking reveals that organized convection over Southern West Africa (SWA) typically lasts for more than >9 h, whereas less intense rainfall types tend to be short-lived, diurnal phenomena.
This novel approach stresses the relevance of mid-level (wave) disturbances on the type and lifetime of convective systems and thereby their regionally, seasonally and diurnally varying contribution to rainfall amount. The present study suggests further investigations into the character of the disturbances as well as possible implications for operational forecasting and the understanding of rainfall variability in SWA.



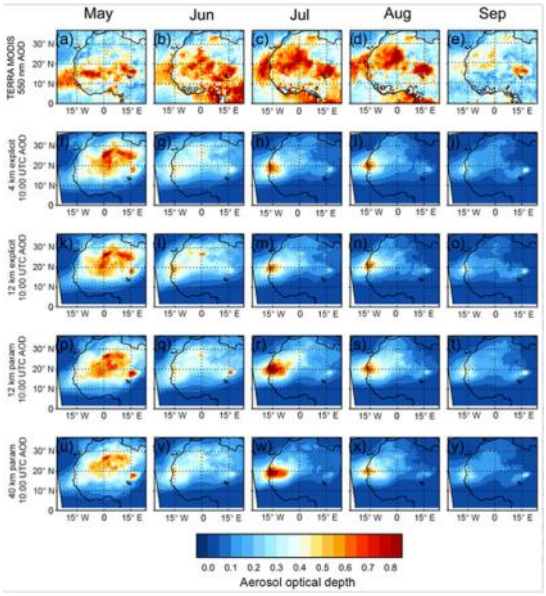
Composited time–height profiles of the anomalies of relative vorticity (colour shading) and of horizontal wind speed and direction (arrows) based on ERA-Interim re-analysis data.

Maranan et al., 2018, *Q J R Meteorol. Soc.* 2018;144:1628-1648. https://doi.org/10.1002/qj.3345, 2019

Can explicit convection improve modelled dust in summertime West Africa?

The summer Saharan dust hotspot is seasonally tied to the occurrence of convective storms. Global weather and climate models parameterise convection and so are unable to represent their associated dust uplift (haboobs). However, this work shows that even when simulations represent convection explicitly dust fields are not strongly affected, since (1) haboobs are too weak, (2) errors in the modelled land surface limit the impact of the haboobs, (3) in runs forced only at their boundaries increased uplift from haboobs is compensated by decrease uplift form morning breakdown of the nocturnal low-level jet.

Roberts et al., 2018: Atmos. Chem. Phys., 18, 9025-9048, https://doi.org/10.5194/acp-18-9025-2018



Monthly mean (May–September, left-right) aerosol optical depths (AODs) at 10:00UTC from (a–e), MODIS Terra satellite (combined deep blue and land–ocean data sets), (f–j) 4 km simulation with explicit convection (4E), (k–o) 12 km simulation with explicit convection (12E), (p–t) 12 km simulation with parameterised convection (12P) and (u–y) 40 km simulation with parameterised convection (40P).

Other Recent DACCIWA Publications

Published articles

Aryee et al. (2018): *Overview of surface to near-surface atmospheric profiles over selected domain during the QWeCI project.* Meteorol Atmos Phys, https://doi.org/10.1007/s00703-018-0618-1

Babić et al., 2019: *Diurnal cycle of low-level clouds over southern West Africa*. Atmos. Chem. Phys., 19, https://doi.org/10.5194/acp-19-1281-2019, 2019

Bärfuss et al. (2018): *New Setup of the UAS ALADINA for Measuring Boundary Layer Properties, Atmospheric Particles and Solar Radiation*. Atmosphere 2018, 9, 28. https://www.mdpi.com/2073-4433/9/1/28

Benedetti et al. (2018): *Status and future of numerical atmospheric aerosol prediction with a focus on data requirements*, Atmos. Chem. Phys., 18, 10615-10643, https://doi.org/10.5194/acp-18-10615-2018

Benedetti, A. and F. Vitart, (2018): *Can the Direct Effect of Aerosols Improve Subseasonal Predictability?.* Mon. Wea. Rev., 146, 3481–3498, https://doi.org/10.1175/MWR-D-17-0282.1

Dunning et al. (2018): *Later Wet Seasons with More Intense Rainfall over Africa under Future Climate Change.* J. Climate, 31, 9719–9738, https://doi.org/10.1175/JCLI-D-18-0102.1

Kniffka et al. (2019): *The role of low-level clouds in the West African monsoon system*, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-19-1623-2019

Reinares Martínez, I.R. and J. Chaboureau, (2018): *Precipitation and Mesoscale Convective Systems: Radiative Impact of Dust over Northern Africa.* Mon. Wea. Rev., 146, 3011–3029, https://doi.org/10.1175/MWR-D-18-0103.1

Discussion papers

Bessardon et al.: *Evaluation of Windsond S1H2 performance in Kumasi during the 2016 DACCIWA field campaign*, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2018-179, in review, 2018.

Brocchi et al.: *Local air pollution from oil rig emissions observed during the airborne DACCIWA campaign,* Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-27, in review, 2019.

Dione et al.: *Low Level Cloud and dynamical features within the southern West African Monsoon*, Atmos. Chem. Phys., https://doi.org/10.5194/acp-2018-1149, in review, 2018.

Dominutti et al.: *Anthropogenic VOC in Abidjan, southern West Africa: from source quantification to atmospheric impacts*, Atmos. Chem. Phys., https://doi.org/10.5194/acp-2018-1263, in review, 2018.

Taylor et al.: *Aerosol influences on low-level clouds in the West African Monsoon*, Atmos. Chem. Phys., https://doi.org/10.5194/acp-2019-40, in review, 2019.

Xu et al.: *Personal exposure to PM2.5 emitted from typical anthropogenic sources in Southern West Africa (SWA): Chemical characteristics and associated health risks*, Atmos. Chem. Phys. Discuss., https://www.atmos-chem-phys-discuss.net/acp-2018-1060/ in review, 2018

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Last DACCIWA Newsletter

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Say Goodbye with the DACCIWA song

https://youtu.be/Mrm6l37Zkwc

(courtesy of the artist at „Chez Ambroise“ Abidjan, Côte d'Ivoire)

DACCIWA

Project Partners

- Karlsruher Institut für Technologie (DE)
- University of Leeds (UK)
- University of York (UK)
- The University of Reading (UK)
- The University of Manchester (UK)
- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DE)
- Université Paul Sabatier Toulouse III (FR)
- Sorbonne Université (FR)
- Université Clermont Auvergne (FR)
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- European Centre for Medium-Range Weather Forecasts (UK)
- Eidgenössische Technische Hochschule Zürich (Switzerland, CH)
- Kwame Nkrumah University of Science and Technology Kumasi (Ghana, GH)
- Obafemi Awolowo University (Nigeria, NGR)
- Met Office (UK)
- Centre National de la Recherche Scientifique (FR)

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