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

DACCIWA Newsletter

DACCIWA

5th Edition
Summer 2017

TOPICS THIS ISSUE

COORDINATOR'S EDITORIAL

Dear Reader,
this newsletter – the fifth of its kind – is part of our effort to communicate our research activities with the scientific community, the general public and policymakers. 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 parties, and the new DACCIWA documentary film.
In the last issue we reported about the successful DACCIWA field campaign in West Africa in June-July 2016. Now most of the rich dataset we have collected has been quality controlled and uploaded to our database at http://baobab.sedoo.fr/DACCIWA, from where it will be freely available to the scientific community after the end of the project in November 2018. The analysis of these observations is now under full swing and will provide a solid foundation for an improved understanding, modelling and monitoring of the atmosphere over southern West Africa. In addition, we have now submitted overview papers to document the data and some first research highlights as well as the meteorological and chemical evolution during the campaign period. We also had our first DACCIWA-organised session on the atmospheric composition, weather and climate of Sub-Saharan Africa at the General Assembly of the European Geosciences Union in Vienna in the last week of April. The session contained 17 oral presentations and 40 posters, many of which by DACCIWA early-career scientists.

Thank you for your continued interest in DACCIWA!
Peter Knippertz, project coordinator

DACCIWA MOVIES

Comprehensive movie on the DACCIWA objectives and the field campaign.
Made by KIT film team (link)

Focus on logistics and implementation of the DACCIWA field campaign.
Made by Arnaud Mansat for ULISSE (link)

News

DACCIWA at EGU 23-28 April 2017

The annual European Geosciences Union (EGU) general assembly brings ca. 14,000 geoscientists from across the world together in Vienna for a week-long conference. This year's assembly took place from 23-28 April 2017 and – for the first time – included a session focused specifically on the atmosphere of Sub-Saharan Africa, which was organised by DACCIWA scientists.

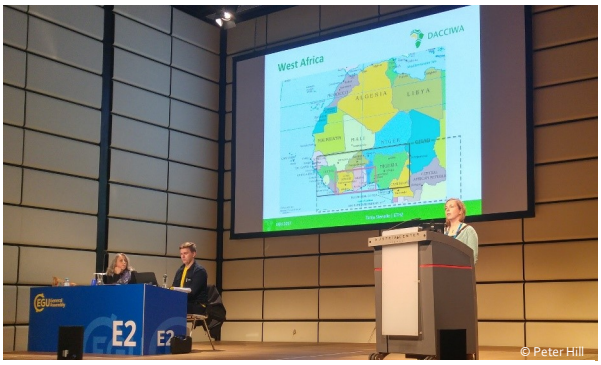
This year's assembly – for the first time – included a session focused specifically on the atmosphere of Sub-Saharan

The session was entitled 'Atmospheric composition, weather and climate in Sub-Saharan Africa' and attracted a total of 58 abstracts (many involving DACCIWA scientists) on a wide range of topics relevant to Sub-Saharan Africa, including atmospheric chemistry, aerosols and associated health impacts, dynamical meteorology, clouds, and precipitation. As a result the session was allocated 18 oral and 40 poster presentations. Unfortunately, this meant we could not allocate an oral presentation to all those who had requested one.

The oral session began with an overview of the DACCIWA project by Peter Knippertz and from there moved through talks on atmospheric dynamics, clouds, precipitation, and the boundary layer, to talks on pollution, aerosols and atmospheric composition. The poster session was well-attended and included some very high quality posters. The table gives an overview of the diverse research topics covered in the session.

DACCIWA coordinator Peter Knippertz giving an overview presentation

A number of talks described observations made during the aircraft field campaign. Here Joel Brito details how aircraft measurements are being used to investigate how anthropogenic emissions affect secondary organic aerosol formation.



There were also a number of DACCIWA talks on atmospheric modelling. In her talk Tanja Stanelle described how different aerosol emmisions inventories impact on a climate model.

Category/Topic	# Oral presentations (total 18)	# Poster (total 40)
Aerosols	5	9
Atmospheric composition	7	15
Boundary layer	2	8
Clouds	2	11
Dynamical meteorology	3	10
Health	1	1
Rain	3	8
Modelling	5	18
Observations	12	24
Female	11	12
Male	7	28
Early career scientists	10	20

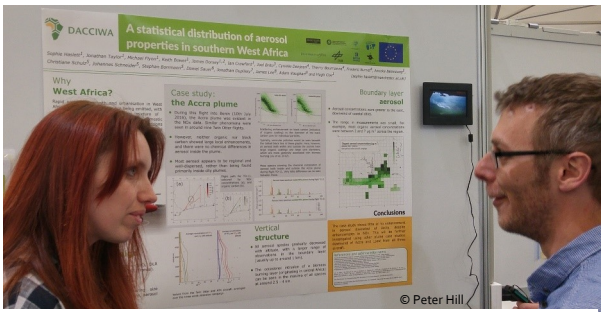
List of presentation topics in the session. Note that each presentation may be included in multiple categories

News

DACCIWA at EGU 24-28 April 2017 (cont.)

Falling approximately 6 months after the last DACCIWA project-wide meeting in Leeds and with a large number of DACCIWA scientists in attendance, the session was an excellent forum for discussing progress within the project. Also a large number of non-DACCIWA scientists took part in the session, providing a valuable opportunity both to advertise DACCIWA science to the wider research community and to learn about other ongoing research in the region. Based on the success of this session, we hope to repeat it at EGU in April 2018 and to see many of you there.

Contact: Peter Hill (p.g.hill@reading.ac.uk)



The poster session provided an opportunity for further in depth discussions.

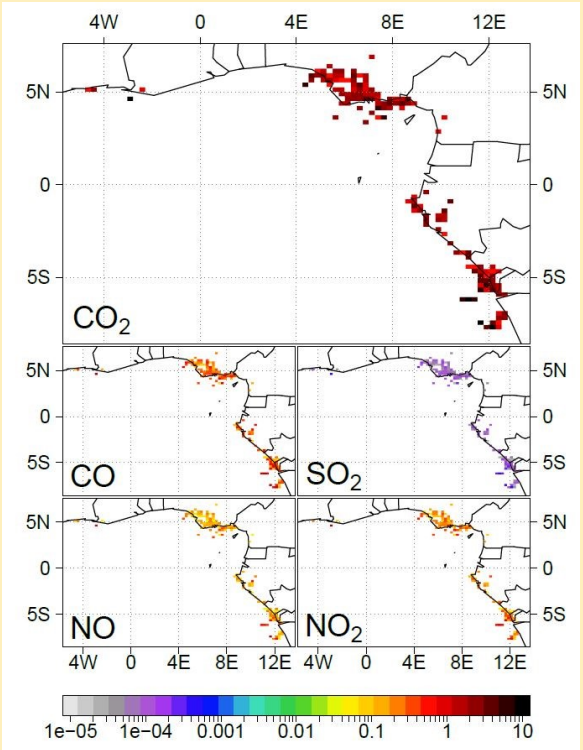
Full list of presentations: http://meetingorganizer.copernicus.org/EGU2017/session/24727

DACCIWA Publication

Development of a new gas-flaring emission dataset for southern West Africa

Content in short

- By combining remote sensing observations and combustion equations, a new method for deriving emissions from gas flaring has been developed and applied for SWA.
- The dataset includes the trace gases carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen monoxide and nitrogen dioxide.
- Furthermore, the study extensively assesses the potential uncertainties of the emission estimates and compares the results to existing inventories.
- The developed software is written in R, can be easily applied to other gas-flaring regions and is freely available for research purposes (https://zenodo.org/record/61151#.WQm1h9ykJpg).
- From Deetz and Vogel (2017) a gas-flaring emission dataset for SWA covering the period March 2012 – August 2016 on a daily basis has been derived and made available to the DACCIWA community in the baobab database (http://baobab.sedoo.fr/Data-Search/?datsId=1712&terms=Gas%20flaring&allKeywords=1&project_name=BAOBAB).
- By using the results as input of a chemistry model, further insight in the influence of gas-flaring on the SWA atmospheric composition can be achieved.



Gas-flaring emissions (t h-1) estimated for June-July 2015 for the trace gases carbon dioxide (CO_2), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen monoxide (NO) and nitrogen dioxide (NO_2) with the new parameterization presented in this study.

Reference:

Deetz, K. and Vogel, B., 2017: Development of a new gas-flaring emission dataset for southern West Africa, *Geosci. Model Dev.*, doi: 10, 1607-1620

Meet the DACCIWAs

Evelyne Touré N'datchoh


© Evelyne Touré N'datchoh

I am a post-doctoral fellow in Laboratoire d'Aerologie in Toulouse within the DACCIWA WP2 work package led by Cathy Liousse. My work consists of using regional climate model for simulations of particulate atmospheric composition related to anthropogenic combustion emissions, and implications on population health.

I am from Côte d'Ivoire where I obtained my Master degree in Tropical climate and environment science at the Université Félix Houphouet Boigny (formal Université de Cocody). I then joined the WASCAL post-graduate school in 2012 for my PhD work and graduated from the Federal University of Technology in Nigeria in 2015. My PhD work contributed to better understand the complex interactions between climate, society and their overall effect on fire patterns in West Africa. I also studied natural dust and its impact on the West African Monsoon.

In the DACCIWA project, I am addressing the problem of air pollution and its implication on human health in urban areas. My role in DACCIWA WP2 is to adapt a modelling chain including aerosols emissions, exposure and health impacts (both epidemiology and toxicological) over West Africa. In addition to sensitivity tests on the use of a regional climate model for air pollution modelling, I focus on secondary aerosol and ion formation using an analytic method. Therefore, I became aware of the importance of primary and secondary organic aerosols and their role in air quality. I have learned new data analysing tools for my work, and get new experience with the emission inventory method. In this present DACCIWA experience, I have attended some field measurement campaigns in Abidjan. Finally, during my stay in Laboratoire d'Aerologie, I discovered real laboratory work. Urbanisation is a growing phenomenon in West African countries. I hope that my work allowing to test different scenarios and their associated impacts together with others DACCIWA WP2 task results (emissions inventory and dose response field campaigns measurements) will help the policy makers to address air pollution issue and monitoring in the countries development planning and strategies.

Contact: evelyne.toure@aero.obs-mip.fr

Meet the DACCIWAs

Sophie Haslett and the DACCIWA social media strategy

I'm a PhD student at the University of Manchester, and I'm coordinating the DACCIWA campaign's social media activity.


© Sophie Haslett

My scientific work on DACCIWA has been as part of the aircraft team, working with the BAS Twin Otter and under Hugh Coe (WP4 leader). During the campaign I was on board of the plane for many of the flights managing cloud and aerosol instruments. This was great fun but also often frustrating work, which sometimes involved showing up at the airport to prime instruments as early as 4 am.

I can't think of many other careers where I could find myself flying a few metres over sea level (…).

I find atmospheric science an incredibly exciting area to work in. It has already taken me to many different parts of the world and introduced me to some great people. I can't think of many other careers where I could find myself flying a few metres over sea level, or caught up in the drama of being rejected from Ghanaian airspace, or sitting by a pool in a hotel in downtown Lomé. Or working with a passionate team of researchers from all over the world to solve a set of problems that will result in real-world, positive impacts for all sorts of people.

I'm particularly fascinated by aerosol science because there are so many questions still to answer. How do the aerosols from cities really affect

Meet more DACCIWAs

Sophie Haslett and the DACCIWA social media Strategy (cont.)

clouds? How much will that impact the kind of weather we see in the future? How much difference to they make, overall, on global climate change? These questions are scientific in nature, but their answers also have very real, very concrete consequences for communities.

This is why communication and dissemination of information is particularly important in this area of science. As part of DACCIWA's dissemination team, I've been involved in running the Twitter account for the campaign. We were unable to use the account to send live updates from the field, so the social media had a rocky start. Since the campaign, however, we've gained over 100 followers and interacted with all sorts of researchers and organisations interested in atmospheric science in Africa.

On Twitter we've gained over 100 followers and interacted with stakeholders interested in atmospheric science in Africa.

We've used this as a platform to share images of the campaign, information about what we're up to, and links to newly-published DACCIWA papers. As the number of papers and presentations increases, we're hoping to get more engagement and to reach new audiences through this medium.

If you have any news related to DACCIWA or atmospheric science in Africa in general that you would like me to share from the account, please get in touch!

Contact: sophie.haslett@manchester.ac.uk

Please follow us on social media

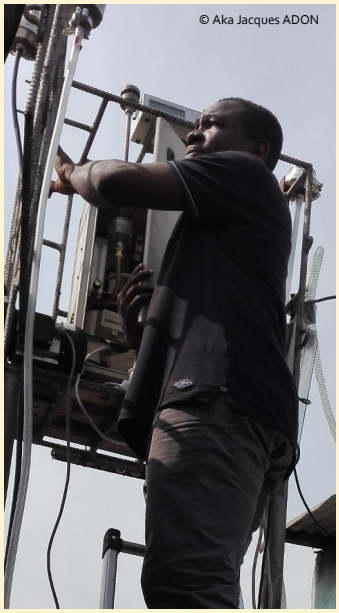
@DACCIWA

www.instagram.com/dacciwa

www.facebook.com/dacciwa.eu/

Meet the DACCIWAs

Aka Jacques ADON


© Aka Jacques ADON

I am a PhD student at the University of Paul Sabatier, Laboratoire d'Aérologie. Within DACCIWA I work for the WP2 "Air pollution and health".

My PhD project under the supervision of Dr Cathy LIOUSSE (Toulouse, CNRS, Laboratoire d'Aérologie), and Dr Armelle BAEZA (Paris, University of Paris 7, Laboratoire de Biologie Fonctionnelle et Adaptative), is to determine the toxicological impact of the aerosol on the respiratory system for the different urban combustion sources typical of West Africa: Domestic fire (DF), Waste Burning (WB), and Traffic (T) in Abidjan (Cote d'Ivoire) and Cotonou. (Benin).

This study took place during the wet and dry seasons from July 2015 to January 2017, with intensive campaigns, from three aerosol impactors for ultrafine, fine, and coarse particles, running in parallel in each site, three times in each campaign, where I was fully involved.

First, after analysing more than 700 filters I have studied the variability of size speciated aerosol chemistry during dry and wet seasons for the different sites.

Second, in the collaboration with M. L Tran I was involved in the determination of the toxicity of DF, WB, T combustion aerosols particularly for oxidative stress measured in vitro for the January 2016 campaign. From these results, a link between aerosol chemistry and inflammation markers for the main combustion sources was established (Adon et al. 2017, DACCIWA conference, Vienna).

This work is ongoing for the other campaigns to determine dose/ inflammatory response functions. Associated to a model of particulate depositions in the respiratory tract and to RegCM model, such results will allow to determine regional variation of aerosol inflammatory impacts for different sources.

Contact: Jacques ADON (adonjacks@gmail.com)

Publication news

Upcoming DACCIWA Overview Publications

Now that the DACCIWA field campaign is history, we have written and submitted a number of papers to summarise some of its most important outcomes and background information for future data analysis.

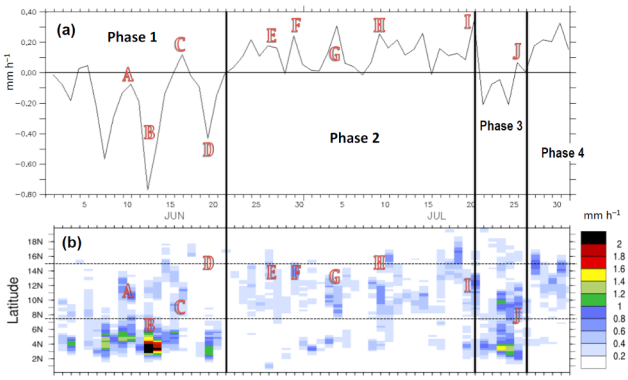
Comrehensive campaign overview -> submitted to BAMS

The first paper entitled "The Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa field campaign: Overview and research highlights" was put together by a team of more than 40 authors, all with important roles in the field campaign, and was led by Cyrille Flamant, who was the main coordinator of the aircraft component of the campaign. The paper was submitted in early May 2017 to the Bulletin of the American Meteorological Society (BAMS) and is currently under review. First discussion about authorship, structure and content of this paper already took place during the campaign in Lomé (Togo), where a critical number of senior members of the DACCIWA team were present. In the following months, this concept was further re-fined and some modifications to the author list were decided. The manuscript and the comprehensive Supplementary Material describe the observational dataset collected in the field in West Africa in June-July 2016 and thus provide an initial context for the ongoing scientific analysis of these data as well as some first research highlights. The paper will act as a central reference that all DACCIWA publications can refer to and as a general scientific advertisement for the DACCIWA project and the rich database it has created. BAMS articles are openly accessible on the internet.

Overview on meteorological and chemical evolution during the field campaign -> ACP accepted for discussion

In addition, it was decided during campaign discussions in Lomé to put together a second overview paper on the meteorological and chemical evolution during the field phase in June-July 2016. This paper is based on the daily weather discussions organised as part of the flight planning activities and is led by WP7 leader Knippertz. The paper puts the field measurements into a larger meteorological context and introduced common terminology for time periods and significant weather systems to be used in other DACCIWA publications. The manuscript was submitted to the open access journal Atmospheric Chemistry and Physics (ACP) in mid-April 2017 and was accepted in early May 2017 as a discussion paper.

doi:10.5194/acp-2017-345



ACP discussion paper: Overview of meteorological and chemical evolution during the DACCIWA field campaign: Rainfall evolution during June-July 2016.

Ground campaign overview -> to be submitted to ACP

The ground campaign overview paper foreseen to be submitted in June 2017 to ACP analyses the daily conditions (Monsoon layer, Harmattan layer, African Easterly Jet, tropospheric stratification) in the investigation area and provides average diurnal cycles of the energy-balance components, near-surface temperature, humidity, wind speed and direction as well as the conditions (LLC, low-level jet) in the boundary layer at the supersites.

In order to increase the visibility of DACCIWA publications, we are currently in the process of establishing a Special Issue in ACP.

Contact: Peter Knippertz (peter.knippertz@kit.edu)

Data News

DACCIWA data available at Sedoo

One of the major outputs from the DACCIWA project is the production of a unique observational dataset. The measurements made last summer and those which are ongoing, are archived by the Service de Donnés de L'OMP (SEDOO) service of Observatoire Midi-Pyrénées. The Base Afrique de l'Ouest Beyond AMMA Base (BAOBAB) part of SEDOO curates a range of West African datasets including that from DACCIWA. http://baobab.sedoo.fr/DACCIWA/

Nearly all the data are now on the database. It is made up of 86 different types of observations ranging from the KIT Sun Photometer observations made at Savé to the AMS aerosol composition measurements made onboard the BAS Twin Otter.

DACCIWA participants already have access to all data, for external users an embargo period of 2 years after the upload applies. Before the end of the embargo period, external users can request the release of individual datasets through application to the SC.

How to gain access to the data :

DACCIWA participants and externals have to create an account http://baobab.sedoo.fr/User-Account-Creation/

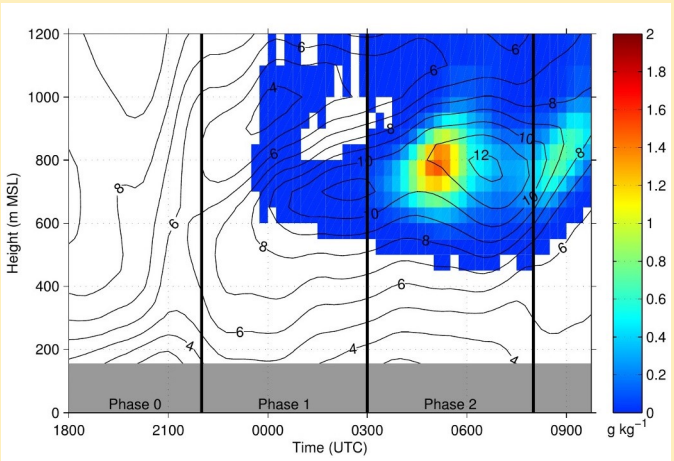
You need to give some basic details about yourself and a brief explanation of what you want the data for. You will also have to sign up to the DACCIWA data policy. This is designed to give fair reward to those people involved in collecting and creating the datasets .

DACCIWA publication

Nocturnal low-level clouds over southern West Africa analysed using high-resolution simulations

Content in short

- There is a large demand to identify controls of the development of the low-level clouds and to improve the understanding of the involved physical processes.
- We simulated a case study with the COSMO model with a horizontal resolution of 500 m for an area around the supersite of Savè.
- Several processes were found to determine the spatio-temporal evolution of these clouds including (i) significant cooling of the nocturnal atmosphere caused by horizontal advection with the south-westerly monsoon flow during the first half of the night, (ii) vertical cold air advection due to gravity waves leading to clouds in the wave crests and (iii) enhanced convergence and upward motion upstream of existing clouds that trigger new clouds.
- Results of this study contributed to the optimization of the measurement strategy during the DACCIWA ground-based field campaign, which was conducted in the monsoon season 2016.



Temporal evolution of the liquid water content (colour-coded) and horizontal wind in m s-1 (black contours) averaged for the area around the supersite of Savè. The grey shaded area marks the mean terrain height. The evolution of nocturnal conditions was divided in different phases; Phase 2 was characterized by the most extended and most dense low-level clouds.

Reference:

Adler, B., Kalthoff, N., and Gantner, L., 2017: Nocturnal low-level clouds over southern West Africa analysed using high-resolution simulations, *Atmos. Chem. Phys*., 17, 899-910, doi:10.5194/acp-17-899-2017

Acknowledgments

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Next Newsletter

Winter 2017

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DACCIWA policy intercations

DACCIWA Policy Strategy

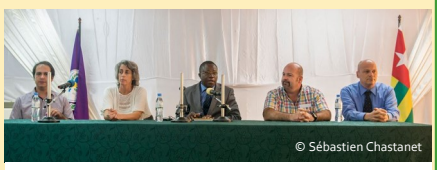
Coordinated by the DACCIWA dissemination team, policy relevant science will be communicated clearly and concisely to policymaking agencies at supra-national and non-governmental level.

Amassadors day in Lomé July 2016

During the field campaign in Togo an ambassadors day was organised with the participation of the French, German and EU ambassadors, where the DACCIWA programm was explained and discussions about the benefits and outcomes relevant for Togo took place.

DACCIWA coordinator Peter Knippertz explaining the DACCIWA project to representatives of the French, German and EU ambassies at the ambassadors day in Lomé during the DACCIWA field campaign.

Public event at University Lomé July 2016



DACCIWA team with local organizer at the Lomé University public event.

Following this interaction a well attended public event at the University Lomé took place targeted at students, researchers, governmental agencies but also at representatives of companies interested at climate research.

Interactions planned in 2018

Further interactions through policy briefs and workshops will take place in 2018 addressing EU policitians, Development Agencies of the Member States, African Government Agencies or Non- Governmental Organisations.

Foreseen policy briefs in 2018:

i. Public health on the city scale
ii. Regional-scale impacts on health, ecosystems and food security
iii. Regional-scale impacts on climate

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)
- Université Blaise Pascal Clermont-Ferrand II (FR)
- Université Paris Diderot - Paris 7 (FR)
- European Centre for Medium-Range Weather Forecasts (UK)
- Eidgenoessische Technische Hochschule Zürich (Switzerland, CH)
- Kwame Nkrumah University of Science and Technology Kumasi (Ghana, GH)
- Obafemi Awolowo University (Nigeria, NGR)
- Université Pierre et Marie Curie - Paris 6 (FR)
- Met Office (UK)
- Centre National de la Recherche Scientifique (FR)

Academic partners associated through subcontracts

- Université Félix Houphouet Boigny, Abijan, Ivory Coast
- Université d'Abomey-Calavi, Cotonou, Benin
- Technische Universität Braunschweig

Front picture courtesy of Sébastien Chastanet: Cornfield in Savè with DACCIWA instrumens (Energy balance, radiation and air chemistry components)