

# Anthropogenic Aerosol Effects on Shallow Clouds during the Dynamics-Aerosol-Chemistry-Cloud Interactions DACCIIWA Field Campaign in West Africa

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Fig. 1: Emissions from domestic fires and road traffic in TWA; cloud measurements on DLR Falcon during DACCIIWA 2016 (Knippertz et al., 2015)

## Motivation and Objectives

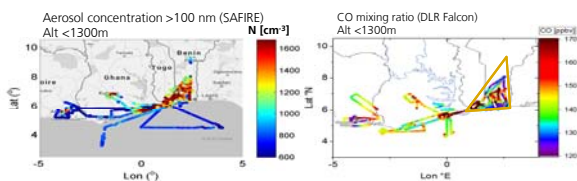
Tropical West Africa (TWA) is a region with strong increases in anthropogenic emissions due to large growth rates in population density. At the same time this region is poorly covered by operational atmospheric monitoring. Therefore weather forecast and climate models are known to have strong deficits in TWA (IPCC2017).

To explore this region, 40 flights were performed in 2016 during the EU project DACCIIWA (Dynamics-aerosol-chemistry-cloud interactions, Flamant et al., 2018) with the DLR Falcon, SAFIRE ATR and BAS Twin Otter to

- characterize atmospheric composition and pollution,
- measure shallow clouds and
- investigate aerosol effects on clouds.

## Instrumentation

Shallow clouds were measured with the Cloud Aerosol Spectrometer CAS (Voigt et al., 2017) onboard the DLR Falcon. Aerosol and CO were used to distinguish pollution levels.



## Results – Shallow Clouds (1)

- Novel in-situ cloud measurements were performed in TWA.
- The effective droplet diameter increases with altitude.
- Polluted clouds contain higher droplet number densities.
- Smaller droplet sizes were measured in polluted clouds.

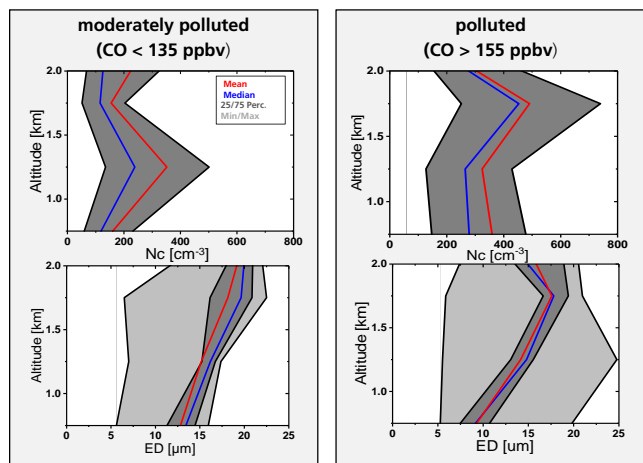


Fig. 2: Cloud droplet number concentration  $N_c$  and effective diameter  $ED$  in moderately and heavily polluted clouds in TWA measured with the CAS onboard the Falcon in July 2016.

## Results – Anthropogenic emissions (2)

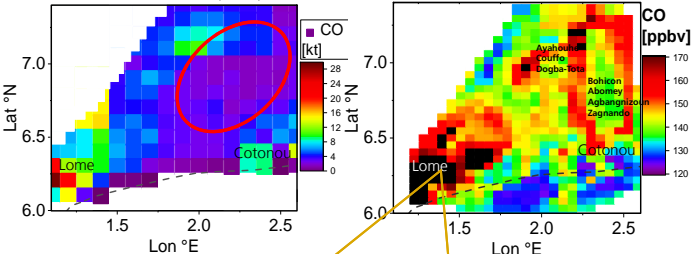


Fig 3: CO emissions from EDGAR V4.2 inventory and CO measurement in Togo. Population density in Togo and the Ruhr area from the luminosity project.

## Implications

- Emission inventories (EDGAR) strongly underpredict anthropogenic CO emissions in TWA.
- The high population density in rural areas contributes to anthropogenic emissions.
- Cleaner conditions were found above the sea.

## References

Knippertz et al.: The DACCIIWA project: Dynamics-aerosol chemistry-cloud interactions in West Africa, *Bull. Amer. Meteor. Soc.*, doi:10.1175/BAMS-D-14-00108.1, 2015  
 Voigt et al.: ML-CIRRUS - The airborne experiment on natural cirrus and contrail cirrus, *Bull. Amer. Meteorol. Soc.*, doi: 10.1175/BAMS-D-15-00213.1, 2017.  
 Flamant et al.: The Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa Field Campaign, *Bull. Amer. Meteor. Soc.*, doi:10.1175/BAMS-D-16-0256.1, 2018.