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Evaluating the importance of photochemistry within urban plumes in West Africa

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As part of the Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa (DACCIWA) project, airborne campaigns were designed to measure a large range of atmospheric constituents focusing on improve our current understanding on the effect of anthropogenic emissions on regional climate. The targeted region, Southern West Africa, holds currently a population of over 340 million people, and is predicted by the United Nations to reach about 800 million by 2050.
The climate in the region is characterized by large-scale atmospheric circulation system which controls precipitation over a land area of about 6 million km2, directly impacting the water resources, agriculture and power generation of hundreds of millions of people. Besides its large natural variability, the West African monsoon system is also expected to be significantly affected by global and regional climate change, with large uncertainties on the role of local pollution An important aspect in assessing impact of human activities on local climate is the understanding emissions and fate of trace gases during their transport.
This work reports some results of the DACCIWA measurement campaign using the French aircraft SAFIRE ATR42, which in combination to German and British research aircraft, aim to characterize the composition of major trace gases (ozone, CO, NO_x, VOCs). Our main focus here is the ozone photochemistry and the oxidative capacity of the explored urban plume by the use of various metrics and indicators (ie. Leighton ratios, indirect calculation of OH). For this purpose a comparison to European urban plumes (continental and Mediterranean) that were explored over the last 5 years by the ATR42 has been carried out. Based on differences and communalities we propose an evaluation of the intensity of photochemical processes within the African urban plumes regarding emission intensity, meteorology and transport.