Geophysical Research Abstracts
Vol. 15, EGU2013-28, 2013
EGU General Assembly 2013

Relief, nocturnal cold-air flow and air quality in Kigali, Rwanda

Sascha Henninger

University of Kaiserslautern, Faculty of Regional and Environmental Planning, Dept. of Physical Geography, Germany (sascha.henninger@ru.uni-kl.de)

Kigali, the capital of the Equatorial African country Rwanda, indicates a fast growing population. This fact and the coherent rising rate of motorization are a reason for a sustainable degradation of the urban air quality. Poorly maintained old mopeds, motorcycles and vehicles cause an increasing concentration of different air pollutants. Apart from the traffic emissions there is another source of air pollution: the usage of simple stoves and open fireplaces. Burning wood, kerosene or dung for domestic energy, cooking and household chores produces a lot of emission, in- and outdoors. Kigali shows a distinctive relief, situated in the Central Highlands of Rwanda. The main business and residential districts are on top of the ridges, which are enclosed by small valleys called "Marais". The lack of space forces more and more people to settle along the slopes and on the bottom of the hills. Though the existence of air pollution depends on the spatial distribution and of course on the intensity of the sources. But pollution is not necessarily bound within the area of strongest emission. Topographical and meteorological conditions could have a very strong influence on the spatial distribution of air quality.
This paper presents the results performed by stationary and mobile measurements between 2008 and 2012. Air temperature, air humidity, precipitation, wind speed and direction, carbon monoxide and suspended particulate matter (PM10) were measured at fixed stations within the urban area. CO and PM10 were additionally detected by mobile measurements using a car traverse, which started in the outskirts of Kigali following paved and unpaved roads through the urban area. A mixture of different types of land use composed the measuring route where different commercial, industrial, residential and mobile sources could be expected.
Although highest levels of concentration were measured in areas with paved roads in business and commercial areas with the highest traffic rates, this result is not reassuringly, because all measured residential districts in Kigali exceeded the recommendations of the WHO, too. This suggests that the inhabitants of Kigali are exposed to enormous levels of PM10 during most of their time outdoors. So PM10 levels are increasing in areas with high rates of traffic due to the exhaust of the vehicles and the stirring up of dust from the ground, but also in fact of burning wood for cooking etc. within the residential districts.
Hazardous measuring trips could be detected for nighttime measurements. Because of high temperatures, high solar radiation and a non-typical missing cloud cover the urban surface could heat up extremely, which produced a cold-air flow from the ridges and the slopes down to the "Marais" at night. This cold-air flow takes away the suspended particulate matters, which tends to accumulate within the "Marais" on the bottom of the hills, the places where most residential neighborhoods could be found and agricultural fields were used. The distinctive relief caused an accumulation within small valleys. Unfortunately, these are the favourite places of living and agriculture and this tends to high indoor-air pollution.