

The paper “Application of the Multi-Scale Infrastructure for Chemistry and aerosol version 0 (MUSICAv0) for air quality in Africa by Tang et.al

Suggest change in the title to show with the application is research or forecasting of air quality?

The paper describes the new model and compares it with currently existing models in use by the community and satellite measurements and makes a recommendation as the most appropriate tool for use in East Africa.

The development of this model and the intended application is very timely as Africa is experiencing an unprecedented economic and population growth. Of all of the developing world, Africa has experienced the highest urban growth rate during the last two decades at 3.5% per year, and this rate is expected to hold into 2050. With increased urbanization rates, Africa is facing increasingly serious urban air quality problems.

Despite the seriousness of the impact of air pollution in the continent studies addressing this problem are very few. While the paper indicates the scarcity of ground-based observations, the many environmental challenges, the core reason for these is not addressed. The colonial legacy and the continued neo colonialism will continue to hinder the efforts of environmental challenges. While the scientific research helps show the problems, will not contribute to the deeper crisis and problems the continent faces as it turns out to be the ground for scramble for economic power houses in North America, China, and Europe.

While this is a purely scientific paper, the introduction that addresses the environmental challenges, poverty (A continent with vast natural resources suffering of poverty), and deficit of knowledge needs to at least mention the political forces that caused the current situation in Africa.

Line 73-74 “Atmospheric chemistry modeling is a useful tool to perform research on air quality conditions and evolution”.. doesn’t make sense. The model can be used to provide air quality forecasts or perhaps understand the chemical processes.

Line 100-103; “MUSICAv0 reproduces the results of WRF-Chem” is not enough justification to introduce a new model. The unique and added values of MUSICAv0 should be clearly stated. Reproducing what other models can do is not enough justification.

Line 264: MODIS AOD

Satellite-based aerosol retrievals of aerosol optical depth (AOD) provide exceptional spatial coverage but suffer over bright surfaces and regions with complicated surface terrain. East Africa has a complicated terrain due to mountains and the rift valley. This issue should be addressed when comparing MODIS AOD products and compare with MUSICAv0) model performance.

Line 274-275:” CO is a good tracer of anthropogenic and biomass burning emissions and modeled CO tracers are used.”

The tracer method has been widely used to identify certain emission sources. For biomass burning, acetonitrile (de Gouw et al.,2003, G. Wang, et al.,2016 hydrogen cyanide Hornbrook et al.2011), methyl chloride (de Gouw et al., 2004 furans (Coggon et al., 1016), levoglucosan (Bhattacharai et al., 2019),

The authors should provide justification for using just CO.

Section 3

Considering the flow of pollutants across the different regions in Africa, across all regions, local emissions from biomass burning and anthropogenic sources impact ambient PM_{2.5} the most within the source region itself.

The impacts of emissions from one region on the annual-average ambient PM_{2.5} in another region depends strongly on meteorology. For example, the combustion sources in East Africa contribute 20% of the annual-average ambient PM_{2.5} over Central Africa. (see <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2022GH000673>)

The authors should address the impact of meteorology in distributions of pollutants across the regions.

Line 372 “Column peak in September likely driven by fire emissions” – This is incorrect.

In the southern, western, and eastern regions of Africa, the trees and grass of the savannah biome become extremely flammable during the dry season, which lasts from May to October in southern Africa and January to April in west and east Africa. September is just the end of the rainy season in East Africa

Line 389: “There are two surface PM_{2.5} sites in East Africa” In addition to the Embassy Sites, MAIA project has several instruments in Addis Ababa.

The authors need to mention the type of the instruments at the sites etc.

Line 415-416: “Overestimation of CO by MUSICA_{v0} should be due to overestimation of anthropogenic emissions from Southern Africa”

This depends on the period. Southern Africa Fire season goes from *April to August*.

Line 493-494- “And then three....” Starting a sentence with And is odd

Please consider revising paragraph starting line 508-520

For example, Line 514-515, “Anthropogenic emissions play a more important role in the region compared to East Africa “The paragraph starts addressing East Africa, what is the region mentioned in the sentence above that is being compared with east Africa?

Line 517-518 “Note that the source analysis using model tracers may be subject to uncertainties in the emission inventories”

Needs to be clarified which inventories are considered? It should also be pointed out that Most modeling studies have relied on emission factors measured outside the continent of Africa (Lamarque et al. 2010; Klimont, Smith, and Cofala 2013; Pokhrel et al. 2021).