African Anthropogenic Emissions Inventories for gases and particles from 1990 to 2016

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Conclusion:

- This work provides detailed regional estimates of BC, OC, SO₂, NOₓ, CO, NMVOC for the period 1990-2016 in yearly 0.125°x0.125° maps
- **Main results for 1990 – 2016 emissions**
  - Global increase of anthropogenic emissions expect for flaring emissions
  - Biofuel and open Waste Burning are main contributors of anthropogenic pollutant emissions in Africa
  - For Biofuel particle emissions, fuel wood is the main contributor mainly used in residential sector.
  - For Fossil Fuel particle emissions, Diesel is the main contributor mainly used in traffic sector and other combustion engine.
- **On going works**
  - Works on Uncertainties and future projections are on going
  - Mitigation of emissions will be focused with improvement of cook stoves, on elimination of high emitters in traffic sector, improvement of fossil fuel quality.
METHOD

Anthropogenic source inventories: fuel consumptions (FC) are combined with emission factors (EF) to derive emission inventory at the country level. \( E = FC \times EF \)

**FC DATA**

For 1990-2014

- United Nations database (UN) 1990-2014, 54 African countries and 22 fuels
- International Energy Agency data (IEA) 1990 – 2014, 28 African countries and all other are aggregated
- Local data (Environment Ministry of Côte d’Ivoire, SIE Côte d’Ivoire, SIE Benin, SIE Togo, SIE Sénégal …)

- For 2015-2016

Hubert’s procedure for segmentation of time series was used → FC data were extrapolated from 2014 to 2020 based on trends for each fuel by sector and country

- For two wheels vehicles

Two-wheel numbers and FC were obtained based on Assamoi and Lioussse, (2010) works: literature and DHS data

- Waste burning

\[ WB = P \times MSWp \times Pfrac \times Bfrac = WB_{residential} + WB_{dump} \] (IPCC guideline, Wiedinmyer et al., 2014)

**EF DATA**

Provided from new ground field measurements (Keita et al., in preparation) and literature
METHOD

FLARING EMISSIONS INVENTORY

- Gas Flaring volume:
  - NOAA DMSP 1992-2011 (Elvidge et al., 2009)
  - NOAA VIIRS 2012-2015 (Elvidge et al., 2015)
- Emission factors (EFx)
  EFx provided from literature (see Doumbia et al., submitted)

DMSP: Defense Meteorological Satellite Program
VIRRS: Visible Infrared Imaging Radiometer Suite

Spatial Distribution of Emission

- Population density given by CIESIN (Gridded Population of the World Future Estimate: GPWFE)
RESULTS: emission trend and sector contribution

BC emission trend and sector contribution

- **BC emissions:**
  - Increase of FF, BF and WB.
  - Decrease of Flaring emissions globally.

- **Total BC Africa 2010:**
  - Relative predominance
    - domestic (40%)
    - waste burning (35%),
    - road traffic (10%),
    - industry (7%),
    - gas flaring (3%)
    - other sector (5%).

(Keita et al. (2) in preparation)
RESULTS: comparison and spatial distribution

COMPARISON WITH PREVIOUS INVENTORIES

- **With** global inventories:
  - **African level**: maximum differences of 40% in 2010
  - Our BC inventory is globally higher
  - **Country level**: various trends exist

- **With Liousse et al. (2014)** (African regional inventory for 2005)
  - Our FF and BF emissions are almost similar for BC (0.64 to 0.68 TgC) and more important for CO (64.43 to 58.6 TgC).
  - This can be explained by the updating of fuel consumption data base and also by the use of new emission factors.

SPATIAL DISTRIBUTION OF BC 2010 EMISSIONS

- **Total BC 2010 emissions in Africa**
  - FF and BF: (0.74 Tg C) → 61.6%
    - (BF: 57.9% wood, FF: 17.8% diesel)
  - WB: (0.43 Tg C) → 35.4%
  - Flaring: (0.036 Tg C) → 3%
  - Nigeria: the most contributing country.
REFERENCES


Acknowledgment
This work has received funding from the European Union 7th Framework Programme (FP7/2007-2013) under Grant agreement no. 603502 (EU project DACCIWA: Dynamics-aerosol-chemistry-cloud interactions in West Africa).