

DICE-Africa User Manual

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Citation:

Marais, E. A., C. Wiedinmyer, Air quality impact of Diffuse and Inefficient Combustion Emissions in Africa (DICE-Africa), *Environ. Sci. Technol.*, 50, 10739-10745, 2016, doi:10.1021/acs.est.6b02602.

Zipped Data Files:

DICE-Africa-2006-v01-4Oct2016.zip

DICE-Africa-2013-v01-4Oct2016.zip

Individual file names are provided below (See Source Sectors).

Data Format: NetCDF.

File Content:

Latitude and longitude centers (in degrees) and emissions of individual chemical compounds (species). Latitude and longitude are 1D vectors; emissions are 2D arrays (3600 columns, 1800 rows)

Horizontal Resolution: $0.1^{\circ} \times 0.1^{\circ}$.

Years: 2006 and 2013.

Source Sectors (and file names):

Household fuelwood use (DICE-Africa-household-fuelwood-use-YYYY-v01-4Oct2016.nc)

Commercial fuelwood use (DICE-Africa-other-fuelwood-use-YYYY-v01-4Oct2016.nc)

Crop residue for energy (DICE-Africa-household-crop-residue-use-YYYY-v01-4Oct2016.nc)

Charcoal use (DICE-Africa-charcoal-use-YYYY-v01-4Oct2016.nc)

Charcoal production (DICE-Africa-charcoal-production-YYYY-v01-4Oct2016.nc)

Kerosene use (DICE-Africa-kerosene-use-YYYY-v01-4Oct2016.nc)

Cars (gasoline and diesel use) (DICE-Africa-cars-YYYY-v01-4Oct2016.nc)

Motorcycles (gasoline and diesel use) (DICE-Africa-motorcycles-YYYY-v01-4Oct2016.nc)

Household fuelwood use (DICE-Africa-household-fuelwood-use-YYYY-v01-4Oct2016.nc)

Household generator use (DICE-Africa-generator-use-YYYY-v01-4Oct2016.nc)

Natural gas flaring (DICE-Africa-gas-flares-YYYY-v01-4Oct2016.nc)

Ad hoc oil refining (DICE-Africa-adhoc-oil-refining-YYYY-v01-4Oct2016.nc)

NOTE: Ad hoc oil refining (in the Niger Delta only) is for one year (2006), as year-to-year variability of this source is not known. The same 2006 values can be applied to 2013.

Units: grams per square meter per year ($\text{g m}^{-2} \text{a}^{-1}$).

Chemical Species:

The emission inventory was developed using the GEOS-Chem chemical mechanism framework. A description of the species acronyms and emission totals for each year (sum of all sectors) is given in the table below. MOH and ALK4 were not included in the GEOS-Chem simulation. In 2006 NMVOCs = 14 Tg without these species; NMVOCs = 24 Tg with.

Species Acronym	Description	Total [Tg species]	
		2006	2013
ACET	Acetone	0.022	0.027
ALD2	Acetaldehyde	0.69	0.77
ALK4	Lumped \geq C4 alkanes	4.79	5.38
BENZ	Benzene	1.52	1.72
BC	Black carbon	0.67	0.66
C2H2	Ethyne	0.33	0.37
C2H4	Ethene	1.58	1.83
C2H6	Ethane	1.74	2.11
C3H8	Propane	0.0055	0.0067
CH2O	Formaldehyde	1.31	1.53
CO	Carbon monoxide	80.8	97.5
GLYC	Glycoaldehyde	0.27	0.30
GLYX	Glyoxal	1×10^{-6}	1×10^{-6}
HAC	Hydroxyacetone	2.31	2.89
HCOOH	Formic acid	0.41	0.47
HCN	Hydrogen cyanide	0.13	0.15
ISOP	Isoprene	0.078	0.088
MACR	Methacrolein	0.0043	0.0052
MEK	Methyl ethyl ketone	0.26	0.29
MGLY	Methylglyoxal	0.097	0.11
MOH	Methanol	6.24	7.72
MVK	Methyl vinyl ketone	0.11	0.12
NH3	Ammonia	0.18	0.23
NO	Nitrogen oxide	0.66	0.80
NO2	Nitrogen dioxide	0.48	0.54
OC	Organic carbon	1.81	2.12
PRPE	Lumped \geq C3 alkenes	0.85	1.05
RCHO	Lumped \geq C3 aldehydes	0.013	0.016
SO2	Sulfur dioxide	0.35	0.41
APIN	Terpenes (not isoprene)	0.10	0.11
TOLU	Toluene	1.44	1.68
XYLE	Lumped xylenes	0.17	0.19

Emission Inventory Caveats:

Due to data limitations the inventory has few chemical compound emissions for kerosene, and many sources are missing where there is no data available (e.g. road dust, electronic waste fires). A discussion of these issues and additional details of the inventory are in the supporting material (<http://pubs.acs.org/doi/abs/10.1021/acs.est.6b02602>).

Implementation of Emission Inventory:

Below is our suggested approach to implement the DICE-Africa emission inventory. Emission sources unique to DICE-Africa should add to existing inventories, whereas updates for improved representation of other emission sources should replace existing inventories.

DICE-Africa emissions to **add to** existing inventories:

- Ad-hoc oil refining (occurs in the Niger Delta only) and gas flares.
- Fuelwood use for charcoal production.
- Fuelwood use in other commercial enterprises.
- Generator use (this may already exist in current inventories if incorporated with residential emissions, but is likely underestimated or not representative of conditions in Africa).

DICE-Africa emissions to **replace** existing inventories:

- Replace land-based transport sector emissions with DICE-Africa diesel and gasoline use for powering cars and motorcycles.
- Replace all residential emissions with DICE-Africa residential use of solid biofuels (fuelwood, charcoal, crop residue) and kerosene.