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EDGARv8 anthropogenic speciated mercury emissions:

hotspots, shift of key emitting sources on global gridmaps and trend analysis over five decades.

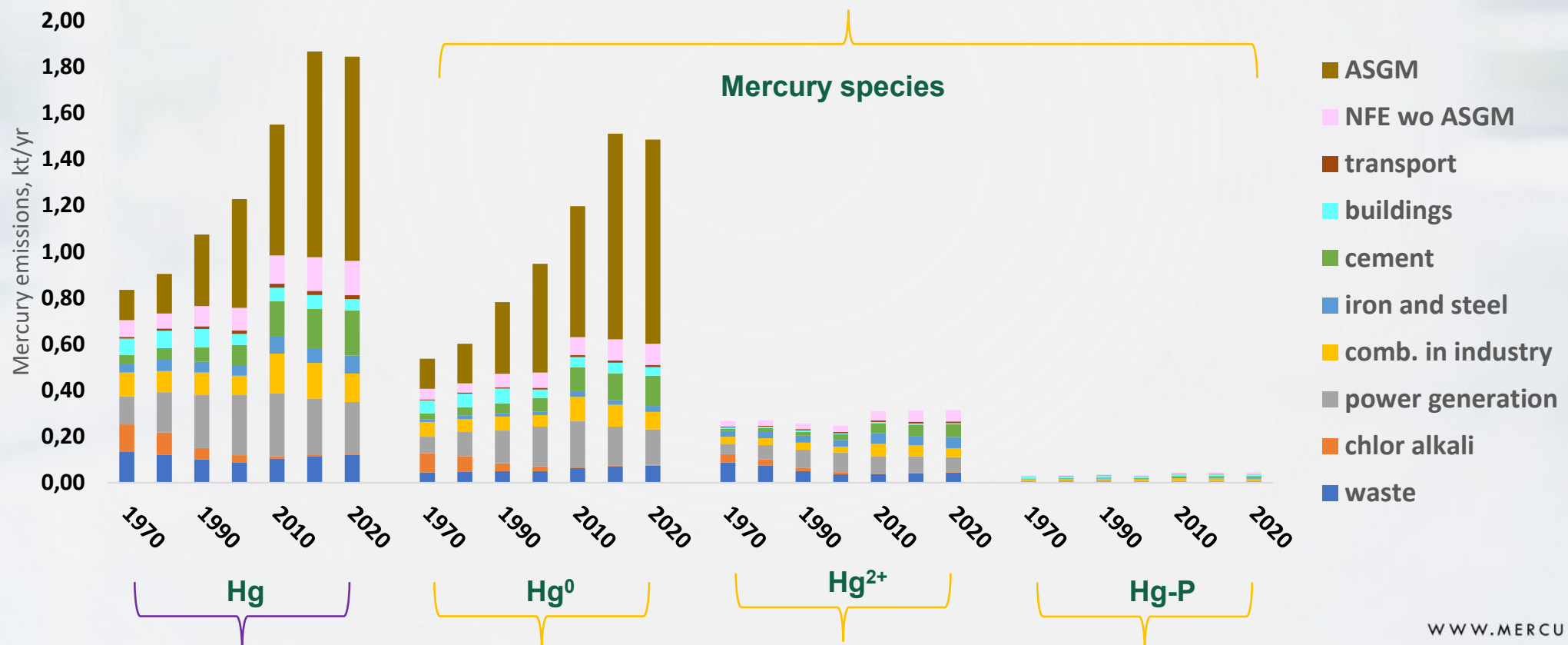


Conclusions

Trends:

- Total global mercury emissions (Hg) increased in the period 1970-2020 by 121%.
- Mercury species, i.e. Hg^0 , Hg^{2+} and Hg-P increased by 177%, 18% and 44% respectively.

The emissions from Artisanal small-scale gold mining (ASGM), had a share in total global mercury emissions of 16% in 1970 and of 48% in 2020. Mercury emissions from the rest of non-ferrous metal production (NFE) sector are provided separately (NFE wo ASGM).



Emissions Database for Global Atmospheric Research (EDGAR)



What can it be used for?

EDGAR is used as independent verification system in support of:

- emissions trend analysis
- track of emissions changes
- global and regional modelling

EDGAR completes the global picture with emissions time-series for each country, contributing to enhanced transparency and providing an additional source with which national and global estimates can be compared.

EDGAR is a multipurpose, independent, global database of human emissions

Includes: GHGs, Air Pollutants and Toxic pollutants (mercury and unintentional persistent organic pollutants (UPOPs))

EDGAR products: Emissions time series from 1970 until recent years and Global gridmaps

Website: <https://edgar.jrc.ec.europa.eu/>



Methodology

$$EM_C(y, x) = \sum_{i,j,k} \left[AD_{C,i}(y) * TECH_{C,i,j}(y) * EOP_{C,i,j,k}(y) * EF_{C,i,j}(y, x) * (1 - RED_{C,i,j,k}(y, x)) \right]$$

Calculation of emissions using a technology based emission factor approach **consistently** applied to all world countries.

Emissions (EM) for a **country C** are calculated for each **compound x** on an **annual basis (y)** and **sector wise** (for **i** sectors).

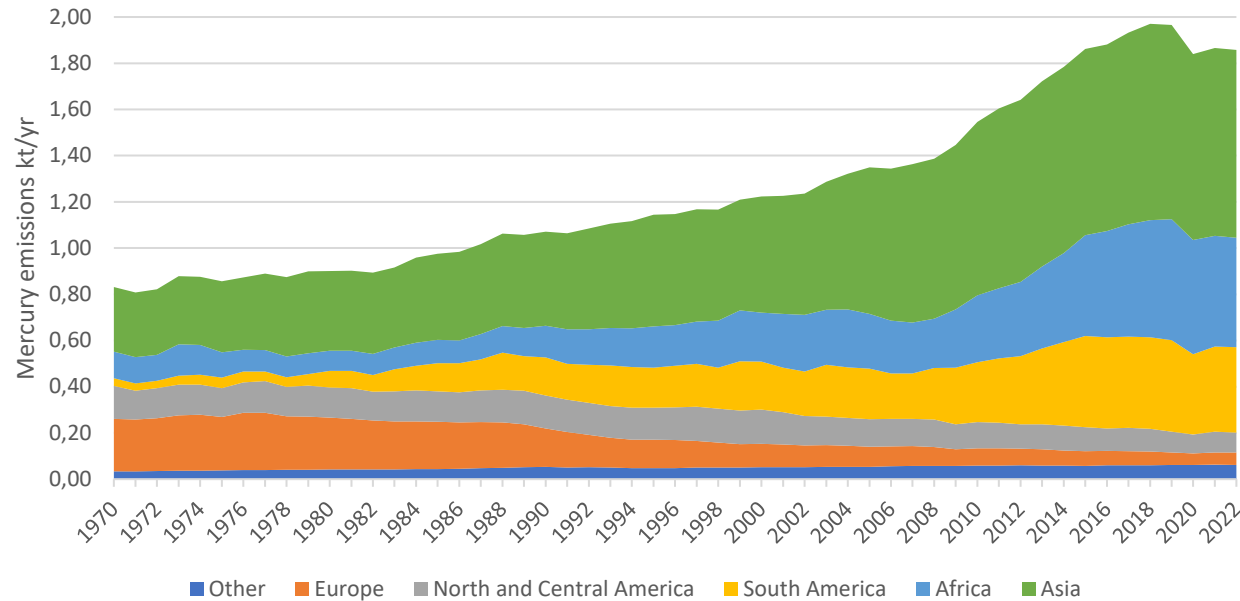
How:
by multiplying

- the country-specific **activity data (AD)**, quantifying the human activity for each of the **i sectors**, with the mix of **i technologies (TECH)** for each sector **i**, and with their **abatement percentage** by one of the **k end-of-pipe (EOP)** measures for each technology **j**
- the **country-specific emission factor (EF)** for each sector **i** and technology **j** with **relative reduction (RED)** of the uncontrolled emission by installed abatement measure **k**.



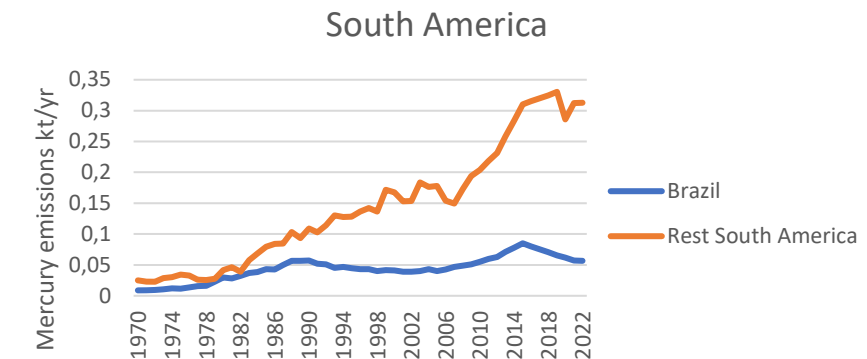
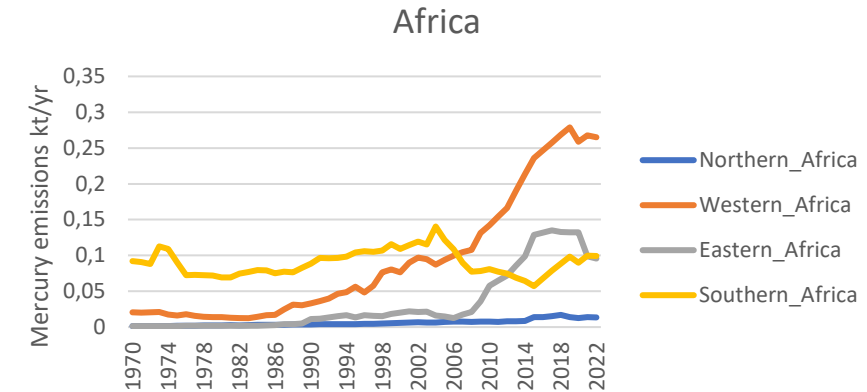
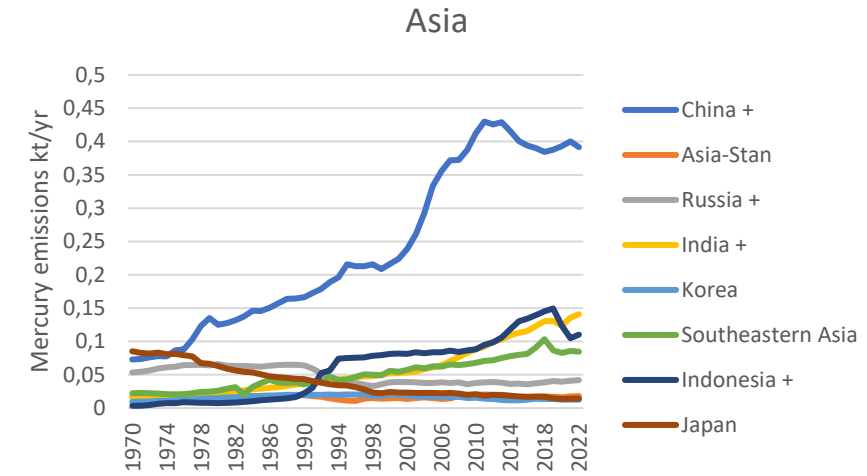
Trends: emissions by region

In 2022, **Asia** contributed to the total global mercury emissions by 44%, **Africa** by 22% and **South America** by 20%; since 1970, the emissions increased by 191%, 311% and 995% respectively.

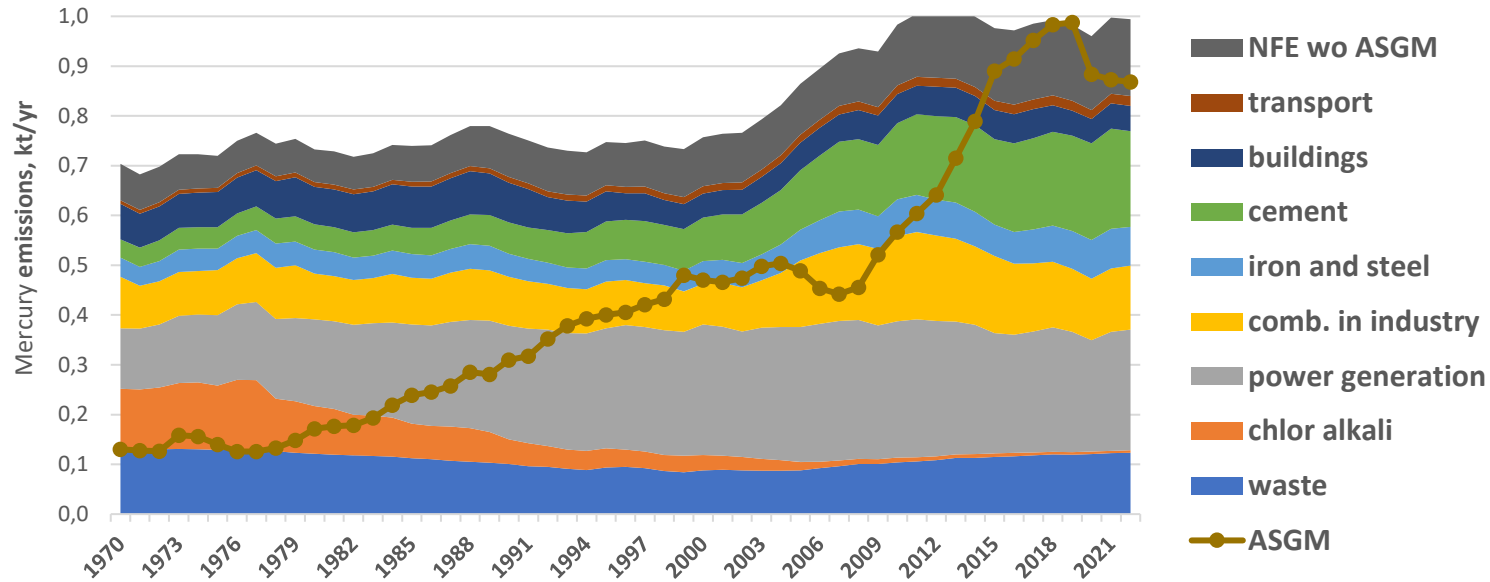


In **Europe** (3% share in 2022) and **North and Central America** (5% share in 2022), the mercury emissions decreased in the period 1970-2022 by 76% and 39% respectively.

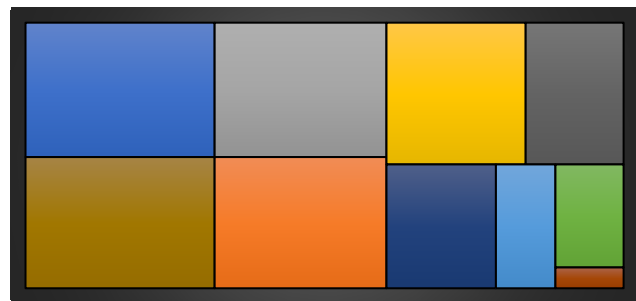
The graphs on the right illustrate the mercury emissions trends for some regions, as they are defined in the IMAGE model (Bouwman et al., 2006).



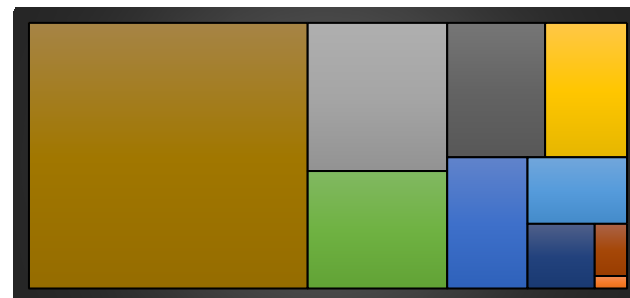
Trends: global emissions by sector



- **Chlor-alkali** with a share of 14% in 1970 decreased by 96%.
- **Power generation** sector contributed to the total global mercury emissions in 1970 by 15% and in 2022 by 13%; the emissions increased by 100% in this period.
- **Cement** production contributed by 4% in 1970 and by 10% in 2022; the emissions from this sector increased by 421%.
- **ASGM*** sector contributed to the total global mercury emissions in 1970 by 16% and in 2022 by 47%; the emissions increased by 567% in this period.



0.9 kt



1.9 kt

Mercury emissions share in 1970 by sector

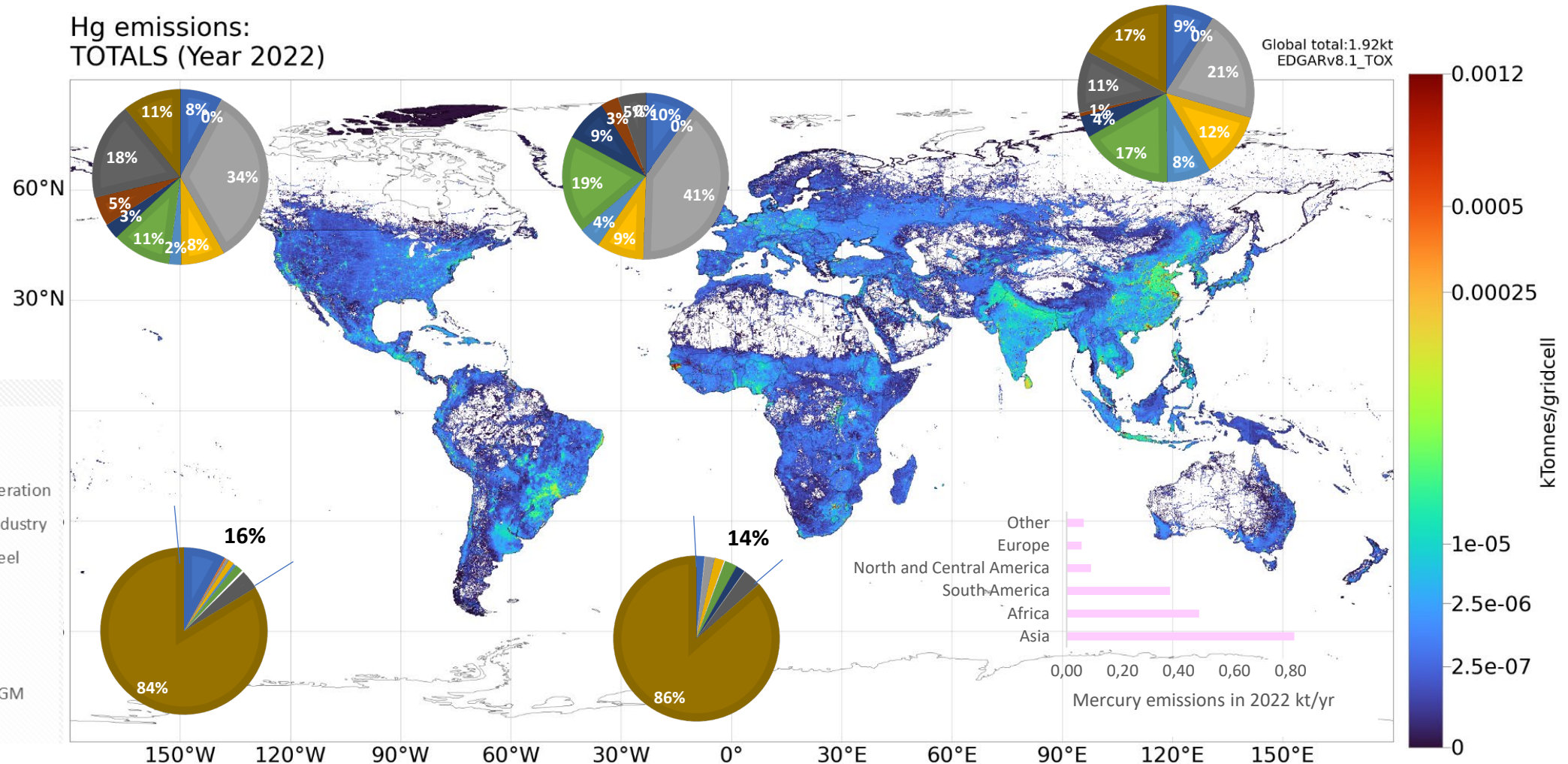
Mercury emissions share in 2022 by sector

*Next step: Reduce uncertainty

Refinement of emissions estimation in EDGAR is foreseen for ASGM based on more reliable data from official national reporting to the Minamata Convention.

Hotspots and sectorial contribution in 2022

Hg emissions:
TOTALS (Year 2022)



Top emitters: shift of key emitting sources over five decades

Location: from developed to emerging economies, ASGM



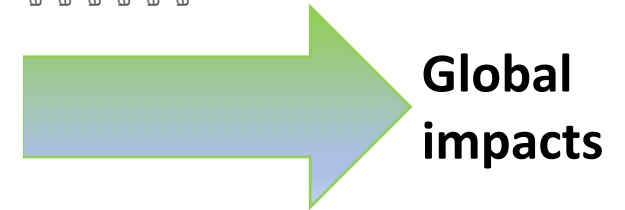
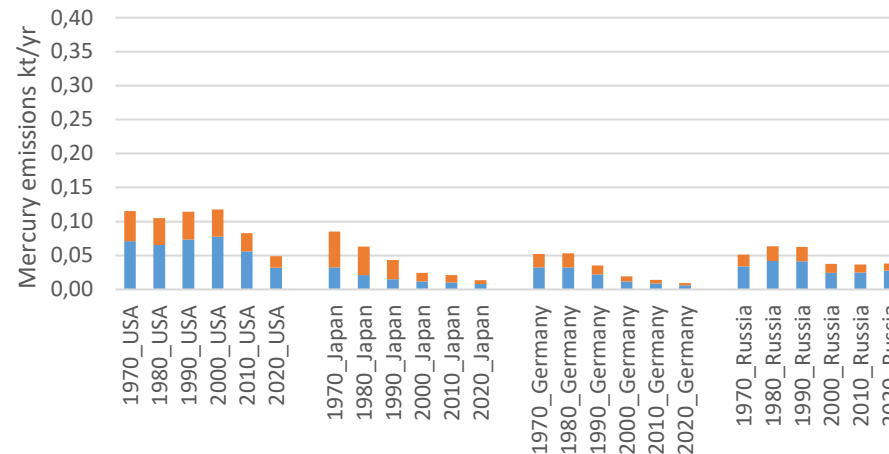
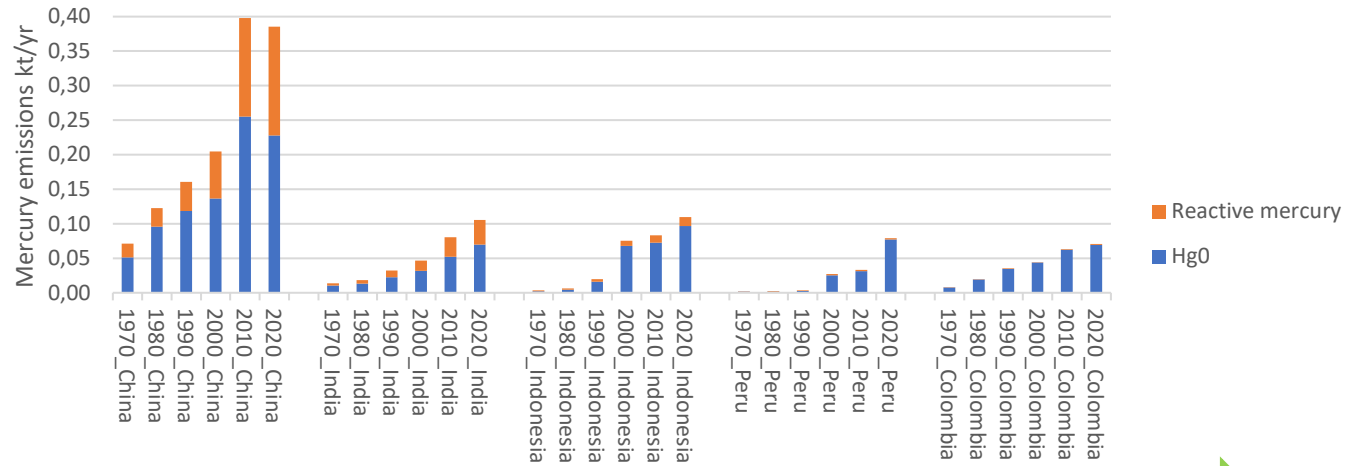
Magnitude: phasing out of chlor-alkali, increases in ASGM



Composition: gaseous elemental mercury vs reactive mercury



Impacts: source shifting globally affects the magnitude and proportion of gaseous elemental mercury (Hg⁰) and reactive mercury (Hg-P, Hg²⁺) emitted in the atmosphere and as a result the local and long range impacts.



Global impacts



Contributors/Reference:

Muntean, Marilena; Crippa, Monica; Guizzardi, Diego; Pagani, Federico; Becker, William; Banja, Manjola; Schaaf, Edwin; Simonati, Andrea (2024): EDGAR v8.1 Global Mercury Emissions. European Commission, Joint Research Centre (JRC) [Dataset] doi: 10.2905/83b507d7-5218-4dc5-95f9-0ec36f073204 PID: <http://data.europa.eu/89h/83b507d7-5218-4dc5-95f9-0ec36f073204>

M. Muntean et al., Trend analysis from 1970 to 2008 and model evaluation of EDGARv4 global gridded anthropogenic mercury emissions, Science of the Total Environment, Vol. 494-495, 1 Oct.2014, pp. 337-350 (doi:10.1016/j.scitotenv.2014.06.014)

Muntean, M. et al., Evaluating EDGARv4.tox2 speciated mercury emissions ex-post scenarios and their impacts on modelled global and regional wet deposition patterns, Atmospheric Environment, 184, 56-68, doi:10.1016/j.atmosenv.2018.04.017, 2018.

Muntean, M. et al., 2024 (in preparation)

Data:

https://edgar.jrc.ec.europa.eu/dataset_tox81

Contact:

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Thank you

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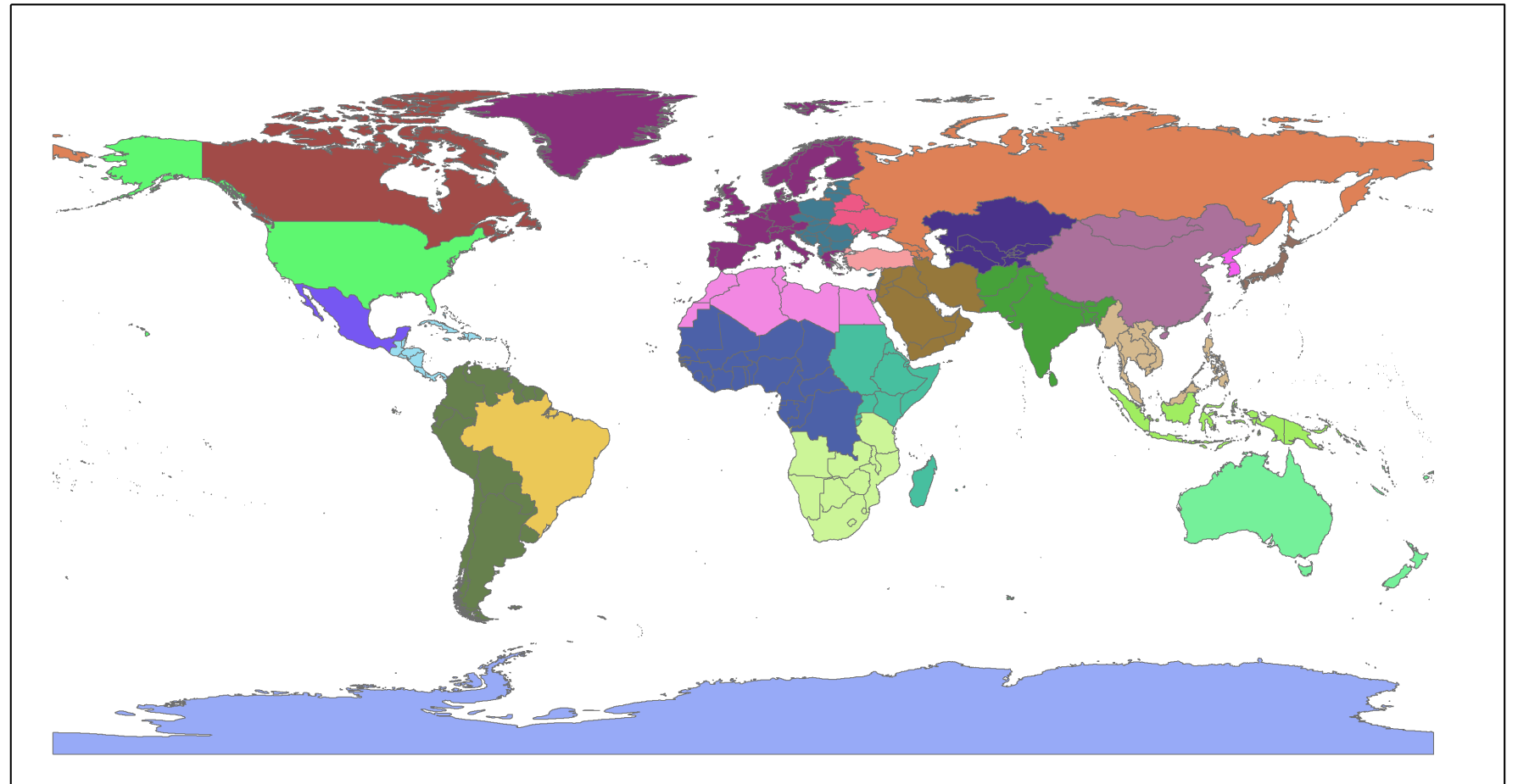
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














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The 24 world regions,
which are defined in the
IMAGE model.



IM24 Regions

 Canada	 Rest South America	 OECD_Europe	 Russia +	 Southeastern Asia
 USA	 Northern_Africa	 Central Europe	 Middle_East	 Indonesia +
 Mexico	 Western_Africa	 Turkey	 India +	 Japan
 Rest Central America	 Eastern_Africa	 Ukraine +	 Korea	 Oceania
 Brazil	 Southern_Africa	 Asia-Stan	 China +	 Antartica