UN Environment/AMAP Global Mercury Assessment

John Munthe, Simon Wilson, Eisaku Toda

+ all chapter authors

Timeline

- 2013: Mandate from UNEP Governing Council Decision 27/12, 2013 to "**...** to provide an update of the GMA 2013 within six years.."
- 2014 - 2015: Planning started….
- 2016: Expert meetings, workshops, forming author teams
- 2017 preparation and review of first drafts Technical Report, preparation of final drafts.
- 2018: Drafting of GMA summary report
- Finalise technical report
- 2018-11: Delivery of reports and products. Technical report + GMA

The Global Mercury Assessment 2018

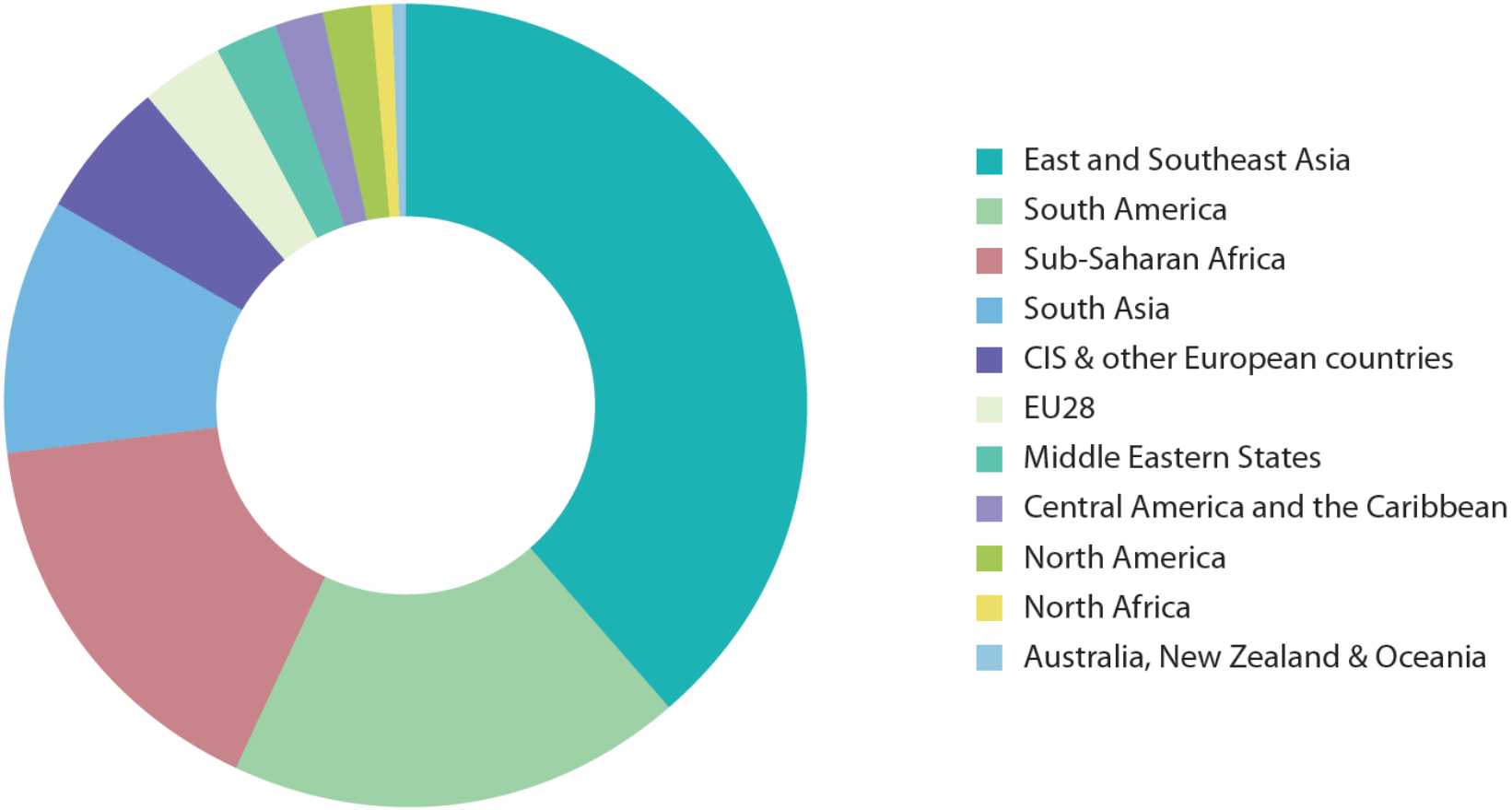
- The Global Mercury Assessment 2018 is the fourth assessment undertaken by UN-Environment, following earlier reports in 2002, 2008, and 2013, and the second produced by UN-Environment in collaboration with the Arctic Monitoring and Assessment Programme (AMAP).
- The assessment consists of a technical background document with chapters:
  1. Introduction and update on results global multimedia models
  2. **Emissions to air**
  3. **Assessment of recent air measurements, spatial and temporal trends in atmospheric Hg.**
  4. **Update on atmospheric modelling – source receptor analysis.**
  5. New calculations of releases of Hg to water – global and regional estimates
  6. Update on aquatic processes and chemistry, links to Hg in biota
  7. Assessment of available data on Hg in biota
  8. Assessment of available information on human biomonitoring, exposure of general population and vulnerable groups

Preliminary conclusions - The Global Mercury Assessment - general

- Environmental mercury loads are at levels of concern for ecological and human health around the world.
- All people are exposed to some amount of mercury - communities with dietary consumption of fish, shellfish, and marine mammals are most affected.

Atmospheric emissions of mercury from anthropogenic sources

Regional breakdown of global emissions of mercury to air from anthropogenic sources in 2015

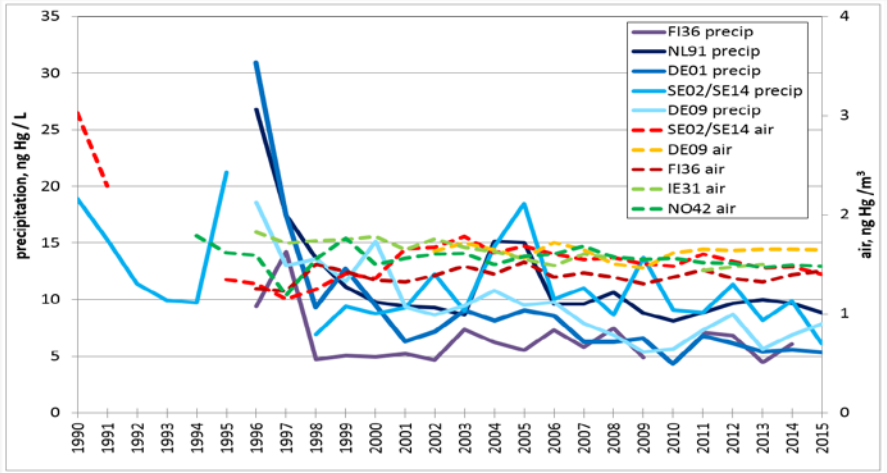


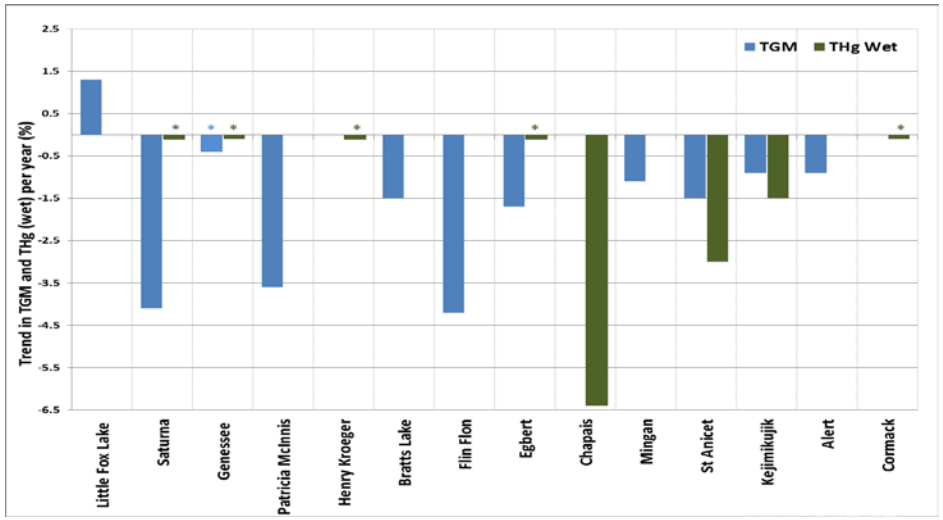
Preliminary conclusions – atmospheric emissions

- A new global inventory of mercury emissions (anthropogenic sources) in 2015, 20 key sectors.
- Estimated global emissions to the atmosphere are approximately 20% higher than in 2010.
  - Increases due to improved methodology and better availability of information
  - Some reductions due to actions to reduce emissions in North America and the EU.
  - Increases due to increased economic activity and use of mercury-added products elsewhere
- Emissions patterns: Asia> South America> Sub-Saharan Africa
- Main sectors: artisanal and small-scale gold mining, energy production (fossil fuels, biomass) and industrial emissions (non-ferrous metals, cement).
- Main uncertainties
  - Missing (small) soruces
  - Speciation of mercury in emissions (Hg^0, HgX_2, Hg(p)
  - Fate of emissions from artisanal gold mining

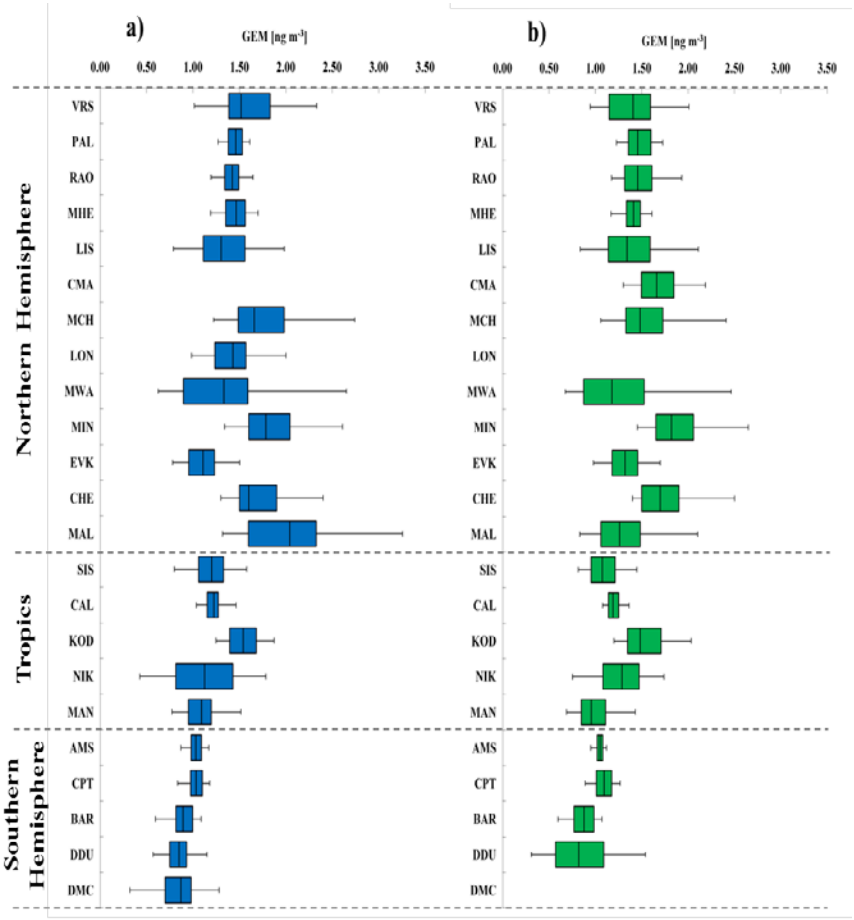
Atmospheric monitoring

Time series of mercury in air and precipitation at EMEP (top) and Canadian (bottom) stations





South-north trend in Hg from GMOS project (by latitude) in 2013 (left) and 2014 (right)

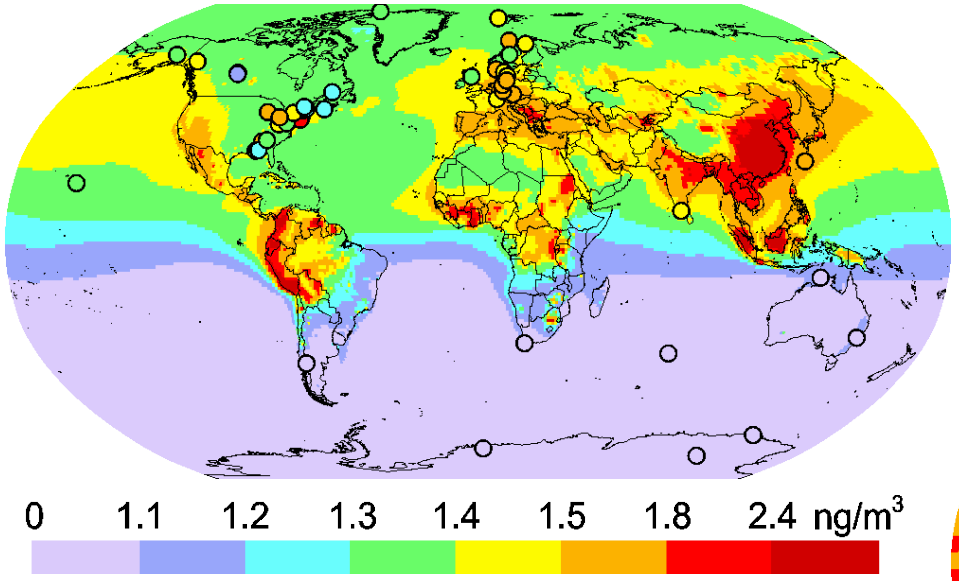


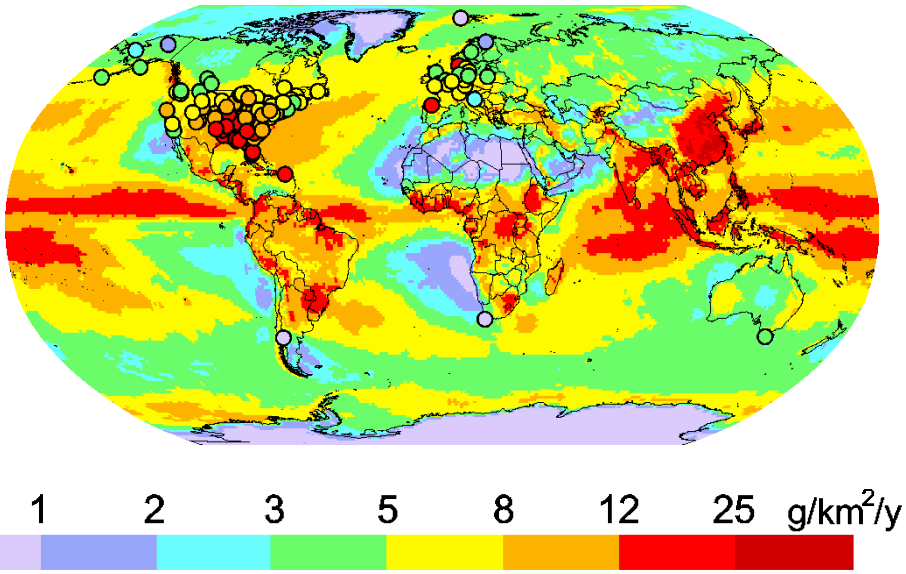
Preliminary conclusions – atmospheric emissions

- Mercury is monitored in many national and regional networks and in international projects
  - Comparability of global monitoring data (Total Gaseous Mercury, wet deposition) has improved – efforts in methods harmonisation, intercomparisons etc. – assessment of temporal and spatial trends is possible
  - Clear south to north trend with lower concentrations and deposition in the southern hemisphere
  - Generally a (slow) decreasing trend in US, Canada, Europe
- Main uncertainties
  - Geographical coverage - gaps in southern hemisphere
  - Monitoring mercury species – uncertaintes in methods (operationally defined), “high maintenance” necessary
  - Measurements of dry deposition
  - Global trends? Asia, southern hemisphere

Atmospheric transport - modelling

Model ensemble distributions of Hg^0 in surface air (left) and wet deposition flux (right) in 2015.





Preliminary conclusions – atmospheric transport, modelling

- The model ensemble median Hg^0 concentration agrees with observed values within ±20% at most of the measurement sites.
  - The scatter of simulated values among models <20%.
- Model-to-measurement difference is larger for wet deposition - good correlation ($r^2 = 0.7$) but overestimation of low and underestimation of high deposition fluxes.
  - Deviation < factor of 2 at the majority of measurement sites.
- Models can be used for source-receptor calculations, projections of expected effects of emission changes etc.
- Main uncertainties
  - Speciation – emissions and in atmosphere (monitoring)
  - Atmospheric chemistry – oxidation of Hg (OH, Br, O_3)- heterogeneous processes; reduction of HgX_2.
  - Dry deposition processes
  - Influence of climate change and legacy mercury pollution

Further questions

- Simon Wilson, s.wilson@inter.nl.net
- John Munthe, john.munthe@ivl.se