Global and regional emissions in the Copernicus Atmosphere Monitoring Service

Mark Parrington (mark.parrington@ecmwf.int)

Johannes Flemming, Richard Engelen, Anna Agusti-Panareda, Vincent-Henri Peuch, Gianpaolo Balsamo (ECMWF)

Vincent Huijnen (KNMI)
Accurate and timely estimates of source emissions are vital to operational forecasts of atmospheric composition and air quality.

Global fire emissions fluxes provided in NRT with Global Fire Assimilation System (GFAS).

Anthropogenic and other emissions fluxes provided by inventories.
CAMS requires consolidated and consistent emissions at global and regional scales.
- Emissions inventories are vital but are typically available 1-2 years behind NRT.

Future requirements for added value of inventories for NRT emissions monitoring need to take into account environmental and meteorological predictors and real time observations.
- Land-vegetation-carbon models for computing on-line emission fluxes of GHGs & NMVOCs.
- Temporal profiles of emissions for global and regional scales for optimal timing of emissions to improve, e.g., air quality forecasts.
- Parametrisations for anthropogenic emissions using weather-related information.
- Inverse modelling of emissions utilising satellite and in situ observations.
**Emissions currently used in CAMS**

Current operational system and **CAMS reanalysis (2003–present)**

<table>
<thead>
<tr>
<th>Reactive gases</th>
<th>Greenhouse gases</th>
<th>Aerosols</th>
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</thead>
<tbody>
<tr>
<td>• MACCity anthropogenic surface emissions.</td>
<td>• EDGAR version 4.2FT2010 anthropogenic surface fluxes.</td>
<td>• <strong>Online schemes for dust and sea-salt (driven by meteorology: wind speed, SST).</strong></td>
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<tr>
<td>• POET natural emissions from soils and oceans.</td>
<td>• <strong>CTESSEL online calculation of biosphere fluxes (including bias correction).</strong></td>
<td>• MACCity anthropogenic emissions of SO$_2$, BC and OM.</td>
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<tr>
<td>• MEGAN2.1 biogenic emissions (simulated off-line, climatological meteorology).</td>
<td>• Agusti-Panareda et al., Atmospheric Chemistry and Physics, 2014</td>
<td>• SOA emissions scaled to MACCity anthropogenic CO.</td>
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<tr>
<td>• Flemming et al., Geoscientific Model Development, 2015</td>
<td>• 3-D emissions of CO$_2$ from aviation (scaled to NO emissions).</td>
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<tr>
<td>• <strong>MEGAN2.1 biogenic emissions (simulated off-line, reanalysed meteorology).</strong></td>
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<tr>
<td>• MACCity &amp; ACCMIP 3-D emissions of NO from aviation.</td>
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<td>• [CMIP anthropogenic surface emissions for pre-industrial and present day.]</td>
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The Future of Operational Emissions

- **CAMS emissions developments.**
  - Consortium led by Claire Granier (LATMOS, OMP, TNO, MET Norway, CUNI, FMI, BSC, MPI-C, EAA, Chalmers – all represented at the GEIA conference) in conjunction with ECMWF and JRC.
  - Will start to address many of the future requirements for operational emissions provision.

- **The CO$_2$ Human Emissions (CHE) project.**
  - Led by ECMWF to design and develop a European Operational Anthropogenic CO$_2$ Emissions Monitoring & Verification Support Capacity.
  - Reconcile top-down and bottom-up estimates of CO$_2$ and co-emitted species.
  - Attributing CO$_2$ emissions from in-situ measurements.
  - Requirements for future CO$_2$ emission monitoring from space (Sentinel-7?).
Emissions in the CAMS global production system

http://atmosphere.copernicus.eu/

Analyses and forecasts from 7 European regional air quality models

http://macc-raq-op.meteo.fr/
The CO₂ Human Emissions project is a H2020 CSA project supporting the European Commission and its expert Task Forces to design and develop a European Operational Anthropogenic CO₂ Emissions Monitoring & Verification Support Capacity.

- Reconciling top-down and bottom-up estimates
- Library of simulations for emissions and atmospheric transport
- Uncertainty trade-off for fossil fuel emissions
- Attributing CO₂ emissions from in-situ measurements
- Towards a prototype of a European anthropogenic emission monitoring system (CO2 & co-emitted species)
- International Stakeholder Coordination and Liaison
- Project Management, Dissemination and Communication