

Global emission estimates for GHG
within the EU EVERGREEN project
(EnVisat for Environmental
Regulation of GREENhouse gases)*

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Work on 'inventories of baseline 1990 and 2003 greenhouse gas (GHG) emissions' is being undertaken as part of the EVERGREEN (EnVisat for Environmental Regulation of GREENhouse gases) project, funded under the EU 5th Framework programme. The main objective of this part of the EVERGREEN work is to review available information pertaining to global emissions inventories of CO₂, CH₄ and CO for the years 1990 and 2003 (or the nearest available year) (12 months of the ENVISAT mission), and to compile datasets on GHG emissions that can be used by other groups involved with project components concerning modeling, etc. The desired spatial and temporal resolution is 1x1 degree, and monthly whenever possible.

A number of the currently available global databases have been considered, including relevant IGBP GEIA (Global Emission Inventory Activities) datasets, the EDGAR 3.2 database on anthropogenic emissions produced by the group at RIVM in the Netherlands, datasets published by the UNFCCC/IPCC, and those compiled within the EU POET project. Most of these databases deal with emissions from anthropogenic activities and/or emissions from biomass burning associated with agriculture, etc. In addition, recent work on emissions from biomass burning (e.g. [1, 2]), and CO₂ fluxes from oceans [3] has been incorporated.

Data on anthropogenic emissions are typically compiled at the national level, using appropriate emission factors for various sectoral activities and source types. With respect to the emissions inventories for recent years in particular, the available databases are generally incomplete, and work has been undertaken within EVERGREEN to evaluate and in some cases fill the gaps in, for example, the UNFCCC datasets.

For modelling purposes, national emission totals are not sufficient, and spatially distributed (gridded) emissions datasets are required. These rely on the

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availability of 'maps' that can represent the spatial distribution of the source sectors/activities concerned. In most cases these maps do not exist and 'proxy' or 'surrogate' datasets are used. The most comprehensive efforts to date to produce spatially distributed (gridded) datasets for anthropogenic GHG emissions are those carried out under the EDGAR initiative. Surrogate datasets such as population distribution maps are used to represent the distribution of source sectors associated with certain human activities (waste disposal, industrial activities, etc.), and agricultural/land-use maps to represent or estimate the locations of emissions associated with agricultural sources (rice cultivation, emissions from cattle, etc.). The EDGAR project has so far produced gridded emissions datasets for 1990 and 1995, datasets for 2000 are however not yet available.

Under the EVERGREEN work, as a first estimate of anthropogenic emissions for 2000, a series of projected datasets for emissions of CO₂, CO and CH₄ were derived by extrapolating the trends in the 1990-1995 EDGAR gridded datasets - Figure 1 shows the results for CO₂. A clearer picture of the changes in the estimated emissions between 1990 and 2000 is shown in Figure 2, where differences between cell estimates for 1990 and 2000 emissions of CO₂, CO and CH₄ are calculated.

Using a similar approach, UNFCCC (national) emissions data for 1990 and 2000 have also been mapped according to spatial distributions employed in the EDGAR 1990 gridded datasets. EDGAR project work included an evaluation of the uncertainties associated with their anthropogenic emission estimates and spatial distribution methods. In the EVERGREEN work, GIS tools have additionally been employed to compare dataset derived from different sources (e.g. EDGAR vs. UNFCCC datasets), for example to identify issues requiring further investigation.

Fire and burnt areas distributions, obtained from satellite remote sensing, have been used by various groups (e.g., [1, 2]) to develop spatially distributed datasets for emissions from biomass burning sources. These are also temporally resolved (to yield monthly, gridded datasets). In this context, biomass burning includes emissions from deforestation, savanna burning, agricultural waste burning, and (temperate) vegetation fires, and not biomass fuel consumption (e.g., wood, straw burning in ovens and boilers).

Within the emissions datasets that have been produced (Figure 1), emissions from individual sectors distinguished under the EDGAR project are identified. It will therefore be a relatively simple matter to replace the annual emissions estimates for biomass burning sectors that are currently defined in the 2000 datasets with monthly resolved biomass burning emissions datasets, when the work on these has been completed.

In a similar manner, it is hoped that the gridded datasets for additional natural sources, such as those produced in the work by [3] can be provided to the modellers working on the EVERGREEN project.

Inaccuracies in emission estimates and differences in global emission datasets need to be considered taking into account the following aspects: availability and completeness of global emissions datasets for the years 1990 and 2000/2003, the fact that global emission inventories are mostly based on models rather than measurements (see especially biomass burning and emissions from the ocean), uncertainties in (economic) activity data and emission factors for GHGs, and the fact that spatial distributions of source sectors/activities use 'proxy' or

'surrogate' datasets for development of gridded emission maps.

References

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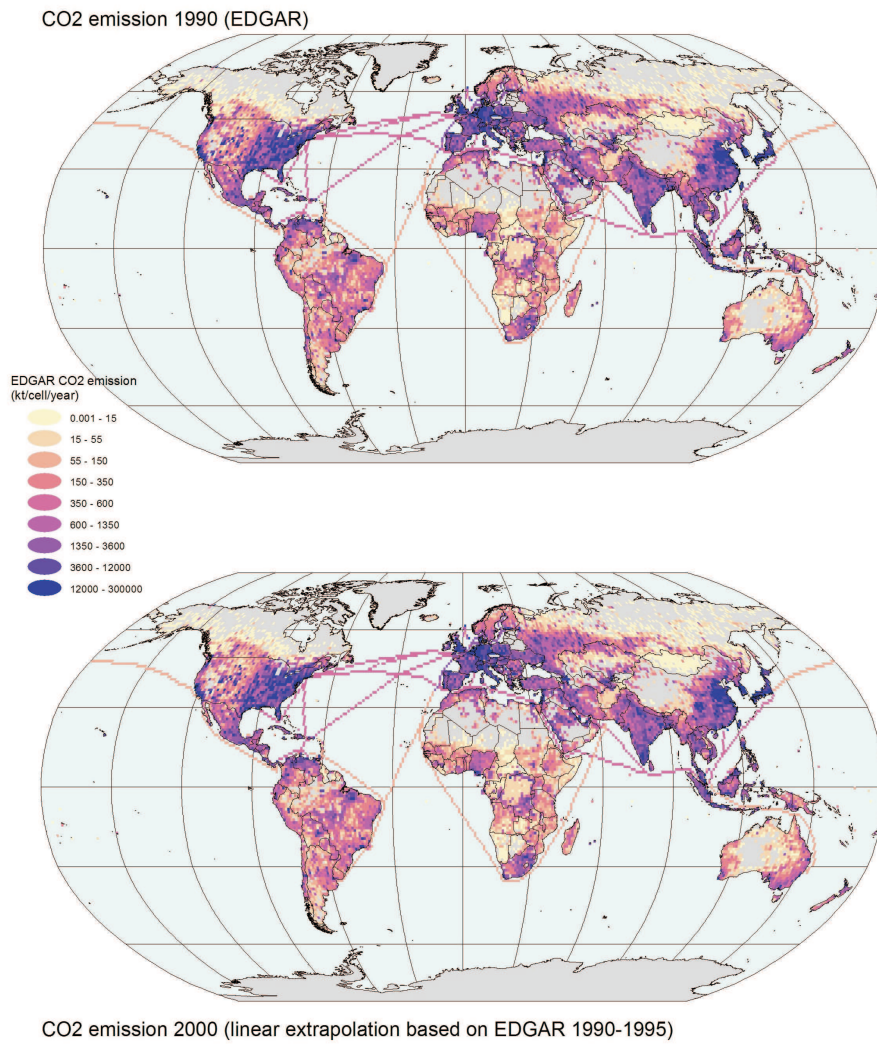


Figure 1: Spatially distributed CO₂ emission estimates for 1990 (EDGAR 3.2) and 2000 (EVERGREEN - based on projection of EDGAR 1990-1995 trends) for all sectors combined.

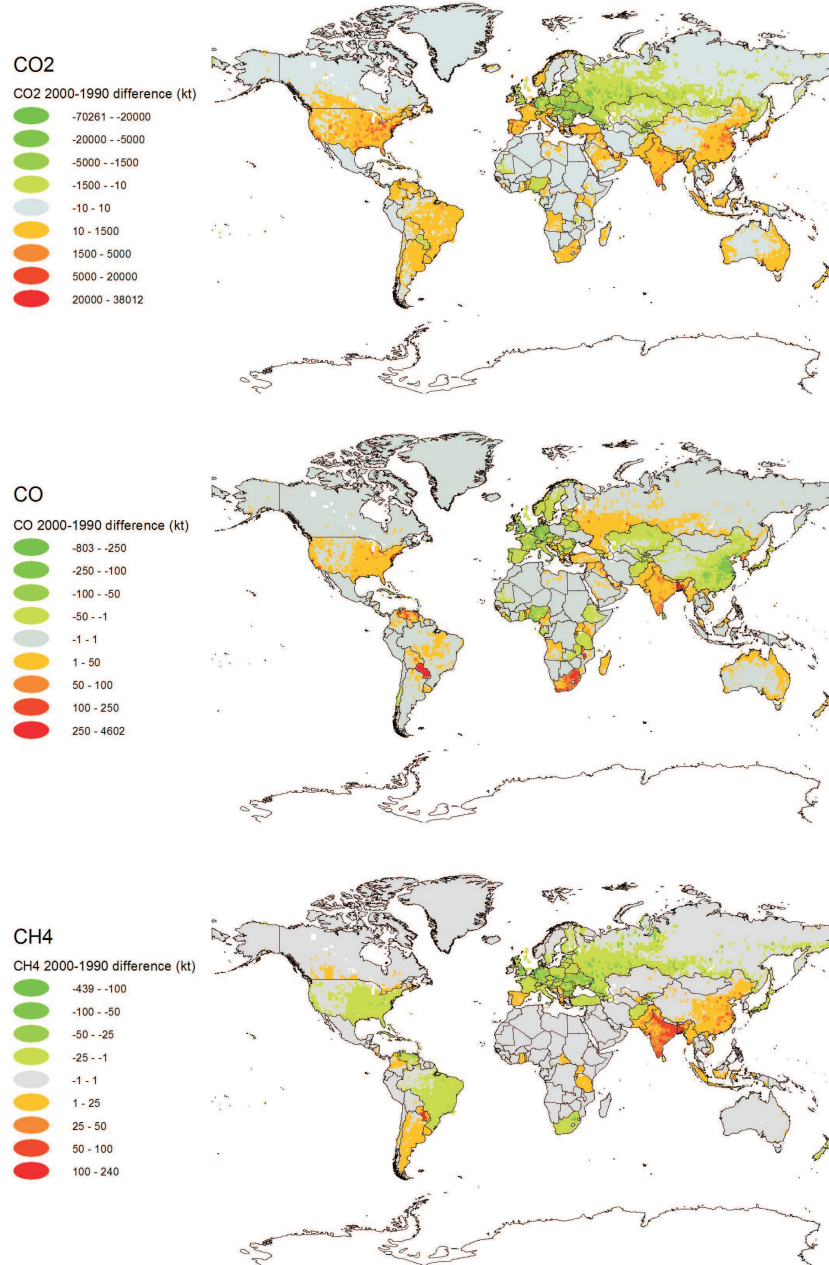


Figure 2: Changes in estimated emissions of CO₂, CO and CH₄, 1990 to 2000 (green shades imply reductions, red shades imply increased emissions).