

EGU2020-10560

<https://doi.org/10.5194/egusphere-egu2020-10560>

EGU General Assembly 2020

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Anthropogenic CO₂ emission uncertainties

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The CO₂ Human Emissions (CHE) project has been tasked by the European Commission to prepare the development of a European capacity to monitor anthropogenic CO₂ emissions. The monitoring of fossil fuel CO₂ emissions has to come with a sufficiently low uncertainty in order to be useful for policymakers. In this context, the main approaches to estimate fossil fuel emissions, apart from bottom-up inventories, are based on inverse transport modeling either on its own or within a coupled carbon cycle fossil fuel data assimilation system. Both approaches make use of atmospheric CO₂ and other tracers (e.g., CO and NO_x) and rely on the availability of prior fossil fuel CO₂ emission estimates and uncertainties (as well as biogenic fluxes for the transport inverse modeling). For a robust estimate of the uncertainty, information from different sources needs to be brought together.

A methodology to calculate yearly and monthly anthropogenic CO₂ emission uncertainties based on IPCC guidelines (2006 IPCC Guidelines for National Greenhouse Gas Inventories + its 2019 Refinements) has been developed. Emission uncertainties are calculated for all world countries, under the assumption of two categories of world countries, depending on whether the country's statistical infrastructure is well or less developed. For well-developed statistical infrastructure, emission uncertainties are lower, while less developed statistical infrastructure countries have higher emission uncertainties. A sensitivity analysis is investigating the impact of the well or less developed infrastructure assumption for several countries on the global emission uncertainty. Sensitivity experiments with different anthropogenic CO₂ sources distributions, as well as the first results on using these prior anthropogenic CO₂ uncertainties in ensemble perturbation runs will be presented.