

Statistical Dependences in Input Data of National GHG Emission Inventories: Effects on the Overall GHG Uncertainty and Related Policy Issues

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Abstract

The uncertainty of the national Austrian greenhouse gas inventory was assessed for a second time after 7 years. Repeating the exercise allowed to collect further knowledge on the inherent principles of uncertainty combination as applied to emission inventories. As has been discussed in several previous studies, the advantages of the more complex “Monte-Carlo” approach to the simpler “error propagation” method are the possibility to consider virtually any potential probability density distribution, and the option to cover partial as well as total statistical dependence of input parameters. The present study focused on the extent to which input parameters could be considered independent. For several cases it could be shown that both activity as well as emission factor inputs of groups of IPCC source categories depend of each other. This is the case when information obtained at less detail is to be considered more precise than on very detailed information, typical for situation where budgets are assessed (like an energy balance). Also, when emission factors may be traced to a small number of original data (N₂O), or uncertainty derives from few, connected assumptions on the available sets of measurements (CH₄), parameters should not be considered independent. As soon as statistical dependence concerns more than one source category, the IPCC default approach to assess and combine uncertainties is not able to cover this dependence, and will underestimate overall uncertainty. In the case of Austria, an underestimation of almost a factor of 2 (3.6% uncertainty instead of 6.1% derived from the Monte-Carlo approach) occurred for the inventory of the year 2005. It can be shown that such a difference is not necessarily limited to the approach taken, but can likewise occur when statistical dependence is being interpreted in a different way also in the Monte-Carlo approach. Understanding that dependence exists necessarily means to also accept that uncertainty figures for individual source categories can not be used to be combined to a total uncertainty – or, in other words, these sectoral uncertainties may appear too low when considered (or compared) individually. This has consequences on the policy aspects of inventory uncertainties, in terms of prioritization of work as well as assigning responsibilities of inventory improvement.