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Development of a prototype global CO_2 emissions monitoring system for the European Union: The CO_2 Human Emission (CHE) project

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The CHE project consortium, which consists of 22 European partners, aims to coordinate efforts towards the development of a European system to monitor global anthropogenic CO_2 emissions. The objective is to deliver a proof of concept system which, given planned and potential future Earth observation missions consisting of a constellation of satellites and an expanded ground-based measurement network, can provide constraints on anthropogenic CO_2 emissions at spatial and temporal scales relevant to policy-makers in support of the implementation of efficient climate change mitigation strategies.

Here, a prototype design overview is presented, which integrates the components of a proposed Earth observation monitoring system relying on bottom-up (prior emission inventory) and top-down (atmospheric measurements) constraints. Uncertainties in the prior emissions and model transport are carefully analysed as a necessary prerequisite to characterize the information content of the inversion system. A hybrid method appropriate for global CO_2 inversions is outlined, which builds on the existing infrastructure of the Integrated Forecast System (IFS) at ECMWF and combines information from both an ensemble of CO_2 simulations and an adjoint-based approach. Early stage preliminary results from the ensemble component of this system are provided, and the main scientific and technical challenges toward building an operational CO_2 emission monitoring system are discussed together with potential solutions.