



## **HERMESv3: an open source and stand-alone multiscale atmospheric emission modelling framework**

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We present the High-Effective Resolution Modelling Emission System version 3 (HERMESv3), an open source, parallel and stand-alone multiscale atmospheric emission modelling framework that computes gaseous and aerosol emissions for use in atmospheric chemistry models. HERMESv3 is coded in Python and consists of a global\_regional module (HERMESv3\_GR) and a bottom\_up module (HERMESv3\_BU). Here we describe the HERMESv3\_GR module, a highly customizable emission processing system that calculates emissions from different sources, regions and pollutants on a user-specified global or regional grid. The user can flexibly define combinations of existing up-to-date global and regional emission inventories and apply country specific scaling factors and masks. Each emission inventory is individually processed using user-defined vertical, temporal and speciation profiles that allow obtaining emission outputs compatible with multiple chemical mechanisms (e.g. CB05, RADM2). The selection and combination of emission inventories and databases is done through detailed configuration files providing the user with a widely applicable framework for designing, choosing and adjusting the emission modelling experiment without modifying the HERMESv3\_GR source code. The emission core module of HERMESv3\_GR is parallelized using a domain decomposition strategy, which allows decreasing execution time and memory consumption. The generated emission fields with HERMESv3\_GR have been successfully tested in different atmospheric chemistry models (e.g., CMAQ, WRF-Chem and NMMB-MONARCH) at multiple spatial and temporal resolutions. The execution of HERMESv3\_GR can be combined with the HERMESv3\_BU module, an emission model that estimates emissions at the source level (e.g. road link, industrial facility, crop type) and hourly level combining state-of-the-art and bottom-up estimation methods with local activity and emission factors along with meteorological data.