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Combination of CTM and Emission Preprocessor – Development, Advantages and Application

Sarah-Lena Seemann, Nikos Daskalakis, Mihalis Vrekousis

IUP

Email: sarah-lena.seemann@uni-bremen.de

Atmospheric model are key tools in environmental science. Validated by measurements, they can be used to evaluate and improve our knowledge, but more essentially, enable the exploration of scenarios and their potential impacts.
Chemistry and Transport Models (CTMs), like TM5-MP [Williams et al. 2017], rely on emission inventories to describe global pollutant sources, and estimate atmospheric composition. Having up-to-date emission inventories included in the CTM, as well as altering them to investigate different scenarios can be a very time-consuming task, especially challenging for new modelers, since in-depth knowledge of the used model and the programming language it is written in is required.
Including an emission preprocessor, such as the High-Elective Resolution Modelling Emission System version 3 for global and regional models (HERMESv3_gr) [Guevara et al. 2019], to TM5-MP simplifies this tasks and reduces the preparation time.

In this seminar will show the advantages of combining TM5-MP and HERMESv3_gr [Seemann et al., 2024] by examining the atmospheric impacts of transitioning from combustion engine cars to electric ones [Seemann et al, in preparation]. To investigate how reduced traffic-sector emissions and increased energy-sector emissions associated with electric cars adoption affect atmospheric composition, two hypothetic worlds were created, each one with its own, fictional, emissions. In the first world (control), electric cars were never invented, and as a result, all cars are operating with
combustion engines. In the second world, electric cars were invented, resembling -to an extent- our own world. Both worlds, or emission scenarios, span from January 2013 to December 2020, taking real-world data into account for producing the emission scenarios, using HERMESv3_gr. The results of major air pollutants (CO, NOx and O3) show a strong dependency on underlying sectoral emissions, geographical region and altitude.

References

Guevara, M.; Tena, C.; Porquet, M.; Jorba, O. & Garca-Pando, C. P. (2019). *HERMESv3, a stand-alone multi-scale atmospheric emission modelling framework – Part 1: global and regional module,* Geoscientific Model Development 12 : 1885-1907.

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Williams, J. E.; Boersma, K. F.; Sager, P. L. & Verstraeten, W. W. (2017). *The high-resolution version of TM5-MP for optimized satellite retrievals: description and validation*, Geoscientific Model Development 10 : 721-750