#### TM5-MP meets HERMESv3\_GR Elect and scale emissions for TM5-MP using HERMES

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## Motivation

• Modify emissions in TM5-MP is not easy to access due to the inclusion of emission in the source code

 Combining TM5-MP with HERMESv3\_GR, an emission election framework, this process should be made easier, faster and more user friendly





- What is HERMESv3\_GR
- The Project
- Future workflow
- Current status of project
- Future Plans



## What is HERMESv3\_GR?

- High-Elective Resolution Modelling Emission System version 3 (HERMESv3)<sup>[1]</sup>
  - Consist of:
    - 1) global\_regional module (\_GR) used in this project
    - 2) bottom-up module (BU)
  - Can be used together or independently

• HERMES = HERMESv3\_GR during this talk

[1] Guevara et al., 2019, https://doi.org/10.5194/gmd-12-1885-2019



## What is HERMESv3\_GR?

• Open source Framework to prepare emissions for different models (so far WRF-CHEM, CMAQ and MONARCH)

- Combine data from different inventories with individual profiles (vertical, temporal, speciation)
- Get data suitable for target model (e.g. spatial resolution)
- Apply country-specific masks and scaling factors







#### Add TM5-MP as possible option in HERMES







Add TM5-MP as possible option in HERMES

Develop TM5-MP to read external emission data







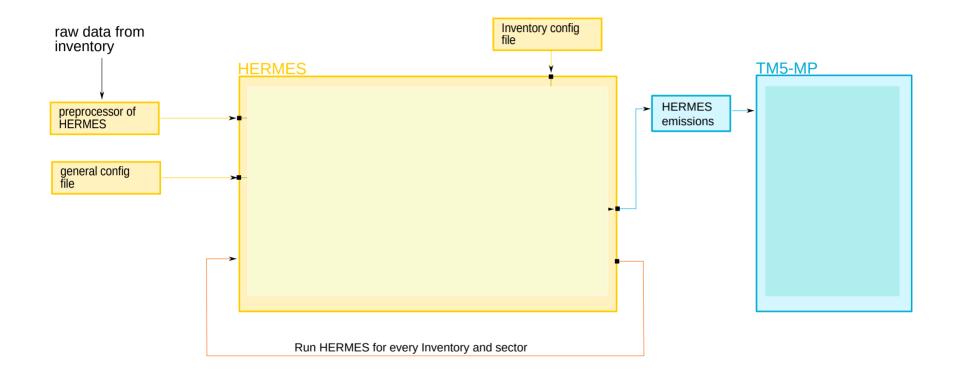
Add TM5-MP as possible option in HERMES

Develop TM5-MP to read external emission data

Use TM5-MP + HERMES in case studies



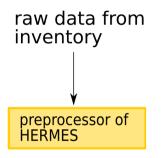






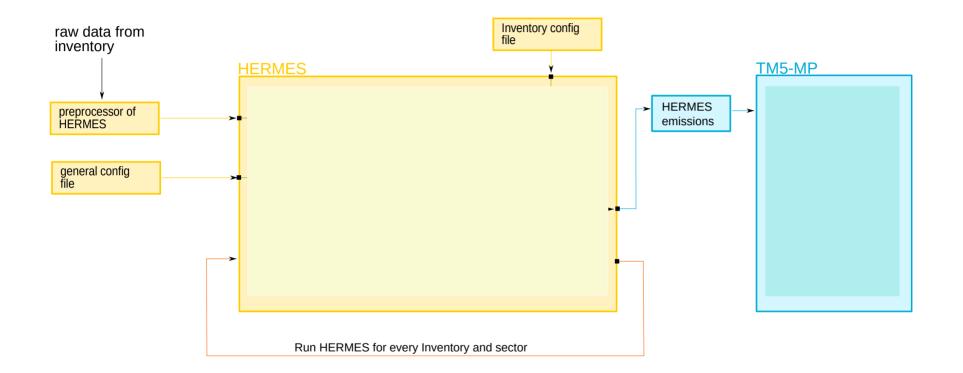






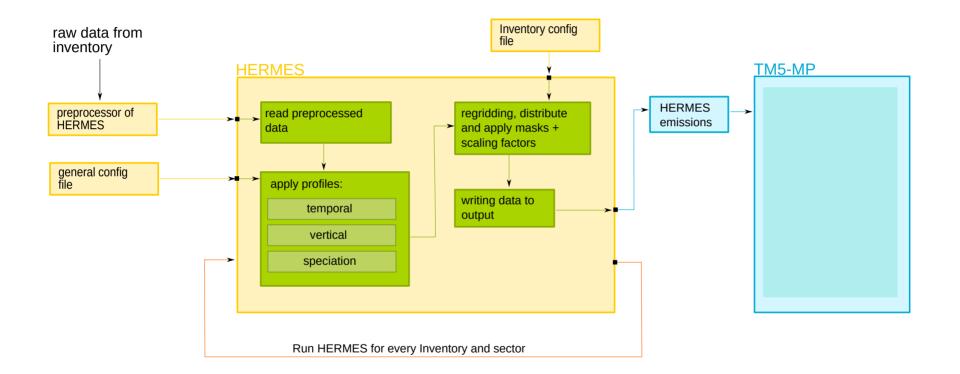
- Most used inventories already included
- Default: CEDS, EDGAR, GFED4
- Already written: CMIP6 future, MEGAN
- To do: LPJ, HYMN











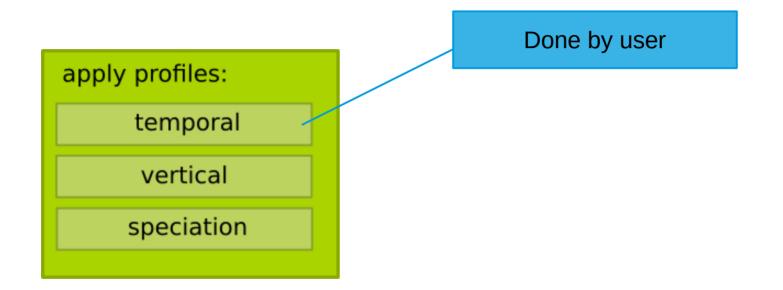






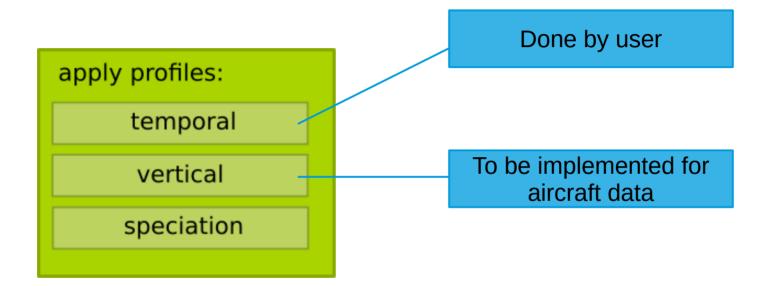






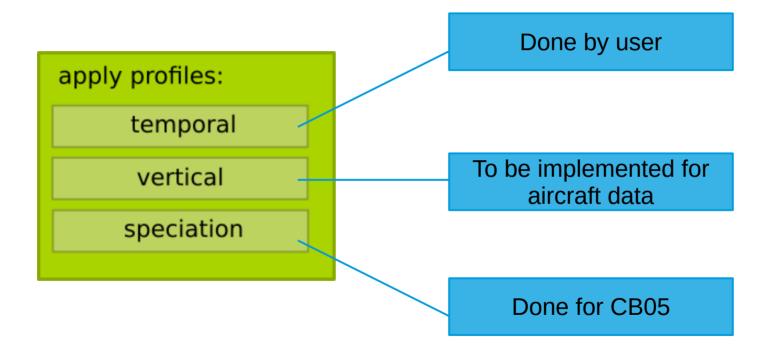
















#### • Profiles are given in separate CSV-Files

1 ID;BC;CH4;C0;NH3;POM;SOX;NOX;DMS;ISOP;Terp;PAR;ETH;OLE;ALD2;MGLY;CH20;CH3OH;HCOOH;MCOOH;C2H6;ETHOH;C3H8;C3H6;Acetone

2 units;kg.s-1.m-2;kg.

s short\_description; black\_carbon; methane; carbon; monoxide; ammonia; particular organic matter; sulfure oxides; nitrogen oxides; dimethyl sulfide; isoprene; terpenes; par; eth; ole; ald2; mgly; ch2o; ch2oh; hcooh; c2h6; ethoh; c3h8; c3h6; acetone

1 E006; hc; ch4; co; hh3; oc; so2; nox\_no2; 0; 0; 0; 3.978963660362539\*voc04+4.991202341158007\*voc05+7.473417163633117\*voc06+0.9991399657817943\*voc09+2.7874017059149208\*voc12+0.9991616123352052\*voc13+1.0988173488799988\*voc15+2.097750839844644\*voc16+2.663389664 5973096\*voc17+3.1934364221567897\*voc18+2.6220674123626795\*voc19+3.045449670036612\*voc20+1.7230430823026328\*voc22+1.0612223044660667\*voc25; 0.9980786985053771\*voc07; 0.9948073248606502\*voc12; 1.0135429613312035\*voc29; 0.3906423985118754\*voc15+0.3992 792502759705\*voc16+0.3942977329669232\*voc17; 0.9991224374590983\*voc21; 1.2976657523494994\*voc01; 0.642031889476229\*voc24; 0.4920677877441072\*voc24; 0.9976820520324445\*voc02; 0.1002841400481873\*voc01; 0.9978082235271839\*voc03; 0.9524533042759483\*voc0 8; 1.2964820752623794\*voc23

- Profile 'E006' gives conversion from CMIP6 emissions to CB05 species (mole based)
  - Factors for NMVOCs based on factors in emission\_read.F90
- Next: Regrid and apply masks and write to output





- Writers format the output for the destination model
- Structure is based on existing writers

writing data to output

• additional transformation to kg/s(m<sup>2</sup>) applied

- Also useful meta data has to be included
  - Suggestions are very welcome







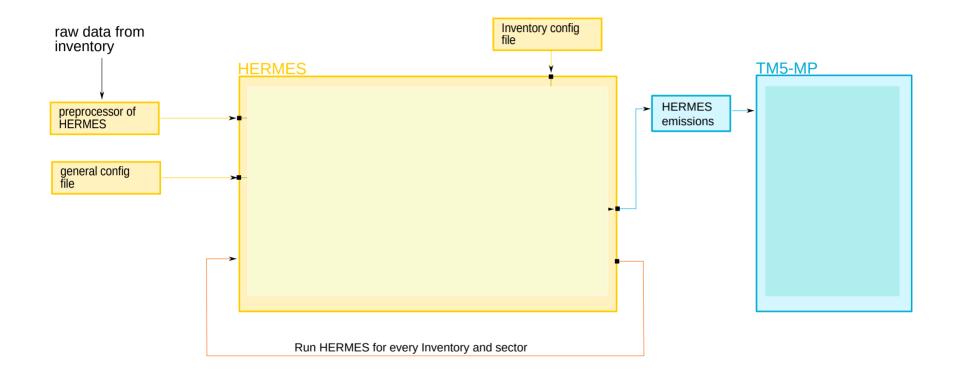
• First tests were successful:

The summed mass for every species from HERMES output (scaled to 1 month) is the same as the mass/month for each species given in TM5-MP log-file

• Able to create output suitable for TM5-MP

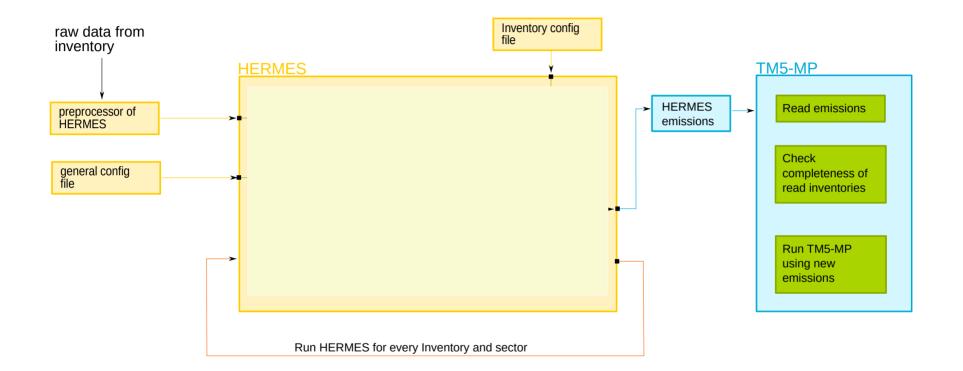
















## Summary

• TM5-MP should read emission files prepared by HERMES

 So far first TM5-MP ready output data can be created using HERMES





## Future plans

- Include HERMES output in TM5-MP
- Add missing preprocessors
- Include python script to run HERMES for TM5-MP

• Aim: First version end of 2021 ready to use

Case studies

## Thanks a lot for your attention

# Any question? Let me know!

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