LRTAP
Long-range Transboundary Air Pollution

Task Force on Hemispheric Transport of Air Pollution

TF HTAP - TFTEI Cooperation

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29 October 2021

2022-2023 Draft Work Plan

Global Emissions Inventory Development

- Complete updated HTAPv3 emissions mosaic (w/JRC, TFEIP) [1.1.4.4a]
- Incorporate emissions estimates for Heavy Metals and POPs (w/TFEIP, MSC-E) [1.1.4.4b]

Global and Regional Model Evaluation and Intercomparison

- Comparison of global ozone source attribution using tagging [1.1.3.3a]
- Intercontinental impact of marine shipping emissions (w/TFTEI, CIAM, MSC-W) [1.1.3.3b]
- Regional ozone response to global methane reduction (w/TFMM, MSC-W) [1.1.3.7]
- Air-surface exchange fluxes for Hg (w/MSC-E) [1.1.4.6]
- Source/receptor relationships for combustion-related POPs (w/TFMM, MSC-E, MSC-W) [1.1.4.7]

Global Scenario Assessment

- Development of Future Global Scenarios (w/CIAM, TFIAM, MSC-W, MSC-E) [1.1.4.3, 1.1.4.2]
    - To support analyses of the impact of air pollution and climate change mitigation policies on O3, PM, Hg, and combustion-related POPs
- Ozone benefits of methane mitigation inside and outside the Convention, including vegetation impacts (w/TFTEI, CIAM, ICP Veg) [1.1.4.3, 1.1.3.7, 1.3.2]
- Continued development of openFASST (w/JRC) [1.1.4.5]

Emerging Issues

- Long range transport of Chemicals of Emerging Concern (w/TFMM) [1.1.1.6]

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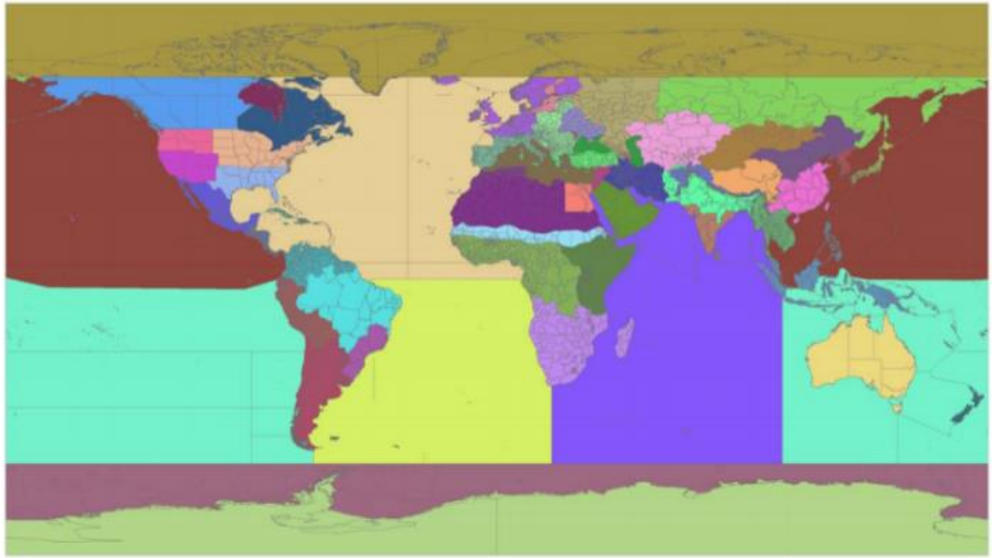
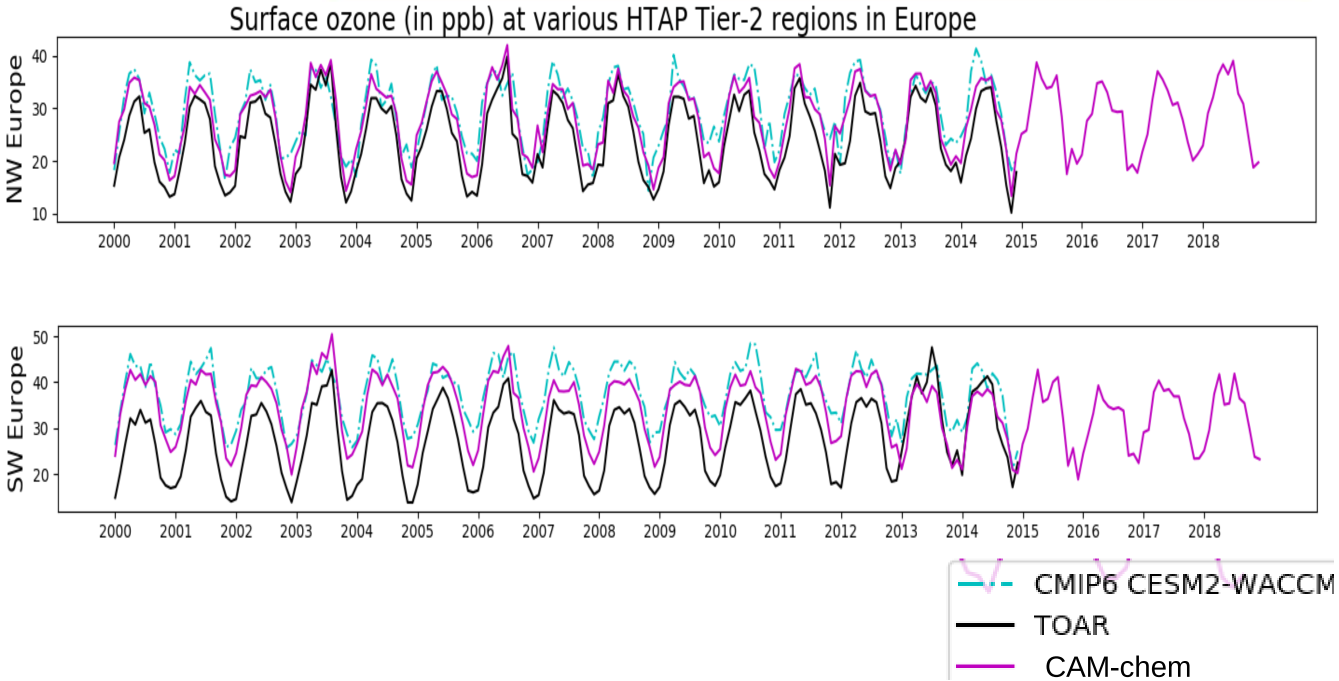
Impacts of Shipping (2020-2021 workplan: 1.1.4.4)

- **Transient model simulations from 2000-2018**
  - Comparison of ozone source attribution methods
    - Focus on shipping
  - HTAP2 continental source regions, higher detail in shipping source regions
  - CAMS-Global emissions
- **Status of runs:**
  - CAM-chem (IASS Potsdam) completed
  - ECHAM5-MESSy (DLR) in progress
  - EMEP Model (MSC-W) in progress
    - Will only simulate 2010 and 2018
    - Focus on sensitivity to changes in shipping NOx
- **CAM-chem:**
  - ~2x2 degree global simulation
  - Ozone tagging as in Butler et al. (2020)
    - Attribution of ozone to NO_x and VOC precursors
    - Two runs: NOx-tagged and VOC-tagged
    - https://doi.org/10.5194/acp-20-10707-2020
  - Results are preliminary!

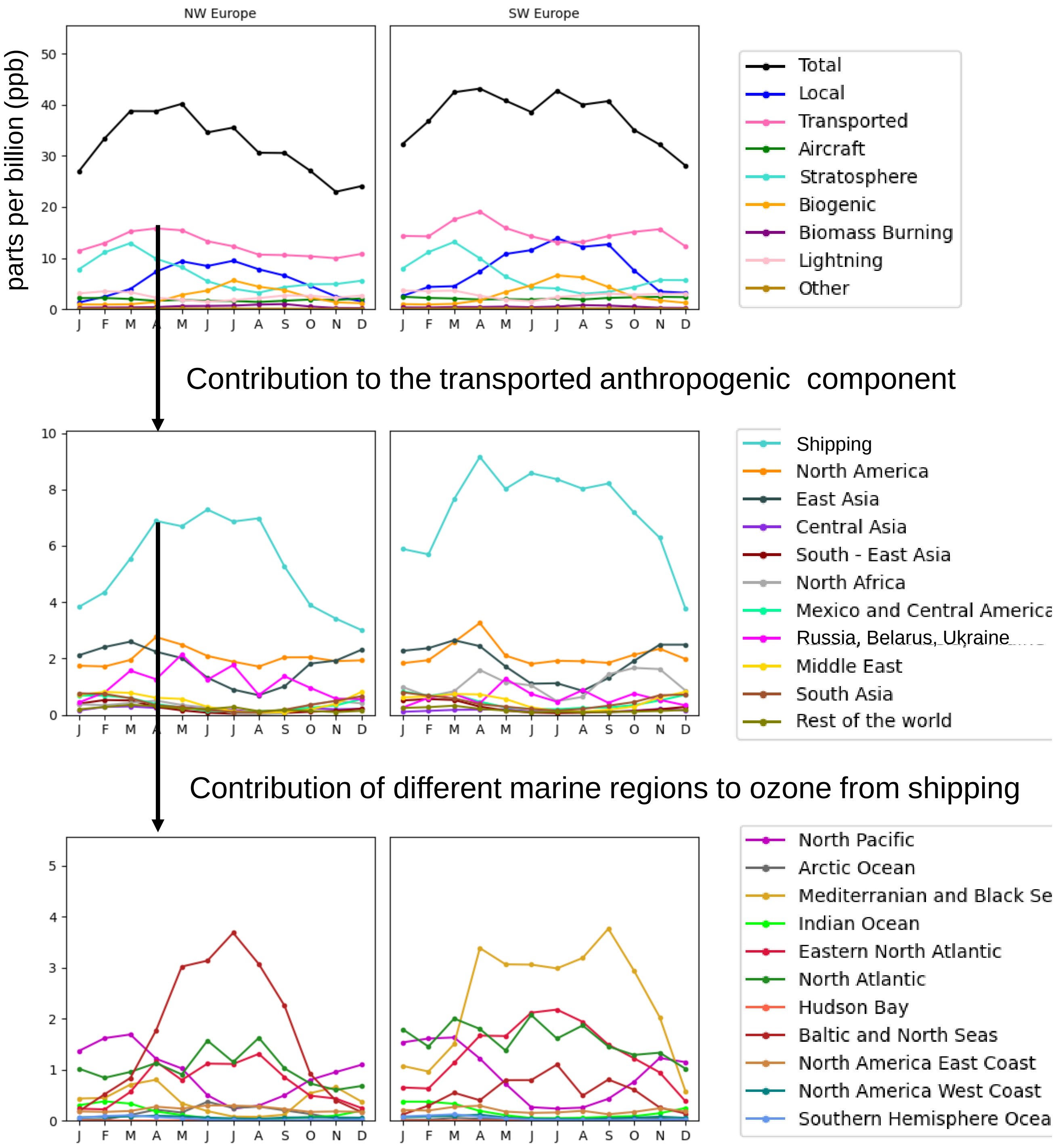




Seasonal cycle of monthly average ozone with attribution to NO_x emissions: Europe 2018

- **Local emissions contribute to summertime ozone**
- **Large long-range contribution to springtime ozone**
- **Ship NO_x emissions dominate the transboundary ozone component**
- **Nearby shipping has a stronger influence in summer**
  - **Baltic and North seas influence NW Europe**
  - **Mediterranean sea influences SW Europe**
- **Remote shipping has a stronger influence in spring**
  - **Strong influence of the North Pacific on springtime ozone in Europe**

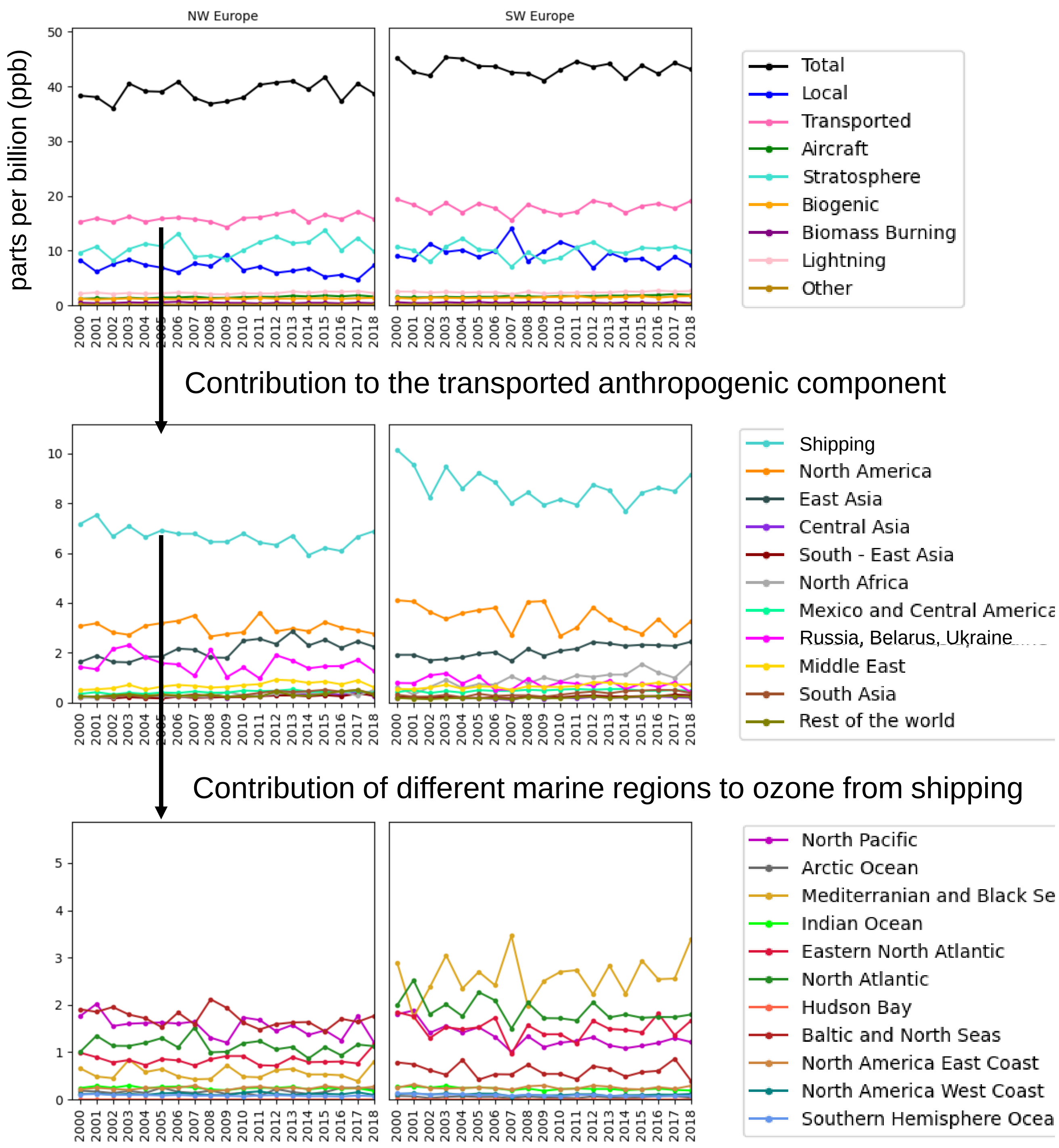
Preliminary results: do not cite!



2000-2018 April average ozone with attribution to NO_x emissions (and the stratosphere)

- **No noticeable trend in April ozone over Europe**
- **Contributions of different NO_x source regions quite stable from 2000-2018**
- **Remote anthropogenic NO_x contributes approximately 2x the ozone as from local anthropogenic NO_x in April**
  - **About half of this is NO_x from shipping**
  - **Contribution from both high seas and coastal shipping**

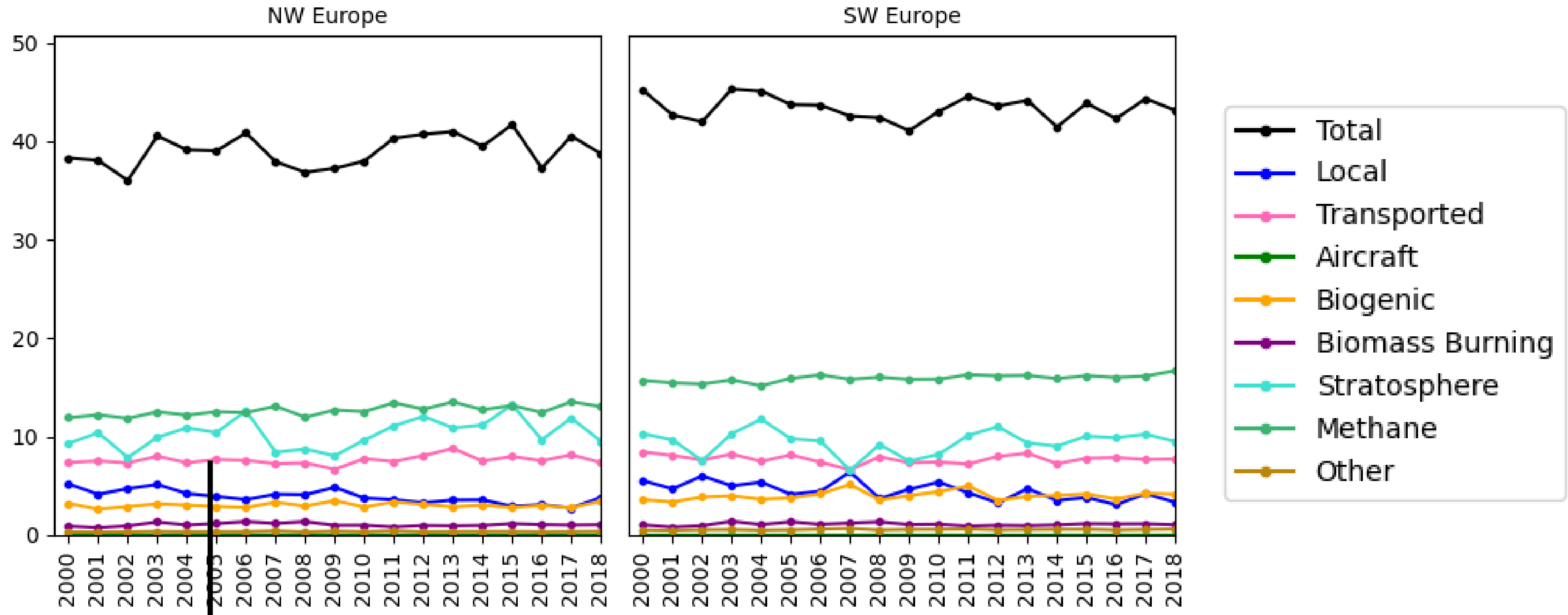
- **Model high bias over SW Europe might be partly due to overactive local ozone production**



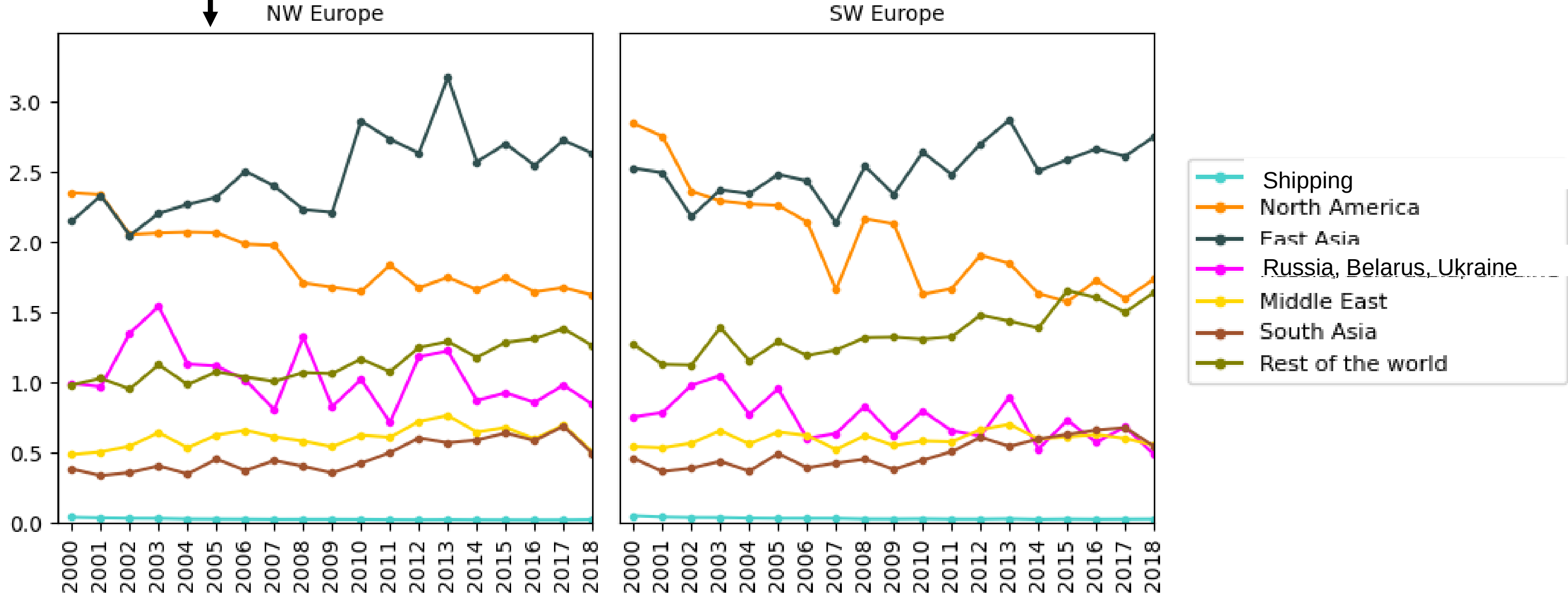
Preliminary results: do not cite!

2000-2018 April average ozone with attribution to VOC emissions

- **Clearer trends in the contribution of NMVOC source regions to European April ozone**
  - **Reductions in the North American and Russian contribution balanced by increases from elsewhere**
- **Significant contribution of methane to April ozone over Europe**
  - **Higher methane contribution over SW Europe is consistent with overactive local ozone production**



Contribution to the transported anthropogenic component



Preliminary results: do not cite!

Next steps for this work

- **Continued evaluation, analysis, and publication of CAM-chem results**

- **Inclusion of results from DLR and MSC-W**
    - **Multi-model intercomparison of ozone source attribution, with initial focus on ship NO_x**

- **Contribution to the draft 2022-2023 workplan**
    - **1.1.3.3: Assessing observed trends in air pollution at the various scales; Linkages between global and regional air pollution**
        - **With TFMM, TFIAM, MSC-W**
    - **1.1.3.7: Perform an evaluation of the impact of potential methane mitigation measures on regional ozone**
        - **With TFMM, TFIAM, MSC-W**

The Shipping Story

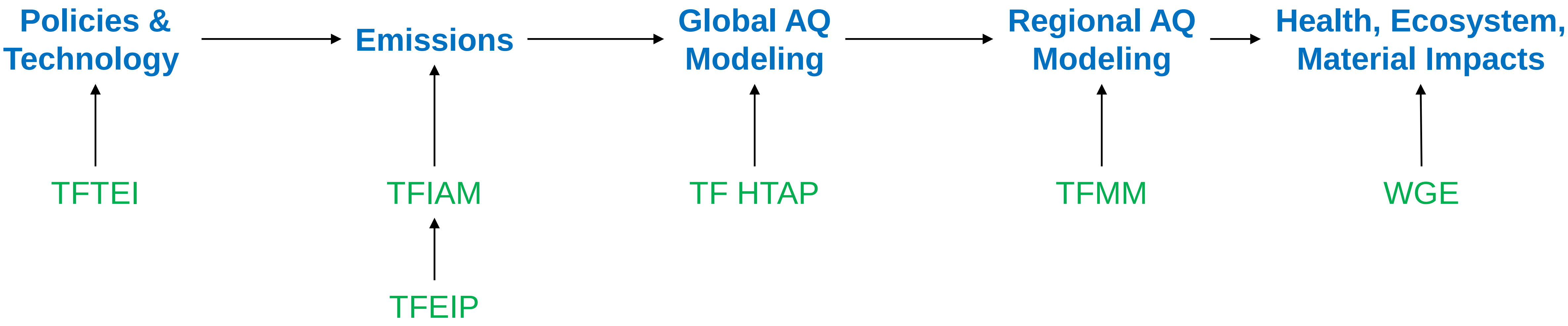
What technologies and level of emission control are available for the shipping industry?

What are the current emissions from the shipping industry and how might they be expected to change into the future with and without policy interventions?

How do changes in shipping emissions in different ocean regions affect AQ in the ECE region?

How do changes in shipping emissions in the coastal waters of the ECE region affect AQ in the ECE region?

How do changes in AQ related to shipping emissions contribute to changes in AQ impacts?



The Methane Story

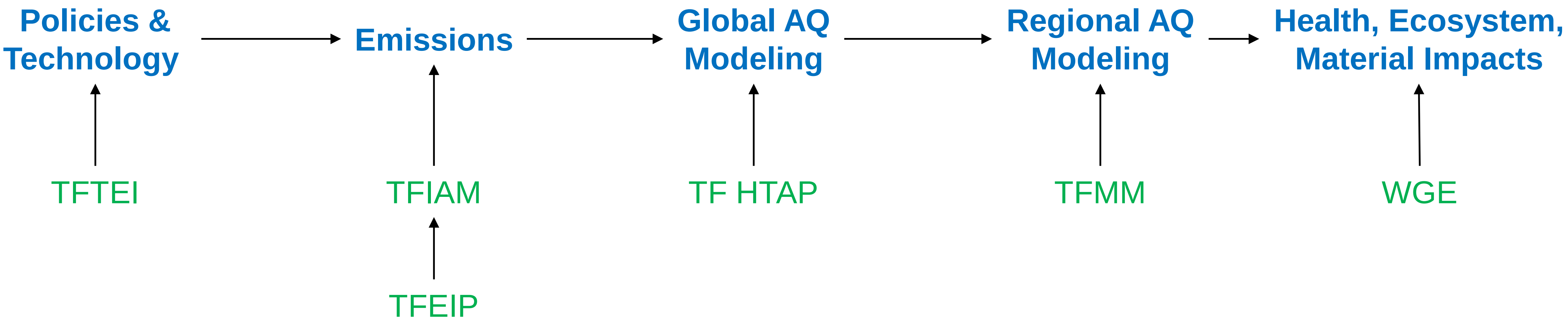
What technologies and level of emission control are available for methane?

What are current methane (and NO_X) emissions and how might they be expected to change into the future with and without policy interventions?

How do global changes in methane and NO_X emissions affect long range transport of ozone into the ECE region?

How do these changes in long-range transport of ozone and methane, and local NO_X emissions affect ozone in the ECE region?

How do changes in AQ related to methane mitigation measures contribute to changes in AQ impacts?



2021 Global Methane Assessment

Benefits and Costs of Mitigating Methane Emissions

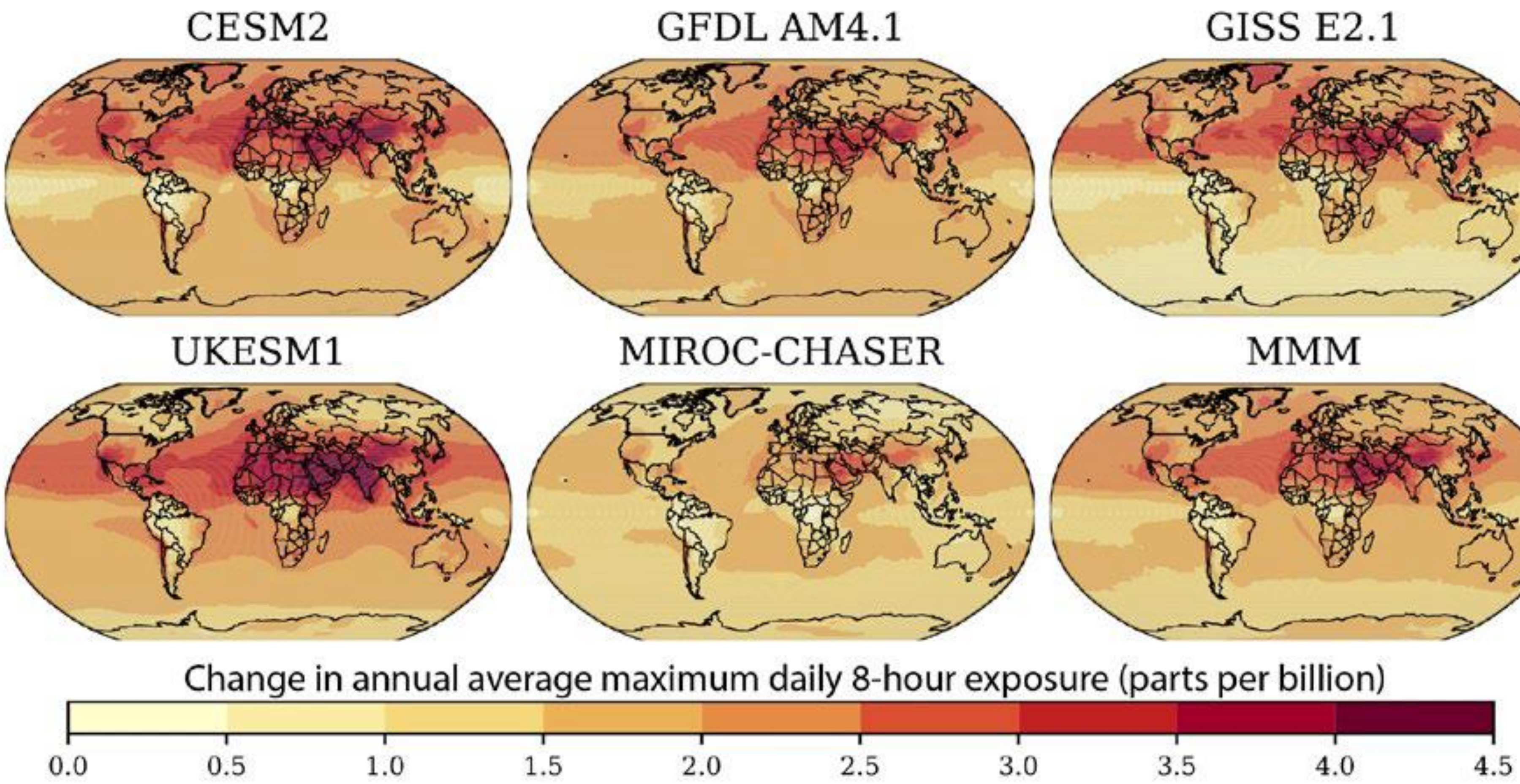


Figure 3.2 Change in annual average maximum daily 8-hour ozone exposure between the present day (2015) and half anthropogenic methane simulations in various models and the multi-model mean (MMM)