



# CAMAERA IMPLEMENTATION OF HAMM7 INTO OPENIFS: FIRST RESULTS AND IMPLICATIONS FOR IFS-COMPO

FMI, KNMI, BSC and ECMWF

Tommi Bergman, Eemeli Holopainen, Harri Kokkola, Anton Laakso, Lianghai Wu, Twan van Noije, Philippe Le Sager, Ramiro Checa-Garcia, Vincent Huijnen, Xuemei Wang, Maria Goncalves, Marios Chatziparaschos, Carlos Pérez Garcia-Pando, Montserrat Costa Suros, Stelios Myriokefalitakis, Adrian Hill, Marcus Koehler, Irian Ayan



PROGRAMME OF  
THE EUROPEAN UNION



IMPLEMENTED BY



1

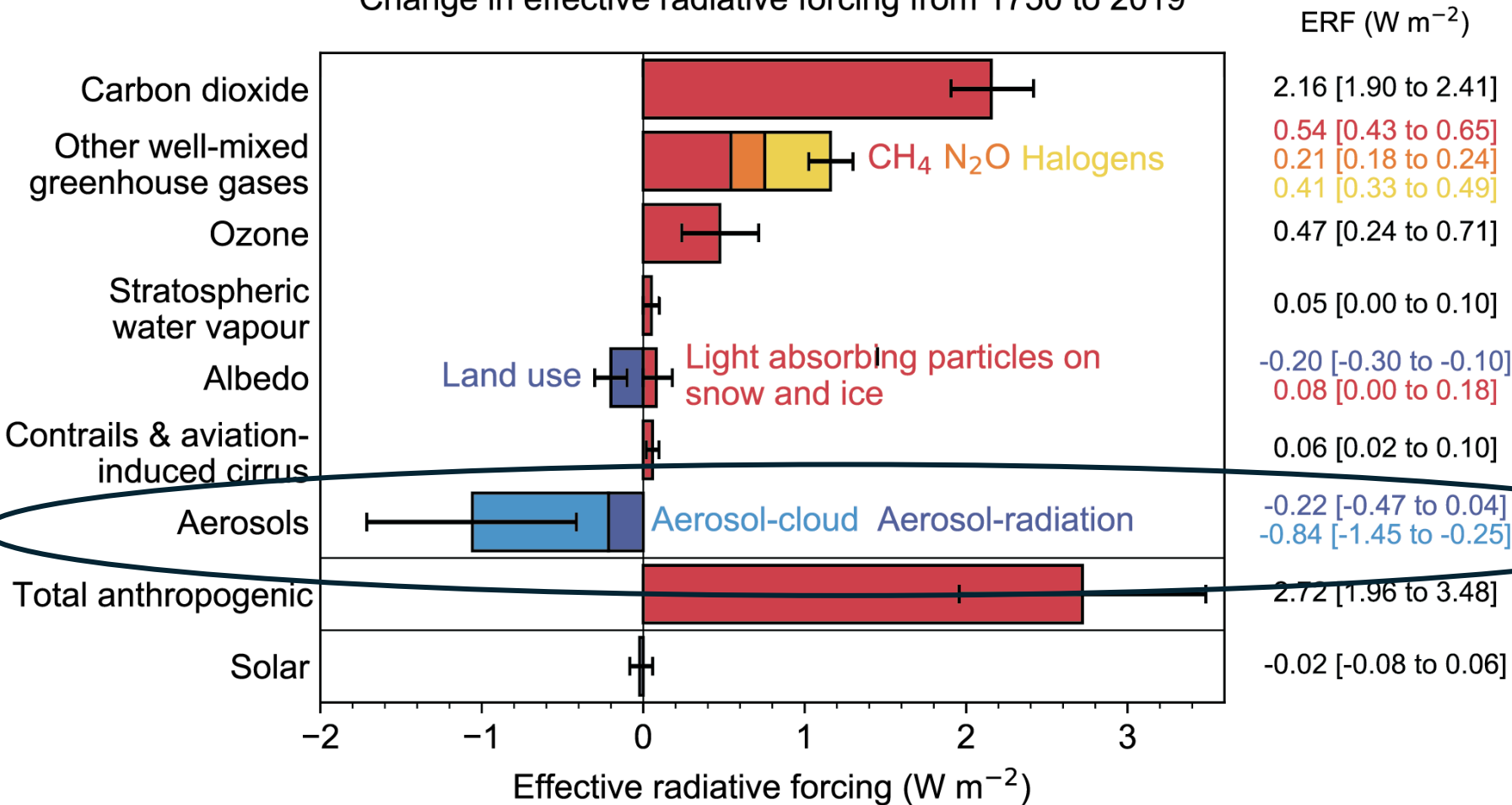
Coordinated by





# WHY USE AEROSOL MODEL

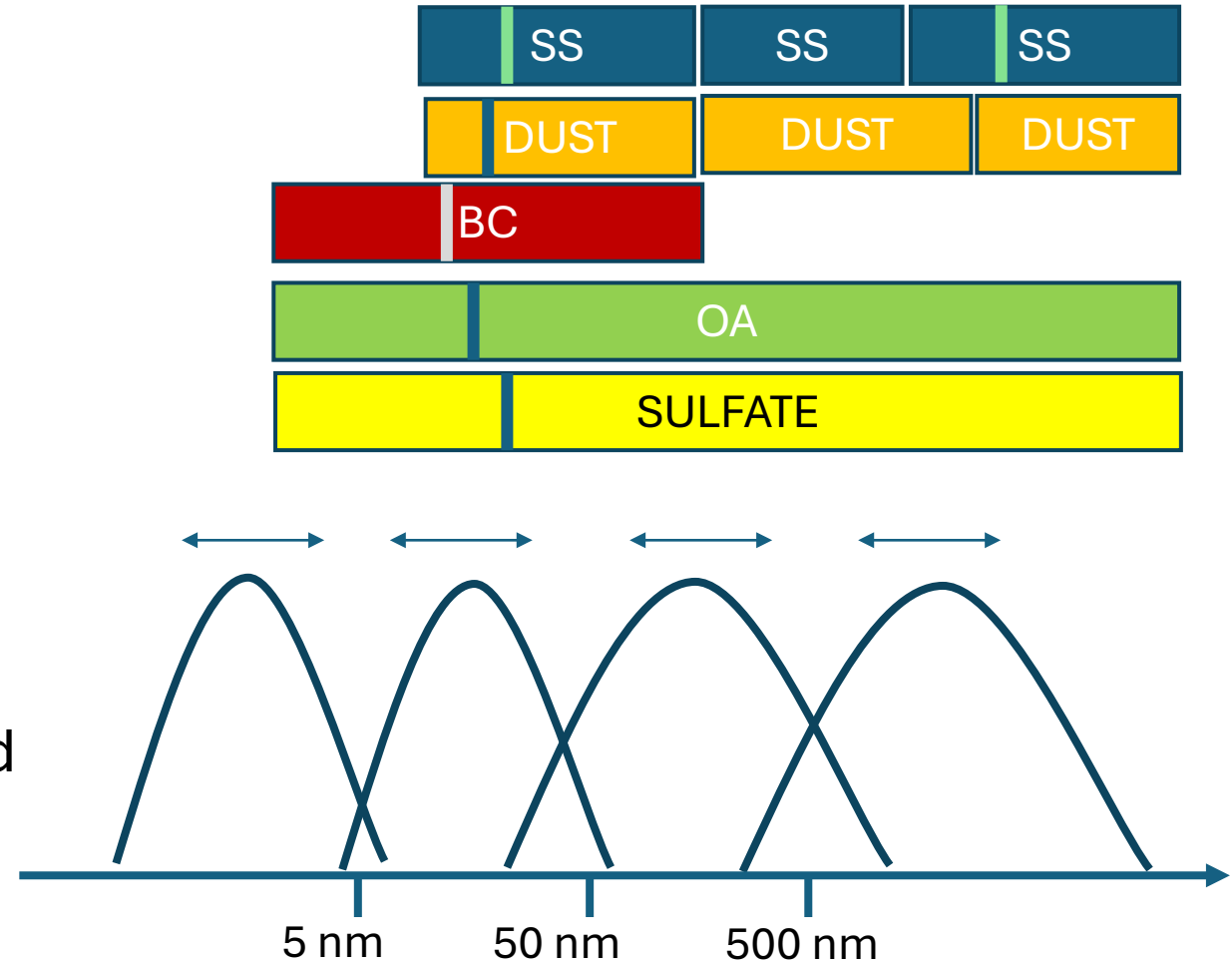
Change in effective radiative forcing from 1750 to 2019





# OPENIFS-HAMM7 VS OPENIFS-AER

- OpenIFS includes AER
  - Remy et al (2019)
  - Fixed size distributions
  - Only mass simulated
  - No interaction
- M7
  - 7 Lognormal modes
  - Number and mass simulated

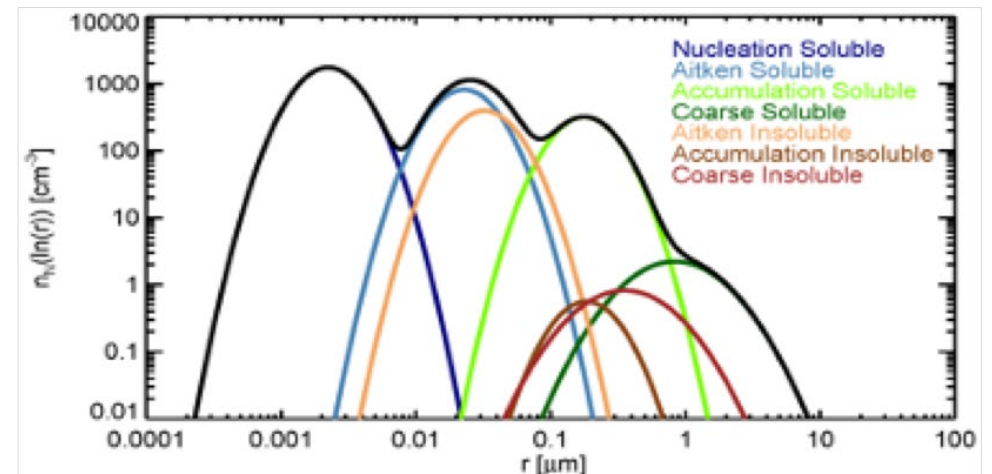




# HAM-M7

- HAM-M7
  - M7: aerosol microphysics,
  - HAM: cloud activation, wet deposition, dry deposition, sedimentation, radiative properties
- aerosol, cloud droplet, and ice crystal size dependent in-cloud & below-cloud wet deposition rates (Croft et al.)
- Hydration: Kappa Köhler (Petters & Kreidenweis)
- Optical properties: aerosol-radiation interactions for SW and LW
- Cloud activation Abdul-Razzak & Ghan (2000)
- Simple sulphur scheme

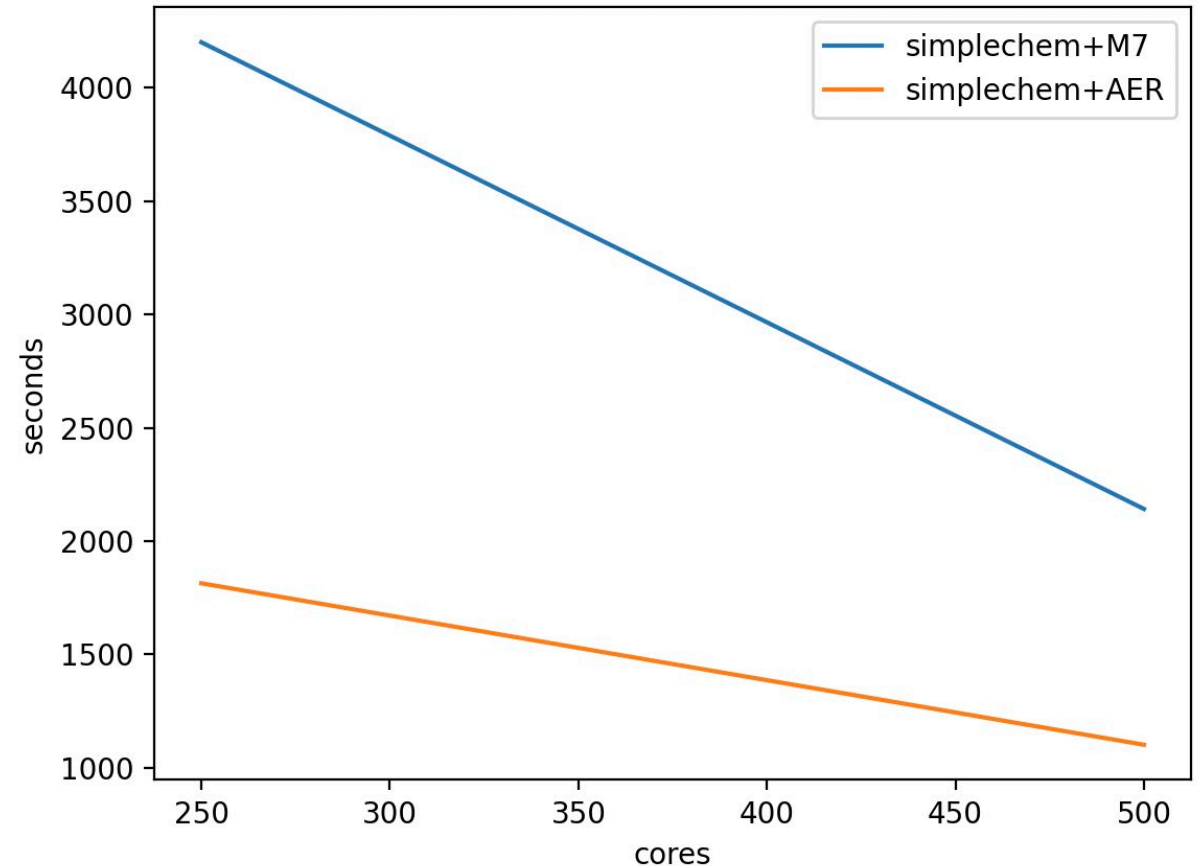
MODES	Hydrophilic	Hydrophobic
<b>NUCLEATION</b> ( $r < 0.005 \mu\text{m}$ )	SO <sub>4</sub>	
<b>AITKEN</b> ( $0.005 \mu\text{m} < r < 0.05 \mu\text{m}$ )	SO <sub>4</sub> , BC, OC	BC, OC
<b>ACCUMULATION</b> ( $0.05 \mu\text{m} < r < 0.5 \mu\text{m}$ )	SO <sub>4</sub> , BC, OC, SS, DU	DU
<b>COARSE</b> ( $0.5 \mu\text{m} < r$ )	SO <sub>4</sub> , BC, OC, SS, DU	DU





# COMPUTATIONAL PERFORMANCE

- Tracer amounts
  - CB05 chem + M7: 85 tracers
    - 56 tracers chem
    - 39 tracers M7
  - M7 + climatological sulfur scheme
    - 41 tracers
      - 39 M7
      - 2 gas-phase tracers: so2 + so4
  - AER aerosols
    - Chem 56 + AER 9 tracers
    - Climatological 10 tracers





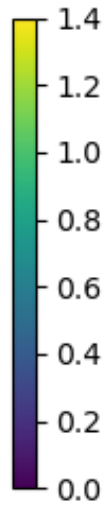
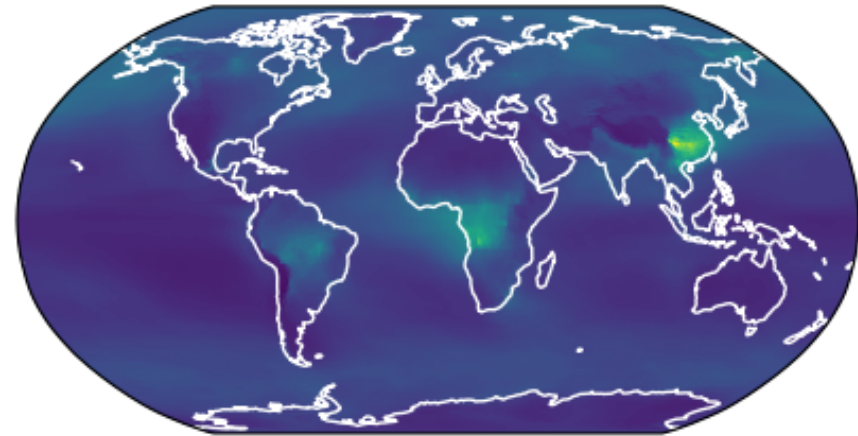
# OIFS-HAMM7 FIRST LOOK SIMULATIONS

- Optical properties
  - Volume weighted refractive indices
- Online aerosol activation to cloud droplets
  - Abdul-Razzak-Ghan (2000)
  - Morales & Nenes in implementation
- Water uptake with Kappa-Köhler parameterisation
- Simulations here Cy43r3
  - Same implementation in Cy48r1
- One year of spinup
- A bug in convective wet deposition
  - Affects the results
  - Fixed by KNMI in Cy48r1 but no year long simulations as of yet

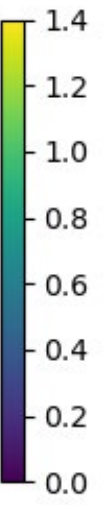
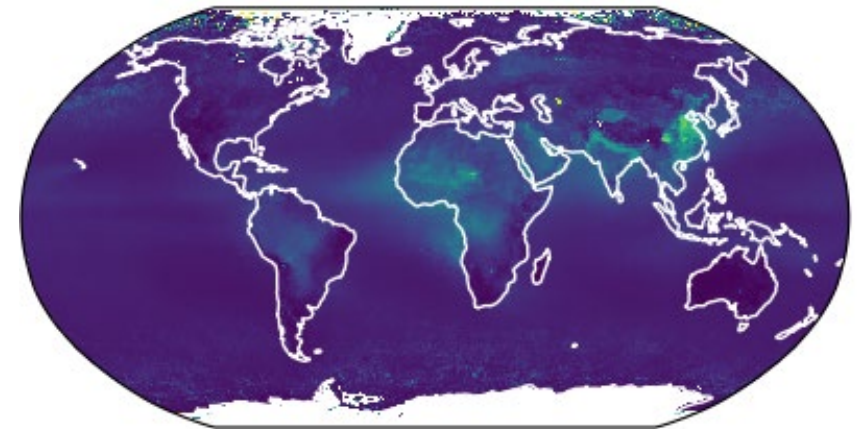


# AEROSOL OPTICAL DEPTH

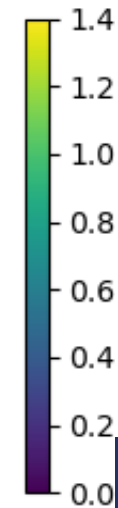
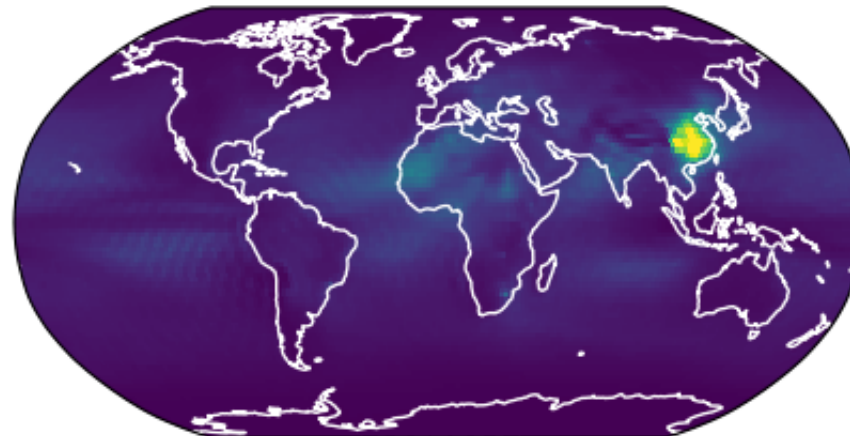
OIFS-HAMM7 annual mean AOD 2010: 0.28



MODIS annual mean AOD 2010: 0.17



ECHAM-HAMM7 11month mean AOD 2010: 0.13

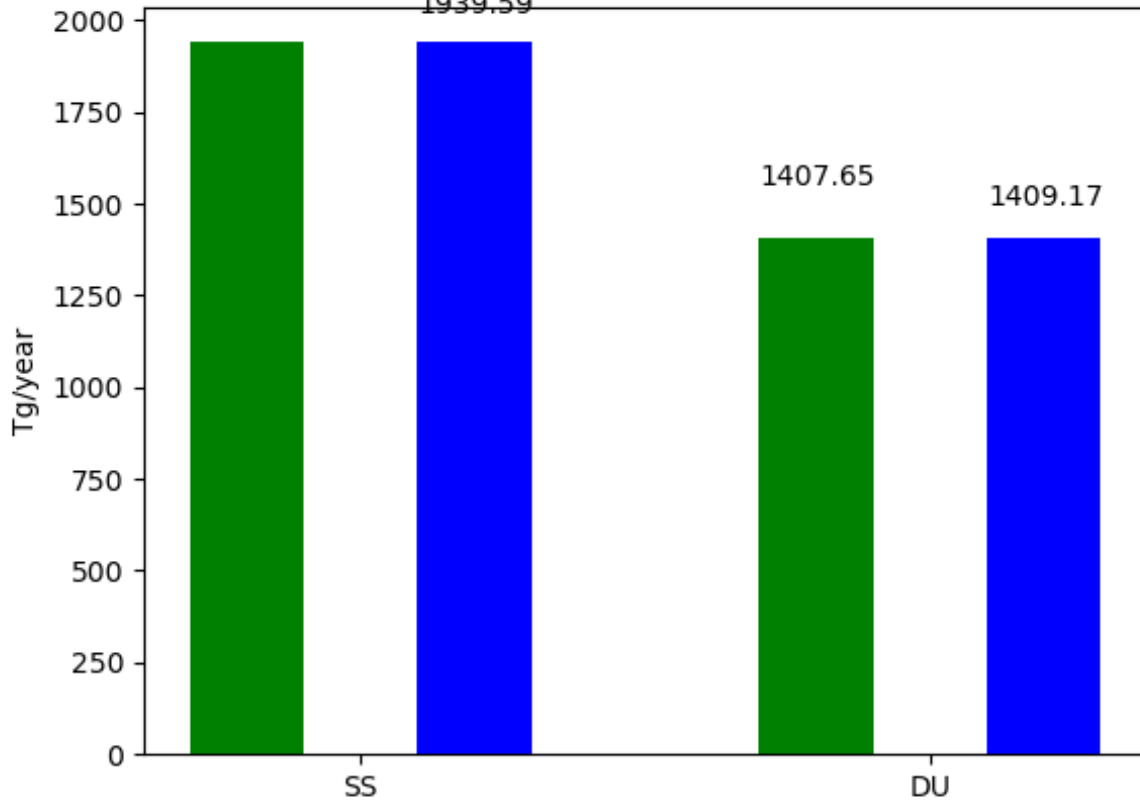




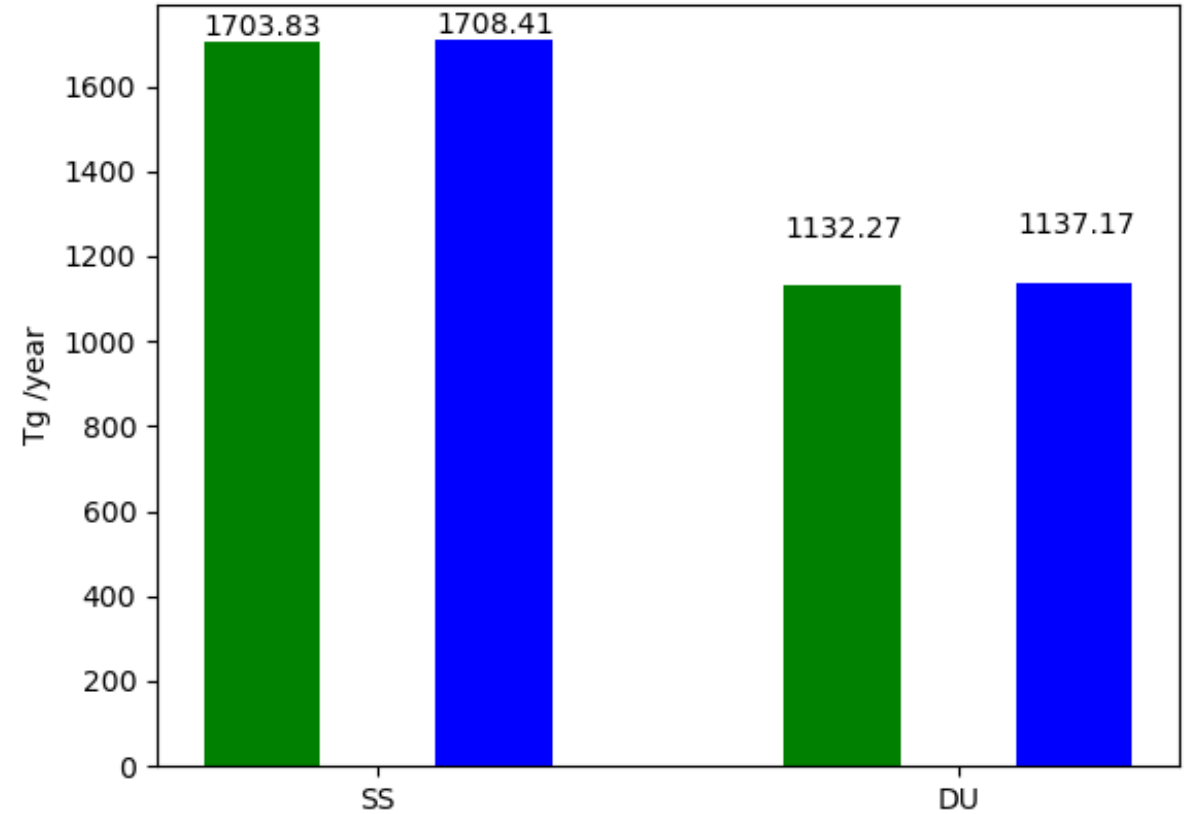
# SEASALT AND DUST AEROSOLS

OIFS-HAMM7

OIFS43r3 sources and sinks  
1939.59



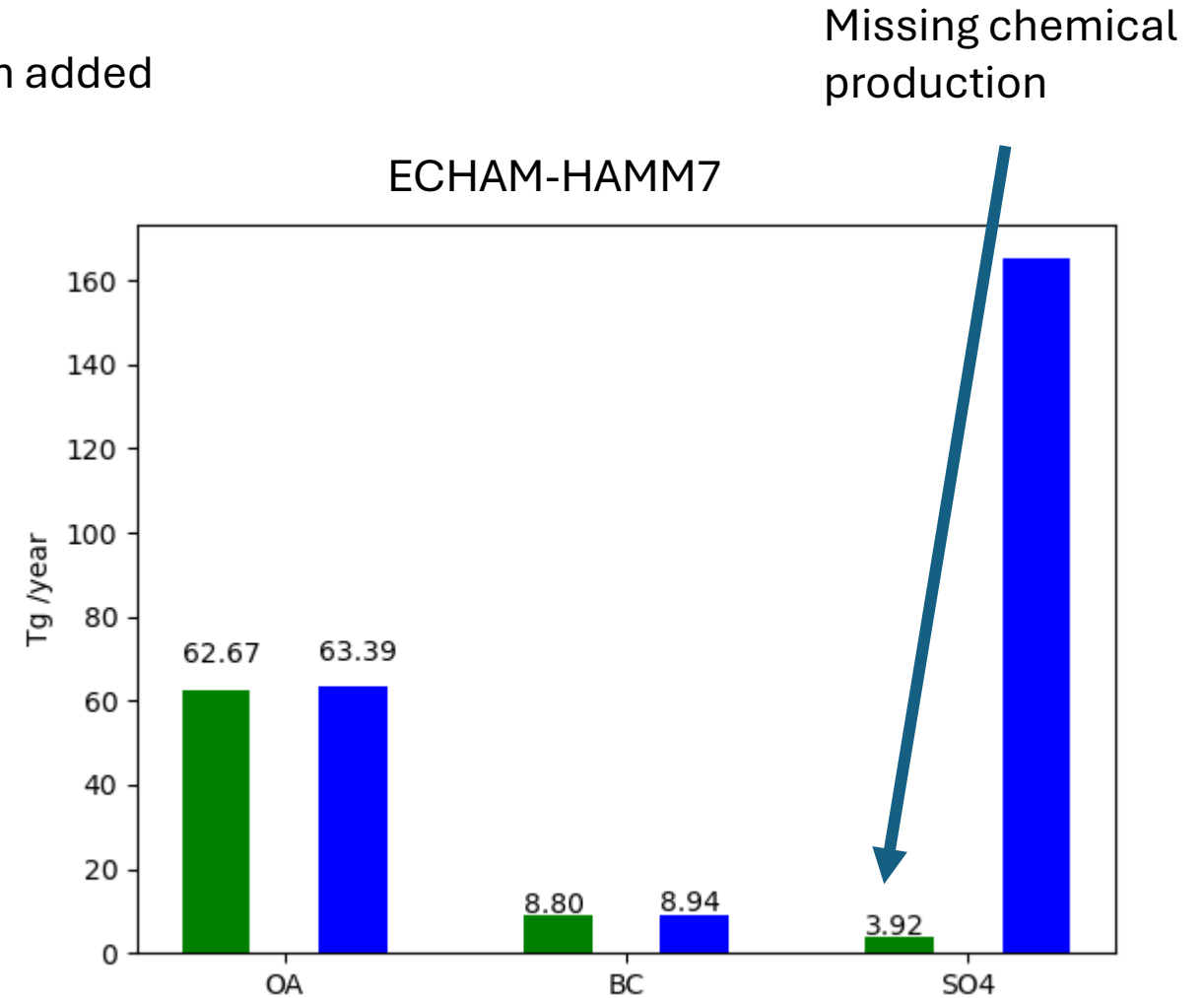
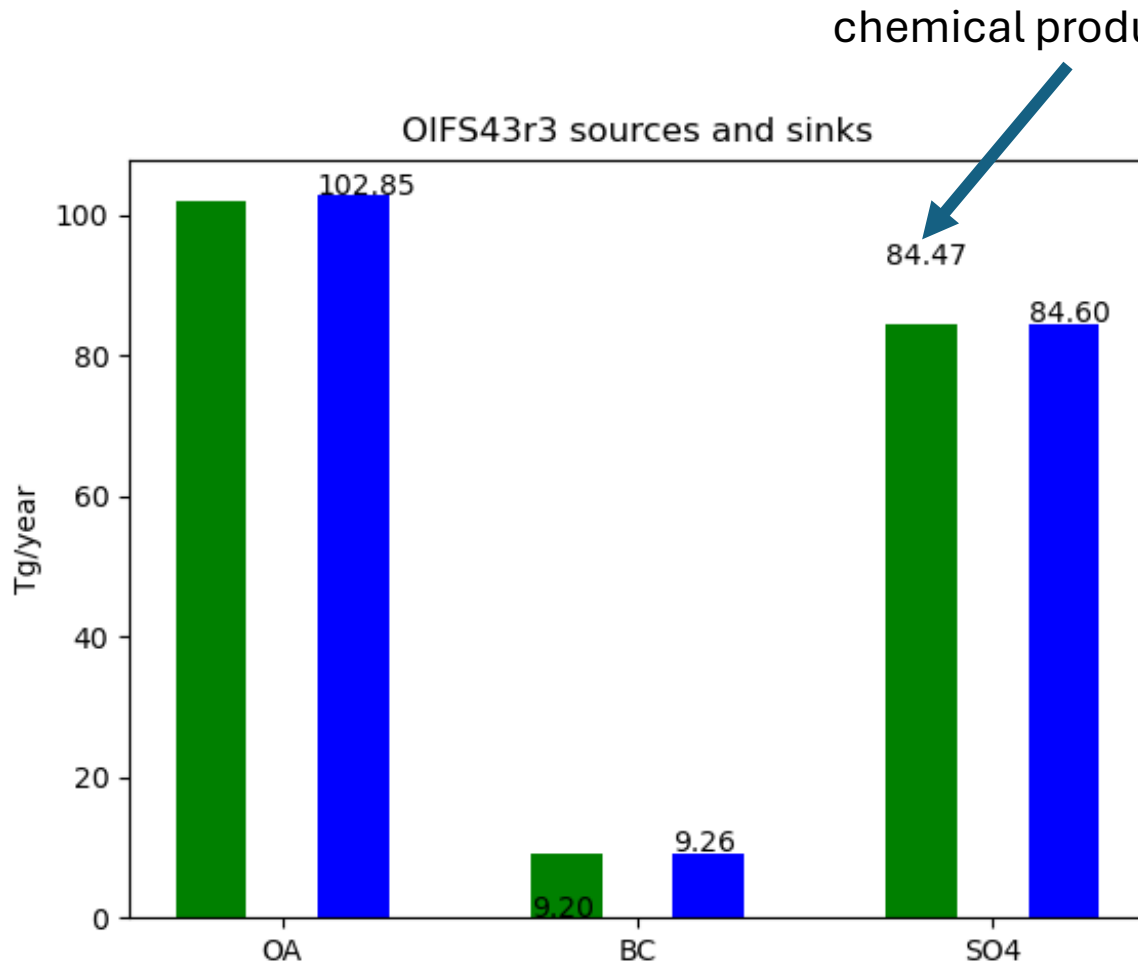
ECHAM-HAMM7







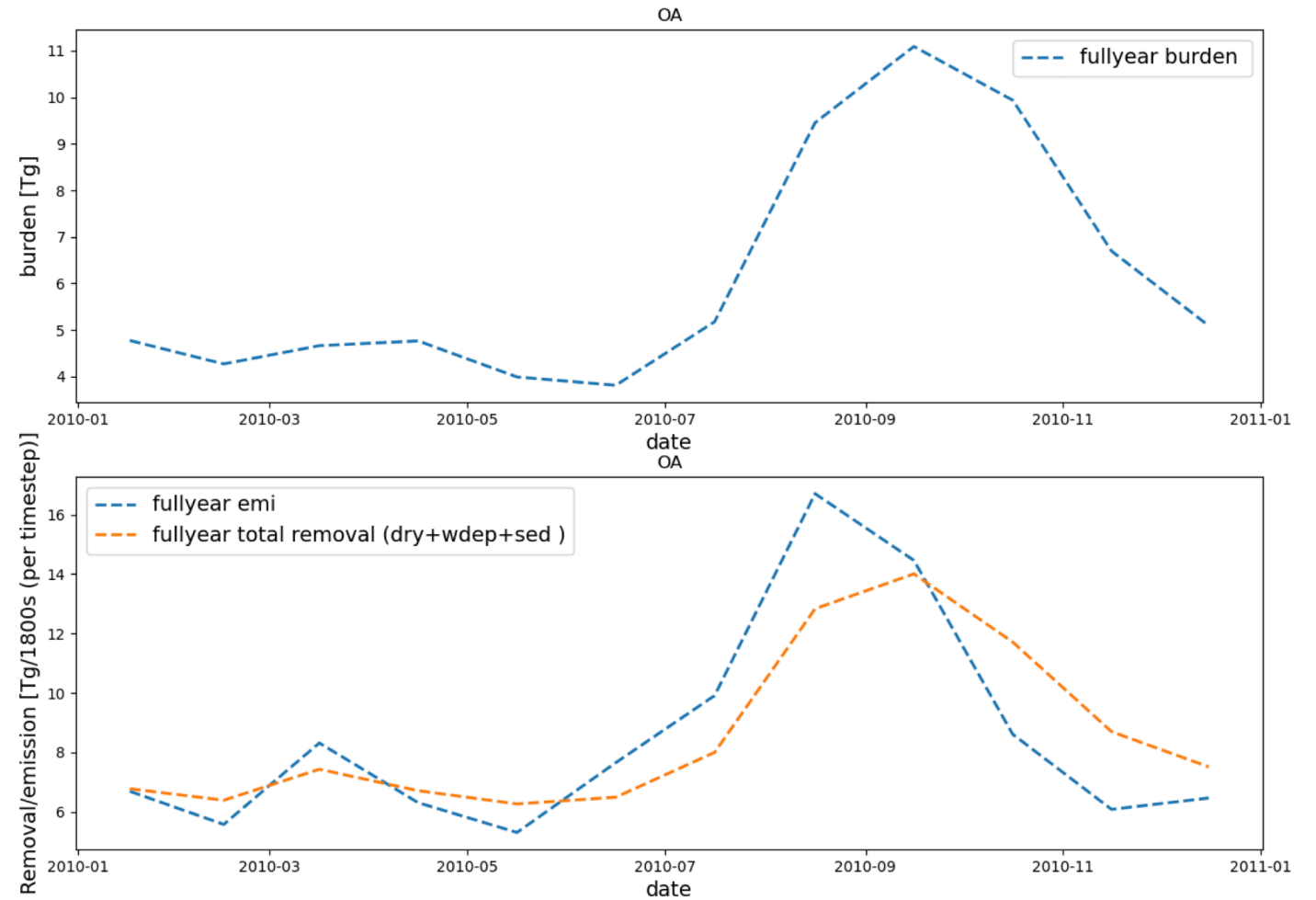
# ANNUAL MEAN SOURCES AND SINKS





# GLOBAL MEAN BURDEN EVOLUTION

- Simulation is stable
  - No accumulation
- Carbon species have major influence of fires





# SUMMARY AND OUTLOOK

- OpenIFS Cy43r3/Cy48r1 HAMM7 implementation is working
  - Full year of simulation done in 43
  - Development is on Cy48r1
- HAMM7 brings a slowdown
- Model evaluation is starting
- Future;
  - Single precision of HAMM7 for speed up (ESiWACE project)
  - SOA as separate compound in M7
  - TKE and cloud activation