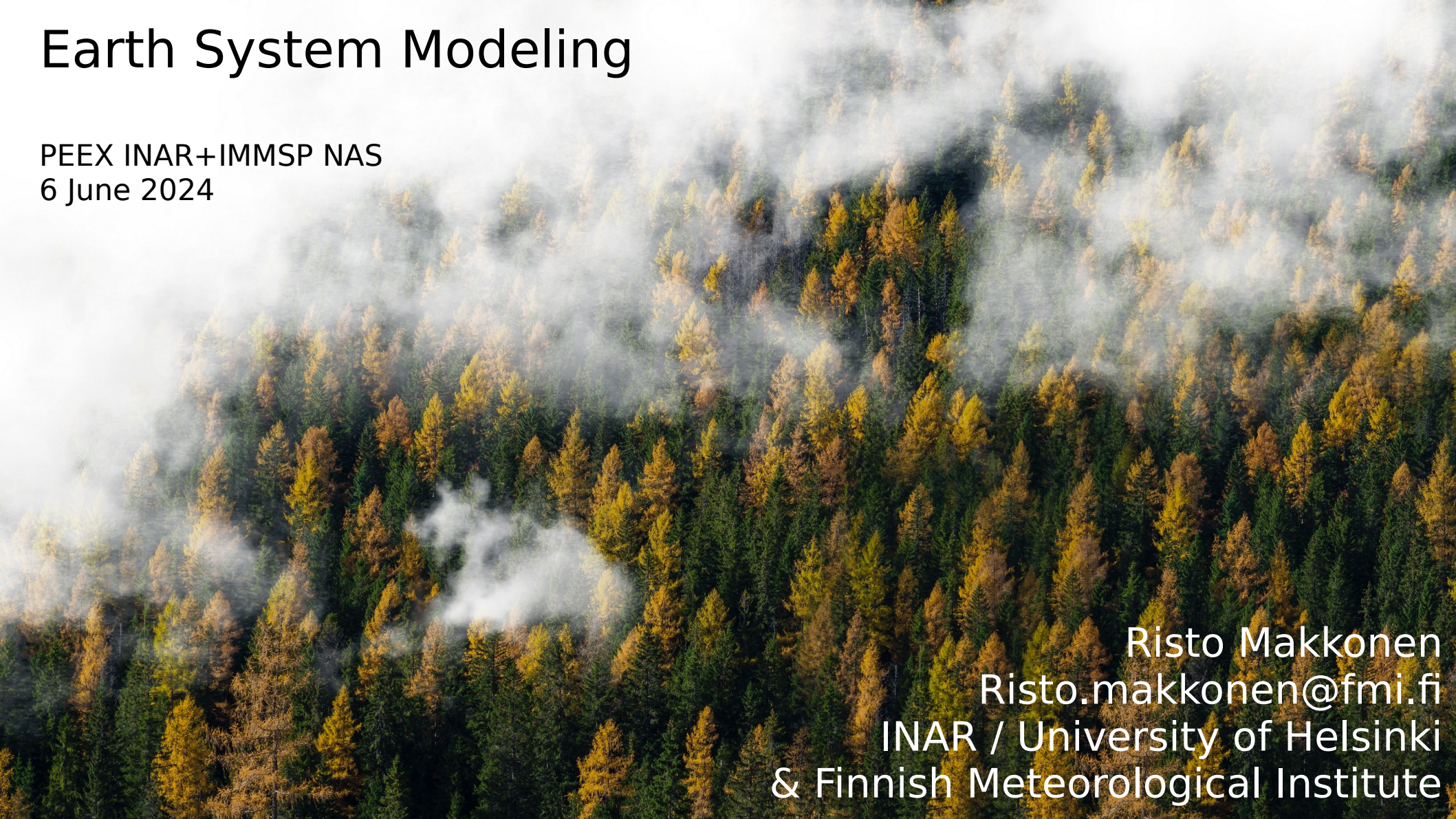
Earth System Modeling

PEEX INAR+IMMSP NAS
6 June 2024



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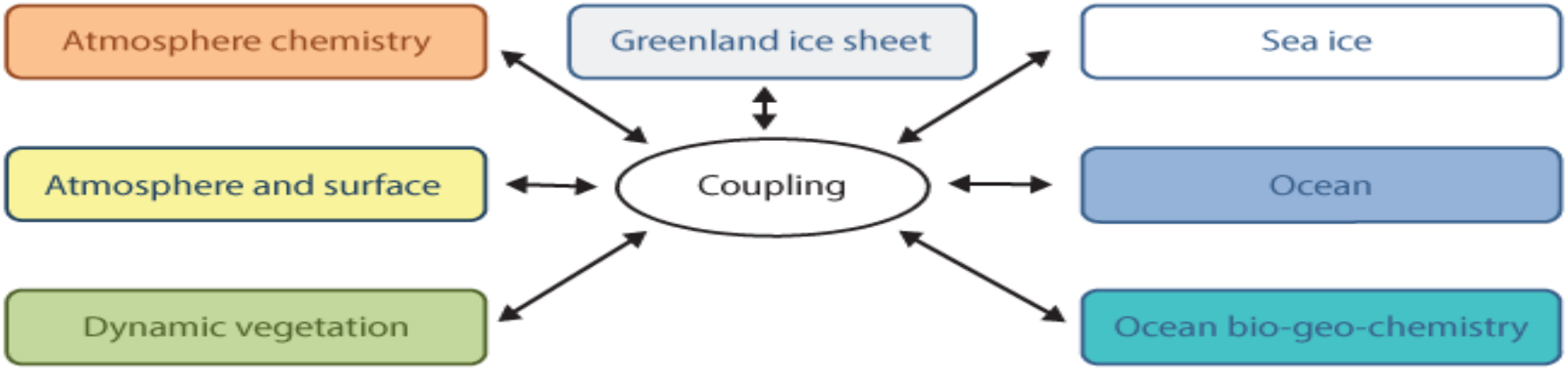
EC-Earth3

- Highly coupled global Earth System Model
- 30+ European partners
- INAR participated in CMIP6/IPCC AR6 with EC-Earth3
- INAR is in core of atmospheric aerosol+chemistry development



EC-Earth as part of PEEX Modeling platform

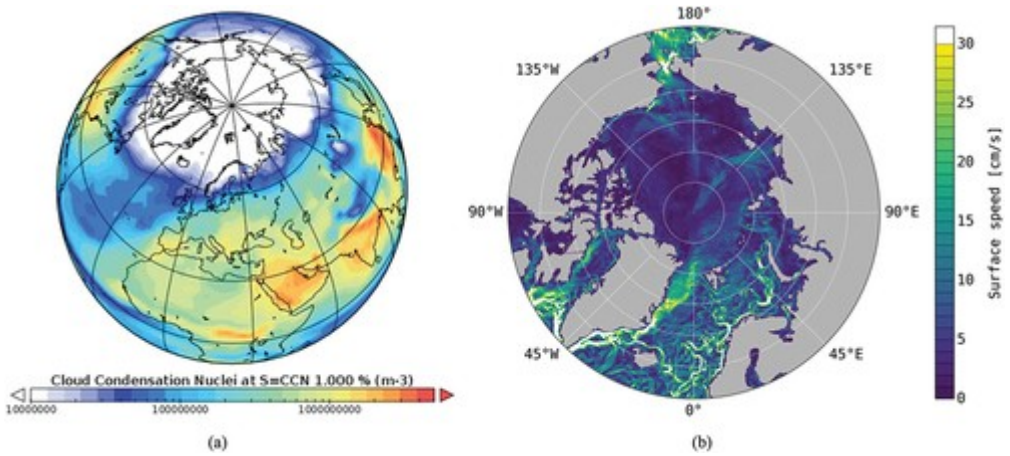
Original Research Article

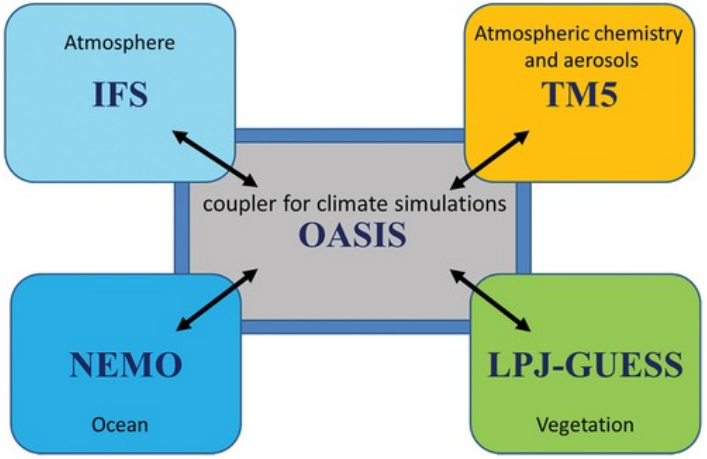
Towards seamless environmental prediction – development of Pan-Eurasian EXperiment (PEEX) modelling platform

Alexander Mahura, Alexander Baklanov, Risto Makkonen, Michael Boy, Tuukka Petäjä, Hanna K. Lappalainen, ...show all

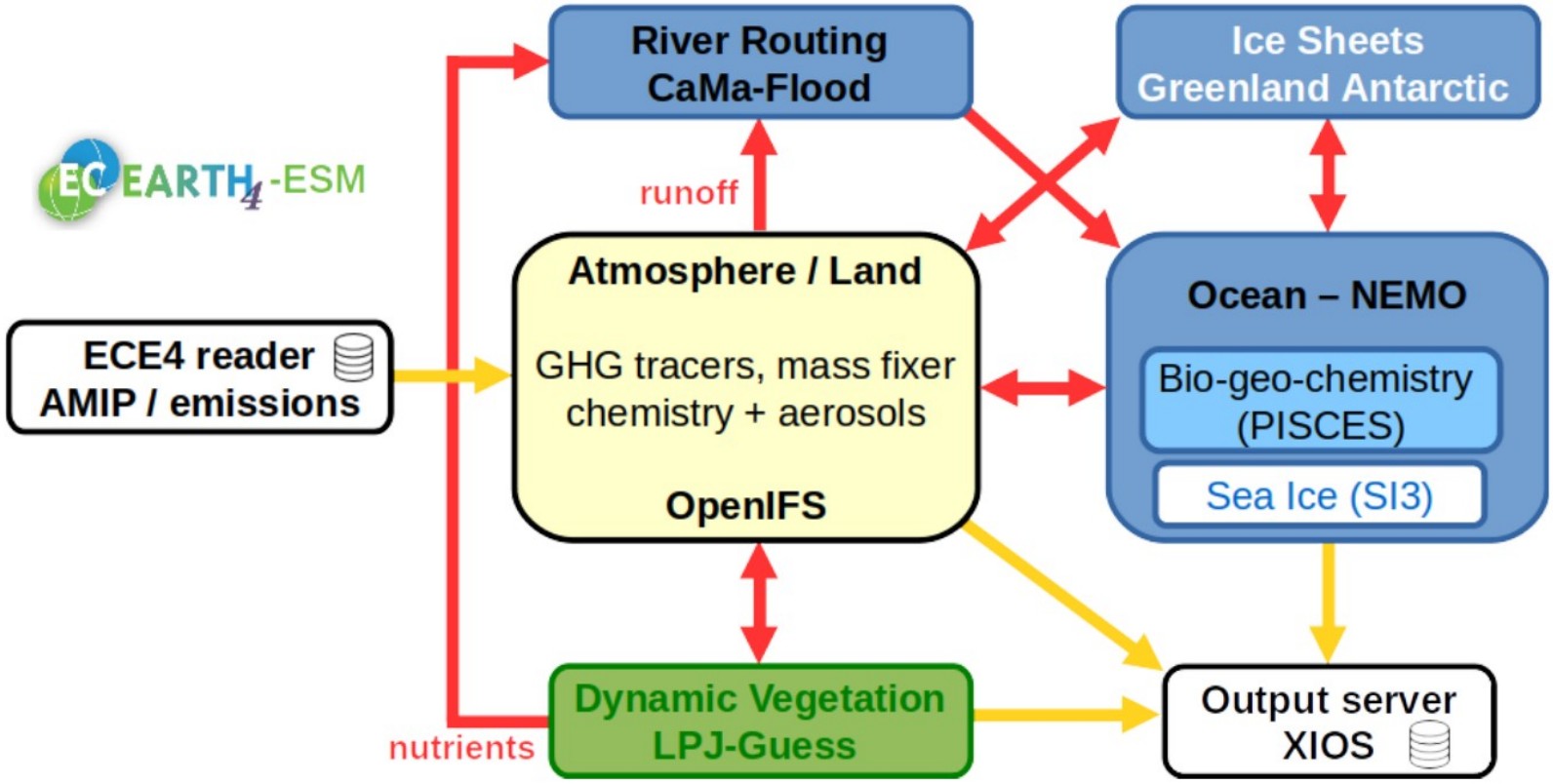
Pages 189-230 | Received 01 Sep 2023, Accepted 26 Feb 2024, Published online: 09 Apr 2024

Cite this article https://doi.org/10.1080/20964471.2024.2325019 Check for updates



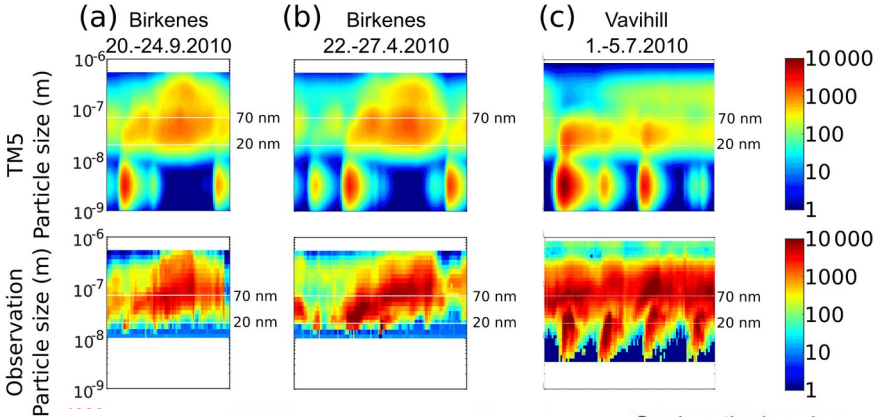


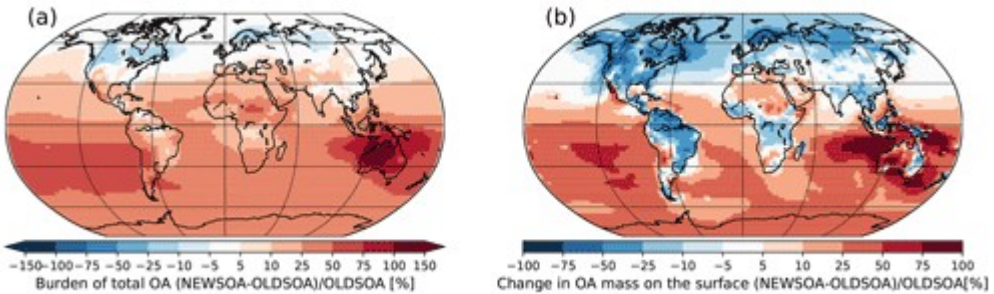
Moving from EC-Earth3 to EC-Earth4

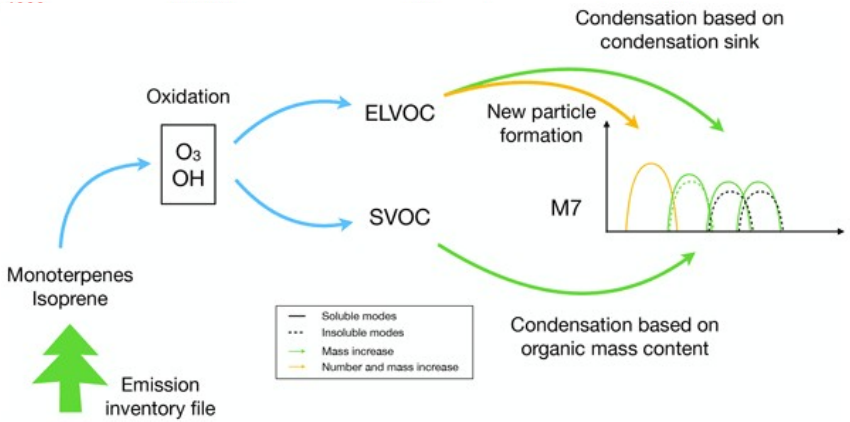


Description and evaluation of a secondary organic aerosol and new particle formation scheme within TM5-MP v1.2

Tommi Bergman ✉, Risto Makkonen, Roland Schrödner, Erik Swietlicki, Vaughan T. J. Phillips, Philippe Le Sager, and Twan van Noije

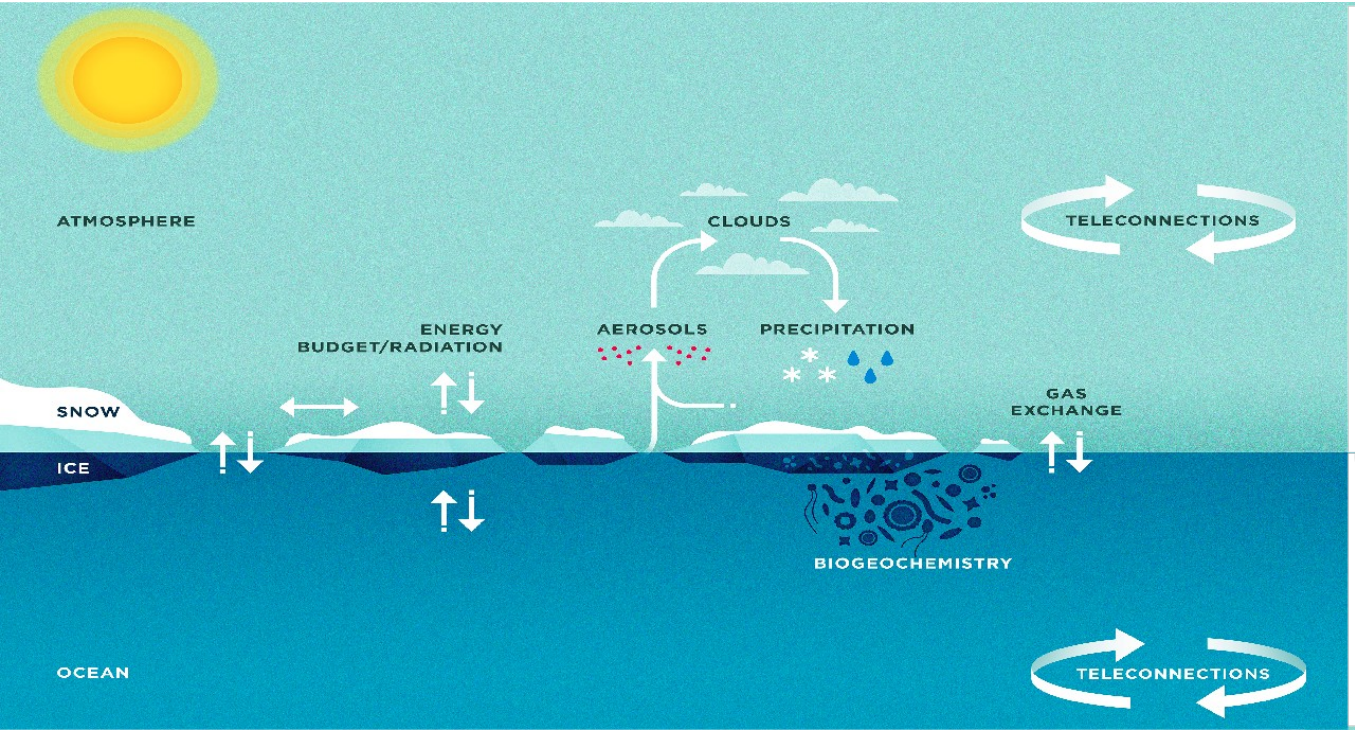


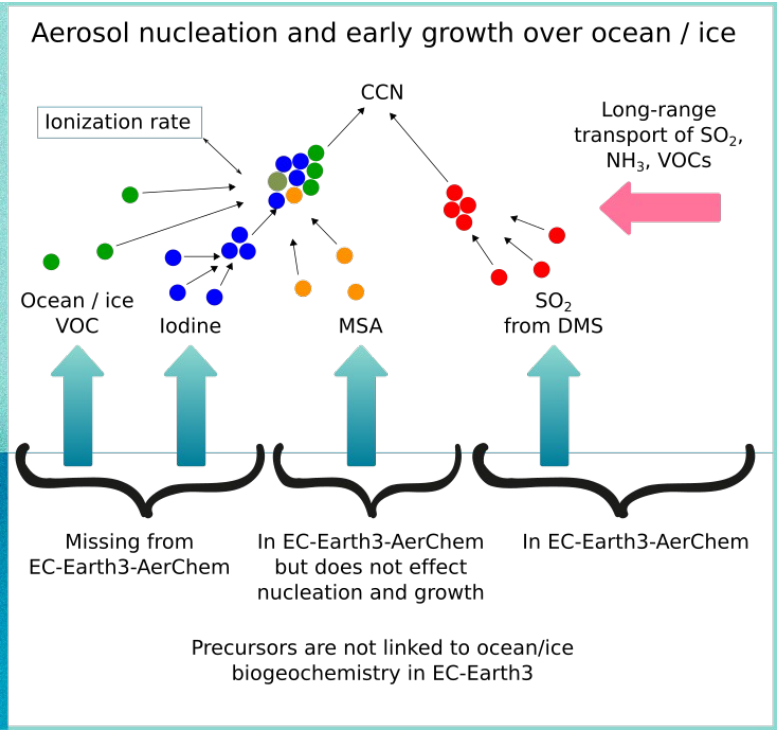




Focus areas:
- Secondary particle formation
- Impact of organic and inorganic on new particle formation
- Secondary vs. primary aerosols in future pathways

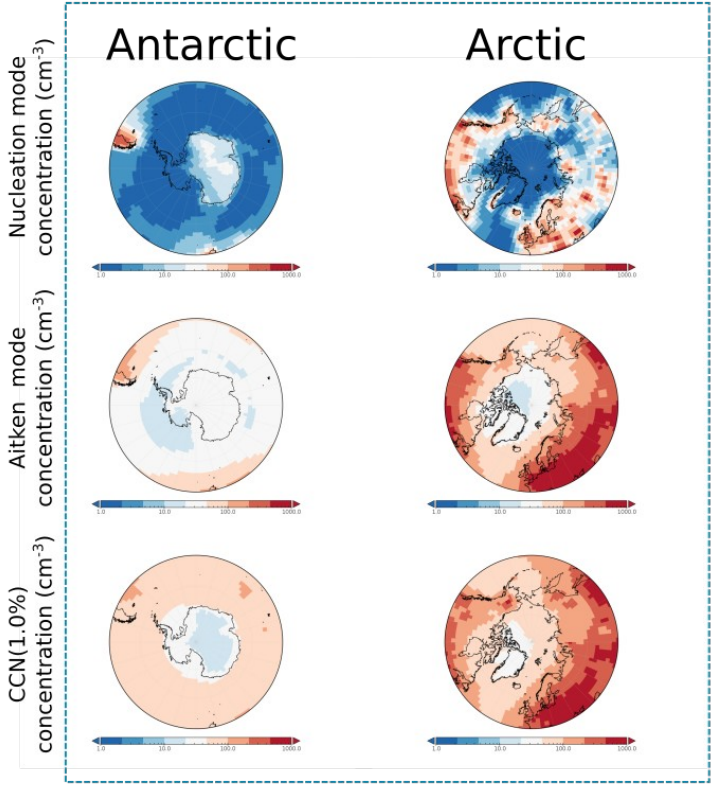
New particle formation in polar regions: Current EC-Earth status and known gaps





CRiceS

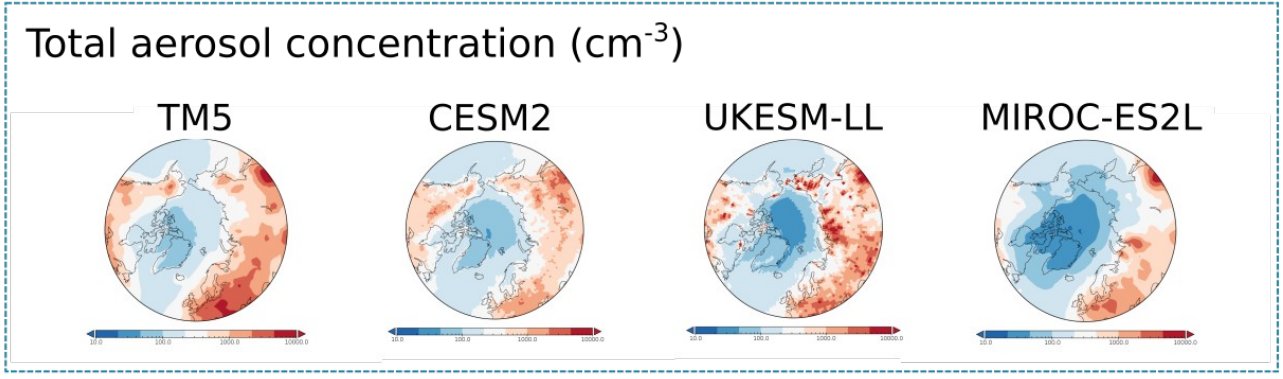
EC-Earth3 aerosol and CCN concentrations over the polar regions



Extremely low nucleation and growth rates throughout Arctic ocean and the Southern Ocean. Aerosols also transported downwards from higher altitudes at the poles.

Similar Arctic aerosol concentrations as in other CMIP6 models (below, plotted as *conccn* from ESGF)

Evaluation of polar aerosol concentrations remains difficult due to insufficient station observations and limitations in satellite remote sensing at high latitudes.



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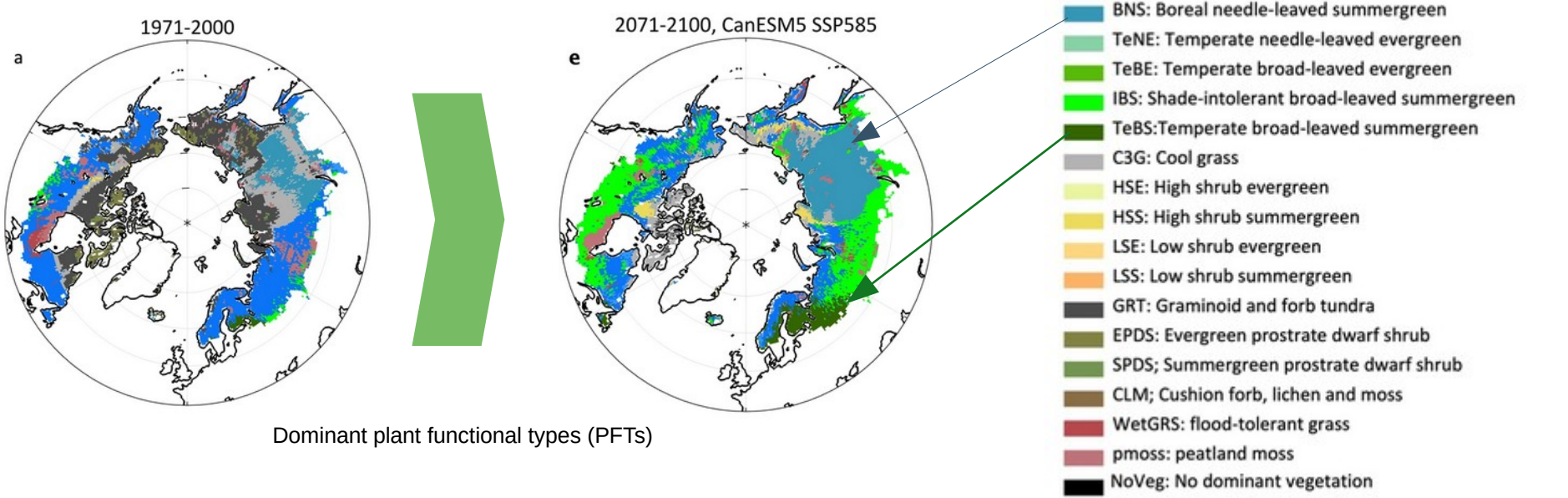
ARTICLE OPEN

Check for updates

High-latitude vegetation changes will determine future plant volatile impacts on atmospheric organic aerosols

Jing Tang[1,2✉], Putian Zhou[3], Paul A. Miller[2], Guy Schurgers[4], Adrian Gustafson[2,5], Risto Makkonen[3,6], Yongshuo H. Fu[7] and Riikka Rinnan[1]



Dominant plant functional types (PFTs)

https://www.nature.com/articles/s41612-023-00463-7

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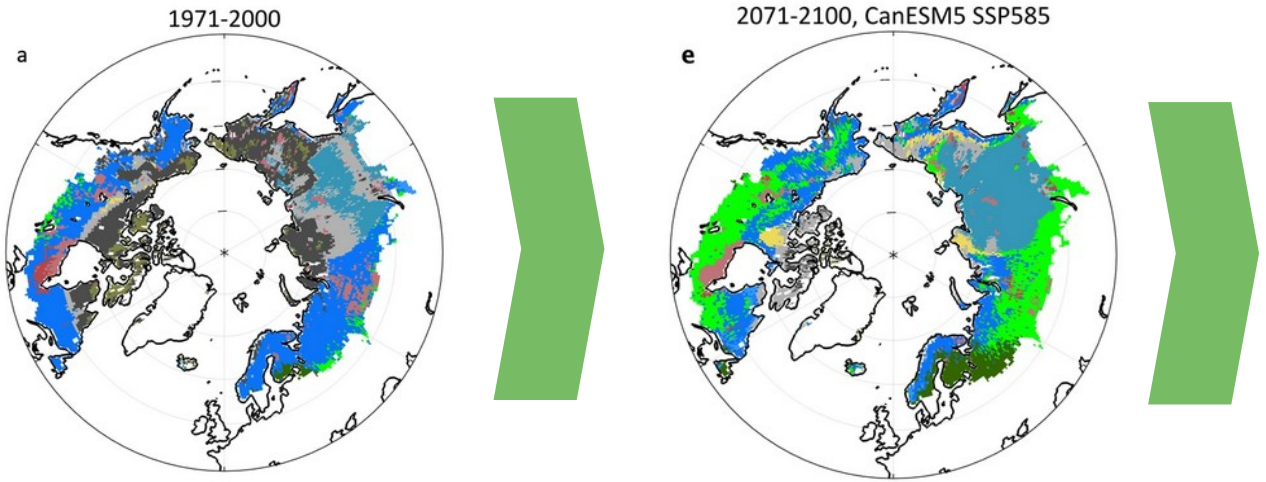
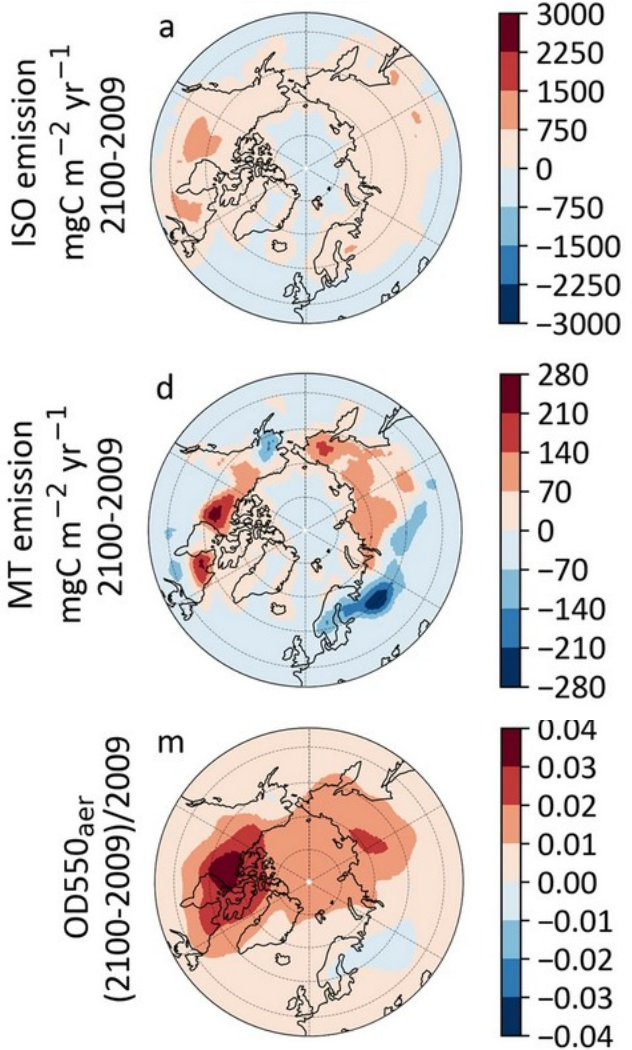
High-latitude vegetation changes will determine future plant volatile impacts on atmospheric organic aerosols

Jing Tang[1,2✉], Putian Zhou[3], Paul A. Miller[2], Guy Schurgers[4], Adrian Gustafson[2,5], Risto Makkonen[3,6], Yongshuo H. Fu[7] and Riikka Rinnan[1]



Dominant plant functional types (PFTs)



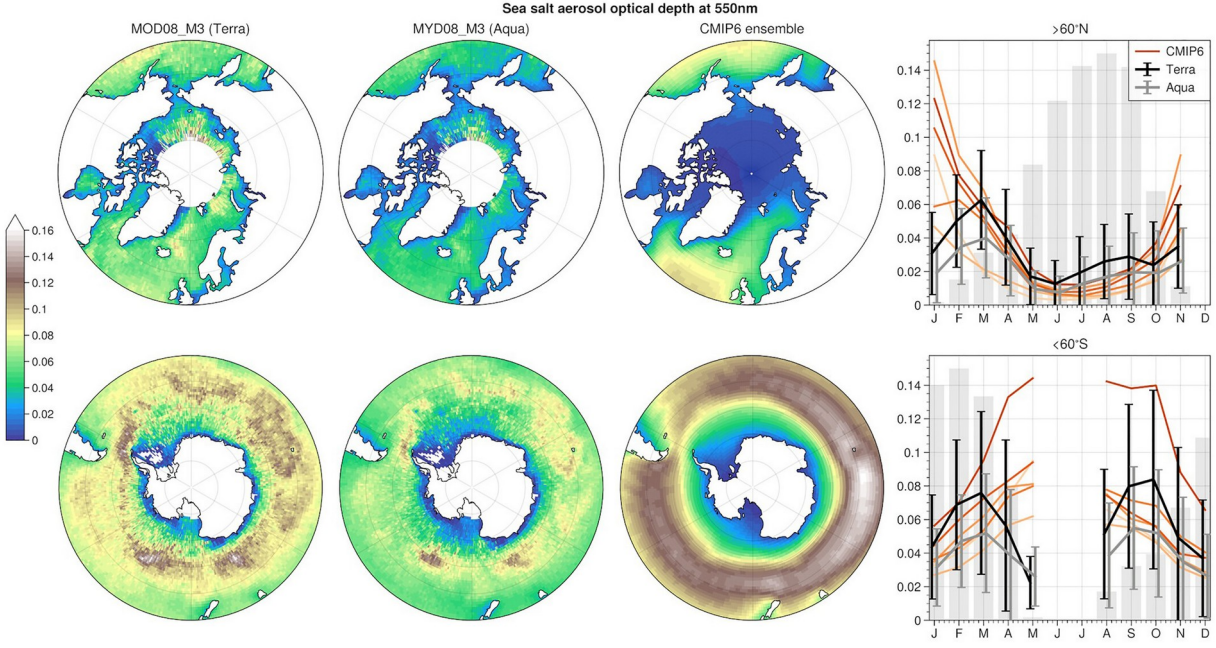
https://www.nature.com/articles/s41612-023-00463-7

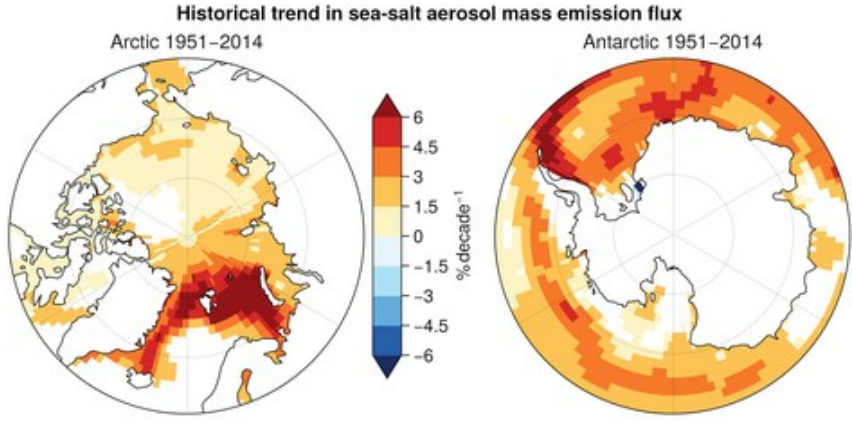
JGR Atmospheres

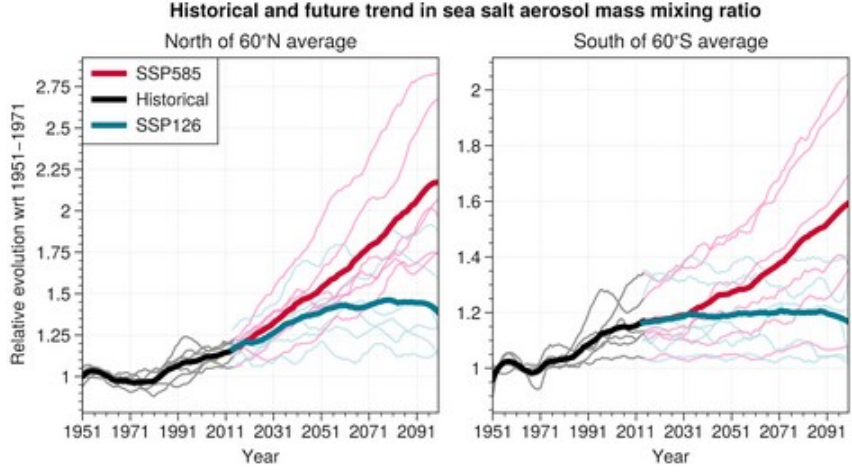
Research Article | Open Access

The Representation of Sea Salt Aerosols and Their Role in Polar Climate Within CMIP6

Rémy Lapere, Jennie L. Thomas, Louis Marelle, Annica M. L. Ekman, Markus M. Frey, Marianne Tronstad Lund, Risto Makkonen, Ananth Ranjithkumar, Matthew E. Salter ... See all authors



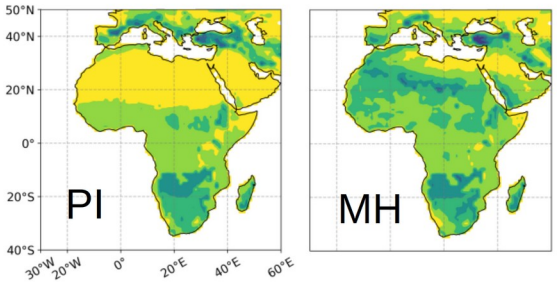




Simulating dust emissions and secondary organic aerosol formation over northern Africa during the mid-Holocene Green Sahara period

Zhou, P., Lu, Z., Keskinen, J.-P., Zhang, Q., Lento, J., Bian, J., van Noije, T., Le Sager, P., Kerminen, V.-M., Kulmala, M., Boy, M., and Makkonen, R.: Simulating the dust emissions and secondary organic aerosol formation over northern Africa during the mid-Holocene Green Sahara period, Climate of the Past, 19, 2445–2462, https://doi.org/10.5194/cp-19-2445-2023, 2023.

BVOC: biogenic volatile organic compounds (e.g., monoterpenes)



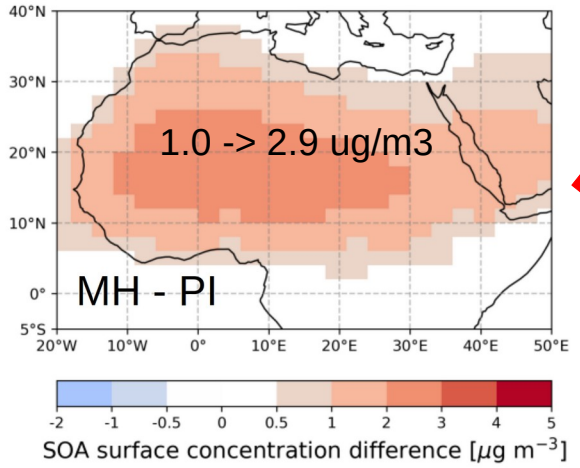
More BVOC emissions

Green Sahara

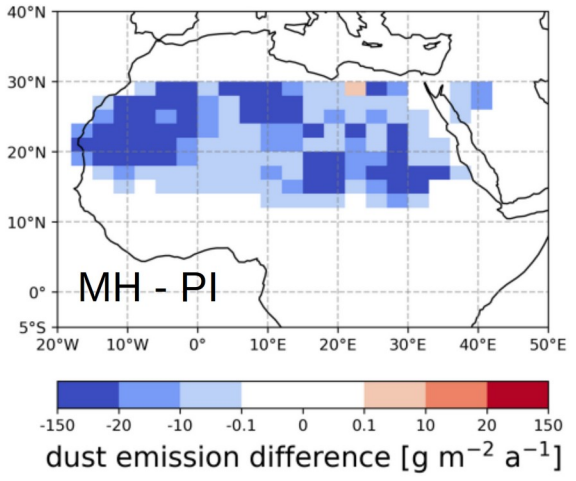
More vegetation growing over Northern Africa during mid-Holocene period (~ 6000 years ago; **MH**) compared to pre-industrial period (**PI**).

More SOA formation

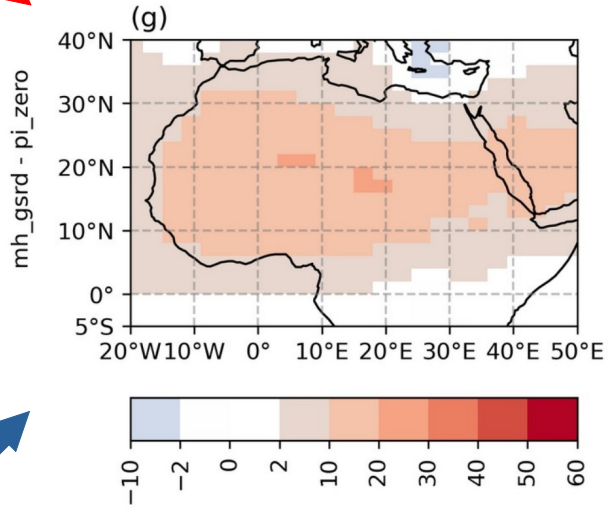
SOA: secondary organic aerosol



280.6 -> 26.8 Tg/a



Less dust emissions



CCN at 0.2% difference

Research article |

BVOC–aerosol–climate feedbacks investigated using NorESM

Moa K. Sporre, Sara M. Blichner, Inger H. H. Karset, Risto Makkonen, and Terje K. Berntsen