

# Simulations with NorESM2.3

January 15, 2025

- What is in NorESM2.3?
- Simulations
- Ocean volume temperature, surface (2 m) air temperature
- Aerosol ERF
- New simulations

# What is in NorESM2.3?

## NorESM2.3

- Cloud2
- Lowered soa-yields
- Modified in-cloud scavenging
- Full-chemistry (optional)
- Secondary ice (optional)
- BLOM/iHAMOCC: new capabilities/features + bug corrections/tunings (small impact)
- OSLO\_AERO: its own repository

## NorESM2.3.1

- Bromoform (optional)
- NPF new particle formation (optional)
- Nenes aerosol activation (optional)

# Simulations

|                     |                 | NorESM2<br>(CMIP6) | NorESM2.1 | NorESM2.1<br>+SH/TS | NorESM2.3 | NorESM2.3<br>Full-chemistry |
|---------------------|-----------------|--------------------|-----------|---------------------|-----------|-----------------------------|
| N1850               | (fully coupled) | x                  | x         | x                   | x*        | x                           |
| NF1850norbc         | (fixed-SST)     | x                  | x         | x                   | x*        | x                           |
| NF1850norbc_aer2014 | (fixed-SST)     | x                  | x         | x                   | x*        | —                           |

(\*: various tests)

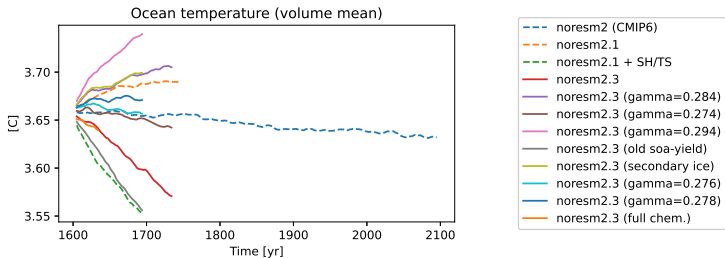
# NorESM2.3 simulations

|                        | N1850<br>(fully-coupled) | NF1850norbc<br>(fixed-SST) | NF1850norbc_aer2014<br>(fixed-SST) | NF1850norbc<br>(fixed-SST, chemistry) | NF1850norbc_aer2014<br>(fixed-SST, chemistry) |
|------------------------|--------------------------|----------------------------|------------------------------------|---------------------------------------|-----------------------------------------------|
| 1 (gamma=0.264)        | x                        | x                          | x                                  | x                                     | x                                             |
| 2 gamma=0.284          | x                        |                            |                                    |                                       |                                               |
| 3 gamma=0.274          | x                        |                            |                                    |                                       |                                               |
| 4 gamma=0.294          | x                        |                            |                                    |                                       |                                               |
| 5 old SOA-yield        | x                        | x                          | x                                  |                                       |                                               |
| 6 <b>secondary ice</b> | <b>x</b>                 | <b>x</b>                   | <b>x</b>                           |                                       |                                               |
| 7 <b>gamma=0.276</b>   | <b>x</b>                 |                            |                                    |                                       |                                               |
| 8 <b>gamma=0.278</b>   | <b>x</b>                 |                            |                                    |                                       |                                               |

(bold: new since last meeting)

# Drift in ocean temperature

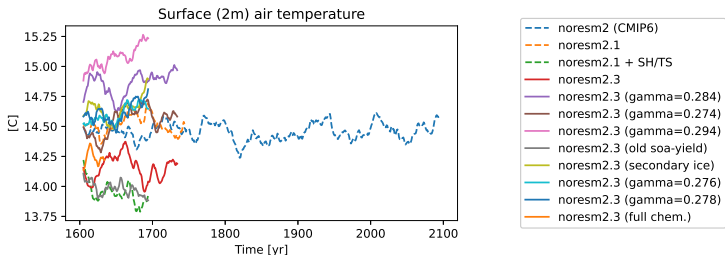
Global mean



(11-year running average)

# Surface (2 m) air temperature

Global mean



# Aerosol ERF

Global mean

|                |                     | NorESM2<br>(CMIP6) | NorESM2.1        | NorESM2.1<br>+SH/TS | NorESM2.3                          | NorESM2.3<br>(old SOA-yield) | NorESM2.3<br>(secondary ice) |
|----------------|---------------------|--------------------|------------------|---------------------|------------------------------------|------------------------------|------------------------------|
| Aerosol ERF    | $[\text{W m}^{-2}]$ | $-1.37 \pm 0.06$   | $-1.22 \pm 0.08$ | $-1.43 \pm 0.09$    | <b><math>-1.62 \pm 0.08</math></b> | $-1.16 \pm 0.08$             | $-1.41 \pm 0.09$             |
| Direct         | $[\text{W m}^{-2}]$ | $0.04 \pm 0.01$    | $0.08 \pm 0.01$  | $0.01 \pm 0.01$     | $0.02 \pm 0.01$                    | $0.05 \pm 0.01$              | $0.03 \pm 0.01$              |
| Cloud          | $[\text{W m}^{-2}]$ | $-1.35 \pm 0.06$   | $-1.37 \pm 0.06$ | $-1.44 \pm 0.08$    | <b><math>-1.63 \pm 0.06</math></b> | $-1.20 \pm 0.06$             | $-1.50 \pm 0.07$             |
| Surface albedo | $[\text{W m}^{-2}]$ | $-0.06 \pm 0.03$   | $0.06 \pm 0.03$  | $-0.00 \pm 0.04$    | $-0.02 \pm 0.04$                   | $-0.01 \pm 0.04$             | $0.05 \pm 0.03$              |

# Aerosol burden in 1850 (fSST simulations)

Global total

|                       |                        | NorESM2<br>(CMIP6) | NorESM2.1 | NorESM2.1<br>+ SH/TS | NorESM2.3    | NorESM2.3<br>(old soa-yield) | NorESM2.3<br>(secondary ice) |
|-----------------------|------------------------|--------------------|-----------|----------------------|--------------|------------------------------|------------------------------|
| BC                    | [Tg]                   | 0.0418             | 0.0412    | 0.0354               | 0.0367       | 0.0362                       | 0.0380                       |
| OM                    | [Tg]                   | 2.06               | 2.15      | 1.81                 | <b>1.12</b>  | 1.93                         | <b>1.16</b>                  |
| Sulphate              | [Tg]                   | 0.57               | 0.596     | 0.52                 | 0.475        | 0.477                        | 0.485                        |
| Dust                  | [Tg]                   | 8.61               | 13.2      | 12.7                 | 13.1         | 12.9                         | 12.9                         |
| Sea-salt              | [Tg]                   | 9.03               | 11.4      | 11.4                 | 8.50         | 8.52                         | 9.23                         |
| DMS                   | [Tg]                   | 0.123              | 0.121     | 0.125                | 0.124        | 0.124                        | 0.122                        |
| SO <sub>2</sub>       | [Tg]                   | 0.259              | 0.261     | 0.252                | 0.261        | 0.260                        | 0.260                        |
| SOA(na)               | [Tg]                   | 0.0170             | 0.0167    | 0.151                | 0.0176       | 0.0165                       | 0.0181                       |
| SOA(a1)               | [Tg]                   | 1.38               | 1.43      | 1.19                 | <b>0.486</b> | 1.30                         | <b>0.512</b>                 |
| U10                   | [m s <sup>-1</sup> ]   | 5.99               | 5.95      | 6.03                 | 6.02         | 6.02                         | 5.98                         |
| Isoprene emissions    | [Tg yr <sup>-1</sup> ] | 486                | 481       | 478                  | 507          | 487                          | 512                          |
| Monoterpene emissions | [Tg yr <sup>-1</sup> ] | 111                | 110       | 109                  | 114          | 111                          | 115                          |

# Clouds in 1850 (fSST simulations)

Global total

|        |                         | NorESM2<br>(CMIP6) | NorESM2.1 | NorESM2.1<br>+ SH/TS | NorESM2.3 | NorESM2.3<br>(old soa-yield) | NorESM2.3<br>(secondary ice) |
|--------|-------------------------|--------------------|-----------|----------------------|-----------|------------------------------|------------------------------|
| CLDHGH | [%]                     | 34.1               | 34.7      | 35.9                 | 34.1      | 34.0                         | 33.8                         |
| CLDMED | [%]                     | 20.6               | 19.5      | 23.0                 | 21.7      | 21.8                         | 20.1                         |
| CLDLOW | [%]                     | 38.7               | 38.3      | <b>39.7</b>          | 39.3      | 39.3                         | 38.6                         |
| CLDTOT | [%]                     | 61.4               | 61.4      | <b>63.3</b>          | 61.9      | 61.9                         | 61.4                         |
| LWCF   | $[\text{W m}^{-2}]$     | 25.1               | 25.4      | <b>28.0</b>          | 25.4      | 25.4                         | 24.6                         |
| SWCF   | $[\text{W m}^{-2}]$     | -48.6              | -48.0     | <b>-52.0</b>         | -49.1     | -49.7                        | -47.2                        |
| LWP    | $[\text{g m}^{-2}]$     | 69.1               | 63.7      | <b>81.1</b>          | 75.1      | 76.2                         | 67.3                         |
| IWP    | $[\text{g m}^{-2}]$     | 12.1               | 13.4      | 11.4                 | 9.5       | 9.5                          | 10.5                         |
| CDNC   | $[10^9 \text{ m}^{-2}]$ | 11.2               | 9.6       | 12.4                 | 10.6      | 11.8                         | 9.5                          |
| ICE(#) | $[10^6 \text{ m}^{-2}]$ | 91.9               | 133       | 97.7                 | 81.7      | 80.8                         | 81.0                         |

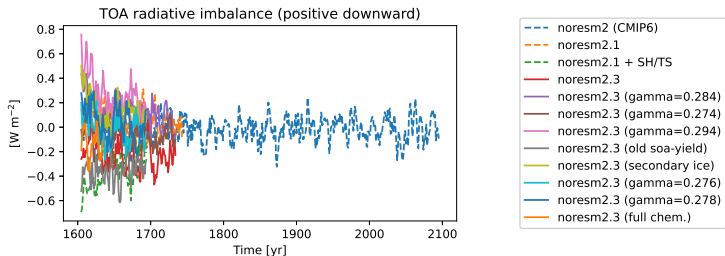
# NorESM2.3 simulations

|                         |               | N1850<br>(fully-coupled) | NF1850norbc<br>(fixed-SST) | NF1850norbc_aer2014<br>(fixed-SST) | NF1850norbc<br>(fixed-SST, chem) | NF1850norbc_aer2014<br>(fixed-SST, chem) |
|-------------------------|---------------|--------------------------|----------------------------|------------------------------------|----------------------------------|------------------------------------------|
| <b>Done simulations</b> |               |                          |                            |                                    |                                  |                                          |
| Test01                  | (gamma=0.264) | x                        | x                          | x                                  | x                                | x                                        |
| Test02                  | gamma=0.284   | x                        |                            |                                    |                                  |                                          |
| Test03                  | gamma=0.274   | x                        |                            |                                    |                                  |                                          |
| Test04                  | gamma=0.294   | x                        |                            |                                    |                                  |                                          |
| Test05                  | old SOA-yield | x                        | x                          | x                                  |                                  |                                          |
| Test06                  | secondary ice | x                        | x                          | x                                  |                                  |                                          |
| Test07                  | gamma=0.276   | x                        |                            |                                    |                                  |                                          |
| Test08                  | gamma=0.278   | x                        |                            |                                    |                                  |                                          |
| <b>New simulations</b>  |               |                          |                            |                                    |                                  |                                          |
| ...                     |               |                          |                            |                                    |                                  |                                          |

# Additional figures

# Net TOA radiative flux

Global mean



# Surface (10 m) wind speed

Global mean

