**AMAP model details.**

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| --- | --- | --- | --- | --- | --- |
| Model name | Model type | Primary Reference | Meteorology for historical time period | Biogenic emissions | Volcanic emissions |
| CanAM5-  PAM | GCM | *1, 2, 3, 4, 5, 6* | Nudged to ERA-Interim reanalysis | none | Specified climatological emissions and CMIP6 stratospheric aerosol |
| CESM2.0 | ESM | *7, 8* | Fully interactive with prescribed SST and SIC | MEGANv2.1 | CMIP6 |
| CESM2.1.1 | ESM | *7, 8* | Fully interactive atmosphere, ocean, and sea-ice | CMIP6 (but only affecting SOA, not ozone) | CMIP6 |
| CIESM-  MAM7 | GCM | *9, 10* | Nudged to ERA-Interim reanalysis | None | CMIP6 |
| CMAM | CCM | *11, 12* | Nudged to ERA-Interim reanalysis | None | None |
| DEHM | Offline CTM, hemispheric | *13, 14, 15* | Nudged to ERA-Interim reanalysis | MEGANv2 | none |
| ECHAM6-  SALSA | GCM | *16, 17, 18* | Nudged to ERA-Interim reanalysis | based on the GEIA inventory (as particulate matter only) | 3D emission fields based on AeroCom III (https://wiki.met.no/aerocom/phase3-experiments); includes emissions for Holuhraun |
| EMEP MSC-W | CTM | *19, 20* | Driven by 3-hourly data from the Integrated Forecast System (IFS) at ECMWF | EMEP scheme | Degassing from Ethna, Stromboli, Eyjafjallajökull (2010) Grimsvotn (2011), Holuhraun (2014, 2015).  For future years: 2010. |
| FLEXPART | Lagrangian Transport Model | *21* | Driven by the 3-hourly ECMWF meteorology | none | none |
| GEM-  MACH | Regional on-line air quality prediction model | *22, 23, 24, 25* | Driven by the GEM numerical forecast, initialized every 24 hours using Canadian Meteorological Centre’s global objective analysis | BEIS v3.09 | None |
| GEOS-Chem | CTM | *26* | Driven by the GEOS meteorology from the NASA data assimilation office | MEGANv2.1 | NASA/GMAO |
| GISS-E2.1 | ESM | *27, 28, 29* | Nudged to NCEP reanalysis | Isoprene: MEGANv2.1; Terpenes: ORCHIDEE; Online DMS, Sea-salt and dust | AeroCom |
| MATCH | Offline chemistry CTM, hemispheric | *30* | ERA-Interim reanalysis 6-hourly | MEGANv2 | Climatological + separate runs with and without Holuhraun eruption |
| MATCH-  SALSA-  RCA4 | Offline coupled CCM, hemispheric | *30, 31, 32* | RCA4 | MEGANv2 | Specified 2014-15, including Holuhraun eruption + Climatological |
| MRI-ESM2 | ESM | *33, 34, 35* | Nudged to the Japanese 55-year Reanalysis (JRA55) | Biogenic VOCs emissions are taken from Horowitz et al. (*47*) | CMIP6 stratospheric aerosol dataset or specified 2014-2015 SO2 emission with Holuhraun eruption |
| NorESM-  happi | ESM & CTM | *36, 37 , 38, 39* | Fully interactive with prescribed SST and SIC | CMIP6 | CMIP6 |
| Oslo-CTM | CTM | *40, 41* | Driven by 3-hourly data from the Integrated Forecast System (IFS) at ECMWF | MEGAN-MACC constant at 2010 level | Emissions for continually degassing volcanoes from AeroCom (*48*). Based on: Andres and Kasgnoc (*49*). Volcano height is based Halmer et al. (*50*). |
| UKESM1 | CCM/ESM | *42, 43, 44* | Nudged to ERA-Interim reanalysis | Isoprene and monoterpenes interactive with land surface vegetation scheme | Climatology of emissions for continually degassing volcanoes. For explosive volcanoes a zonal mean climatology of stratospheric aerosol optical properties over historical period used from CMIP6 dataset |
| WRF-Chem | Regional-  Arctic chemistry-aerosol climate model | *45, 46* | Nudged to NCEP Final Analysis (FNL) | MEGAN2.1 | No |

Acronyms: GCM=Global Climate Model, ESM=Earth System Model, CCM=Chemistry Climate Model, CTM=Chemical Transport Model.

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