**Table 1.** WRF-CMAQ modelling system configurations

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| --- | --- | --- | --- |
| Model | Parameter | Configuration schemes | |
| WRF | Horizontal resolution | | 36km, 181 (column) × 136 (row) |
| Vertical resolution | | 47 sigma levels from surface to tropopause |
| IC and BC | | Final analysis data from NCEP |
| Shortwave radiation | | New Goddard scheme1 |
| Longwave radiation | | RRTM scheme2 |
| Surface layer | | Pleim–Xiu scheme3 |
| Planetary boundary layer | | ACM2 scheme4 |
| Cumulus | | Kain–Fritsch scheme5 |
| Cloud microphysics | | WSM6 scheme |
| Nudging | | Analysis nudging, observational nudging, soil nudging were conducted  added additional station observations from the China Meteorological Administration (http://data.cma.cn/wa) |
| CMAQ | Horizontal resolution | | 36km, 172 (column) × 127 (row) |
| Vertical resolution | | 28 sigma levels from surface to tropopause. The values of sigma levels are 1.000, 0.9975, 0.995, 0.992, 0.988, 0.984, 0.980, 0.975, 0.970, 0.963, 0.956, 0.938, 0.916, 0.893, 0.868, 0.839, 0.808, 0.777, 0.744, 0.702, 0.648, 0.582, 0.500, 0.400, 0.300, 0.200, 0.120, 0.052 and 0.000 |
| IC and BC | | Global chemistry transport model CAM-Chem outputs |
| Gas-phase mechanism | | CB05 |
| Aqueous-phase mechanism | | RADM |
| Aerosol module | | AERO6 |
| Cloud module | | ACM\_AE6 ACM cloud processor |
| Photolytic rate | | In-line calculation |
| Heterogeneous reactions | | Updated heterogeneous reactions involving HO2, O3, OH, H2O2, NO3, and HNO3 in the original CMAQ model\*1 |
| Anthropogenic emissions | | MEIC for China; MIX for other Asian countries |
| Biogenic emissions | | MEGANv3.1\*2 |
| Open biomass burning | | GFED47 |
| Dust | | In-line calculation |
| Lightning | | Not included |

\*1 Yuxi Liu, Guannan Geng, Jing Cheng, Yang Liu, Qingyang Xiao, Liangke Liu, Qinren Shi, Dan Tong, Kebin He, and Qiang Zhang, Environmental Science & Technology 2023 57 (24), 8954-8964, DOI: 10.1021/acs.est.3c00054

\*2 Isoprene emission response to drought and the impact on global atmospheric chemistry