Reduced complexity model intercomparison project phase 1: Protocol, results and initial observations: supplementary information

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Table S1. Overview of the technical components of the models participating in RCMIP Phase 1.

| Model     | Development home | License                  | Approximate release frequency | Codebase size (approximate lines of code) | Simulation years per second (approximate for a single core machine) | Language, distribution format and support platforms | Code testing                        |
|-----------|------------------|--------------------------|-------------------------------|------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------|-----------------------------------|
| ACC2      | Internal only    | AGPLv3                   | N/A                           | 500                                      | 100                                                               | GAMS                                               | Manual validation and verification |
| AR5IR (both variants) | N/A             | AGPLv3                   | N/A                           | 500                                      | 5 000                                                             | Python 3.7 (https://github.com/openclimatedata_openscm/blob/ar5ir-notebooks/notebooks/ar5ir_rcmip.ipynb) | Manual validation and verification |
| CICERO-SCM | Internal only    | GNU                      | Fortran 90                    | 3000                                     | 1                                                                 | Fortran 90                                         |                                    |
| ESCIMO     | GitHub           | Apache 2.0               | Sub-yearly                    | 3 500                                    | 3 500                                                             | Vensim                                             | Manual validation and verification |
| FaIR       | GitHub           | Creative Commons Attribution 4.0 License | Python 2.7, 3.5, 3.6, 3.7 Linux, macOS and Windows. | Python 2.7, 3.5, 3.6, 3.7. Linux, macOS and Windows. | Unit tests and continuous integration. |
| GIR        | Github           | Creative Commons Attribution 4.0 License | 250                           | 200 000                                  | Python 3.6+ (recommended), Excel, MatLAB and IDL available upon request. Linux, macOS and Windows. | Manual validation and verification |
| GREB       | GitHub           | Creative Commons Attribution 4.0 License | Yearly                        | 1700                                     | 1                                                                 | Fortran 90 (GrADS or Python 3.7 for data processing) | Fortran 90 code tested by gfortran on Mac and ifort on Linux under continuous integration |
| Model                      | Development home | License           | Approximate release frequency | Codebase size (approximate lines of code) | Simulation years per second (approximate for a single core machine) | Language, distribution format and support platforms                                                                 | Code testing                                                                 |
|----------------------------|------------------|-------------------|-------------------------------|------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Hector                     | GitHub AGPLv3    | Yearly            | 500                           | 5 000                                    | R and Python packages (with C++ backend). Linux, macOS and Windows. | Unit tests and continuous integration                                                        | Manual validation and verification                                               |
| Held et al. two layer model| GitHub APLv3     | Yearly            | 500                           | 5 000                                    | Python 3.7 (https://github.com/openclimatedata/openscm/blob/ar5ir-notebooks/notebooks/held_two_layer_rcmip.ipynb) | Manual validation and verification                                                        |                                                                                       |
| MAGICC                     | Private GitLab  | Decadal           | 15 000                        | 350                                      | Fortran 90 (Open-source Python wrapper available). Linux, macOS and Windows. | Unit tests and continuous integration                                                        |                                                                                       |
| MCE                        | Private GitHub, preparing public release | n/a | 760 excluding calibration code | 500                                      | Python 2.7 and 3.7 on multiple platforms                    | Comparing results for idealized scenarios with analytical solutions                  |                                                                                       |
| Model  | Development home | License       | Approximate release frequency | Codebase size (approximate lines of code) | Simulation years per second (approximate for a single core machine) | Language, distribution format and support platforms | Code testing                      |
|--------|------------------|---------------|-------------------------------|------------------------------------------|-------------------------------------------------|-------------------------------------------------|----------------------------------|
| OSCAR  | Development internal, with release on GitHub https://github.com/tgasser/OSCAR | CeCILL sub-yearly | 5000 excluding calibration code | Python 3.7 | Manual validation and verification | WASP C++ code tested only on GNU GCC compiler collection |
| WASP   | Internal Creative Commons Attribution License |                      | 100000                        | C++ 11 | | |
Figure S1. Historical effective radiative forcing for RCMIP models in illustrative configurations. In order to provide timeseries up until 2019, we have used data from the combination of historical and ssp585 simulations. (a) - total effective radiative forcing; (b) - aerosol effective radiative forcing.
Table S2. Emulation scores and equilibrium climate sensitivities (ECSs) for RCMIP model calibrations. In parentheses we show the number of simulations available for each model variant.

| Target CMIP6 model       | RCMIP model                      | ECS (K) | RMSE (K) |
|--------------------------|----------------------------------|---------|----------|
| AWI-CM-1-1-MR_r1i1p1f1 (5) | MAGICC-v7-1-0-beta (5)           | 3.22    | 0.16     |
| BCC-CSM2-MR_r1i1p1f1 (6)  | MCE-v1-1 (2)                     | 2.90    | 0.21     |
|                          | MAGICC-v7-1-0-beta (6)           | 2.83    | 0.16     |
|                          | ar5ir-2box (2)                   | 7.35    | 0.13     |
|                          | ar5ir-3box (2)                   | 7.78    | 0.13     |
|                          | held-two-layer-uom (2)           | 2.63    | 0.13     |
| BCC-ESM1_r1i1p1f1 (4)     | MCE-v1-1 (2)                     | 2.96    | 0.12     |
|                          | MAGICC-v7-1-0-beta (3)           | 3.13    | 0.13     |
|                          | ar5ir-2box (2)                   | 15.30   | 0.18     |
|                          | ar5ir-3box (2)                   | 8.06    | 0.15     |
|                          | held-two-layer-uom (2)           | 2.31    | 0.12     |
| CanESM5_r1i1p1f1 (10)     | MCE-v1-1 (2)                     | 5.08    | 0.13     |
|                          | hector62381e71 (4)               | 4.79    | 0.42     |
|                          | MAGICC-v7-1-0-beta (10)          | 5.72    | 0.30     |
|                          | ar5ir-2box (2)                   | 5.24    | 0.19     |
|                          | ar5ir-3box (2)                   | 11.82   | 0.21     |
|                          | held-two-layer-uom (2)           | 3.14    | 0.30     |
| CanESM5_r1i1p2f1 (7)      | MCE-v1-1 (2)                     | 5.08    | 0.13     |
|                          | hector62381e71 (4)               | 4.79    | 0.43     |
|                          | MAGICC-v7-1-0-beta (7)           | 5.64    | 0.27     |
| CanESM5_r10i1p1f1 (5)     | hector62381e71 (2)               | 4.79    | 0.29     |
|                          | MAGICC-v7-1-0-beta (5)           | 6.01    | 0.18     |
| CESM2-WACCM_r1i1p1f1 (6)  | MCE-v1-1 (2)                     | 3.85    | 0.15     |
|                          | hector62381e71 (3)               | 4.17    | 0.26     |
|                          | MAGICC-v7-1-0-beta (6)           | 4.26    | 0.21     |
|                          | ar5ir-2box (2)                   | 4.64    | 0.45     |
|                          | ar5ir-3box (2)                   | 13.42   | 0.21     |
|                          | held-two-layer-uom (2)           | 2.55    | 0.13     |
### Table S2. Continued.

| Target CMIP6 model | RCMIP model                  | ECS (K) | RMSE (K) |
|--------------------|------------------------------|---------|----------|
| CESM2_r1i1p1f1 (6) | MCE-v1-1 (2)                 | 4.20    | 0.17     |
|                    | hector62381e71 (3)           | 4.00    | 0.67     |
|                    | MAGICC-v7-1-0-beta (6)       | 5.32    | 0.27     |
|                    | ar5ir-2box (2)               | 5.40    | 0.24     |
|                    | ar5ir-3box (2)               | 8.31    | 0.24     |
|                    | held-two-layer-uom (2)       | 3.63    | 0.20     |
| CNRM-CM6-1_r1i1p1f2 (8) | MCE-v1-1 (4)              | 4.06    | 0.24     |
|                    | hector62381e71 (5)           | 3.86    | 0.36     |
|                    | MAGICC-v7-1-0-beta (8)       | 4.08    | 0.18     |
|                    | ar5ir-2box (4)               | 8.13    | 0.43     |
|                    | ar5ir-3box (4)               | 9.12    | 0.43     |
|                    | held-two-layer-uom (4)       | 2.91    | 0.16     |
| CNRM-ESM2-1_r1i1p1f2 (10) | MCE-v1-1 (2)             | 4.02    | 0.20     |
|                    | hector62381e71 (4)           | 3.51    | 0.25     |
|                    | MAGICC-v7-1-0-beta (9)       | 3.71    | 0.18     |
|                    | ar5ir-2box (2)               | 8.22    | 0.27     |
|                    | ar5ir-3box (2)               | 12.18   | 0.27     |
|                    | held-two-layer-uom (2)       | 2.29    | 0.17     |
| E3SM-1-0_r1i1p1f1 (2) | MCE-v1-1 (2)                | 5.10    | 0.17     |
|                    | MAGICC-v7-1-0-beta (2)       | 5.69    | 0.22     |
| EC-Earth3-Veg_r1i1p1f1 (7) | MCE-v1-1 (2)             | 4.13    | 0.19     |
|                    | MAGICC-v7-1-0-beta (7)       | 4.47    | 0.25     |
|                    | ar5ir-2box (2)               | 15.91   | 0.27     |
|                    | ar5ir-3box (2)               | 8.32    | 0.22     |
|                    | held-two-layer-uom (2)       | 3.50    | 0.19     |
Table S2. Continued.

| Target CMIP6 model     | RCMIP model              | ECS (K) | RMSE (K) |
|------------------------|--------------------------|---------|----------|
| FGOALS-g3_r1i1p1f1 (4)| MAGICC-v7-1-0-beta (4)  | 2.77    | 0.15     |
| GISS-E2-1-G_r1i1p1f1 (4)| MCE-v1-1 (4)            | 2.69    | 0.16     |
|                        | MAGICC-v7-1-0-beta (4)  | 2.81    | 0.19     |
|                        | ar5ir-2box (4)          | 5.24    | 0.15     |
|                        | ar5ir-3box (4)          | 18.98   | 0.58     |
|                        | held-two-layer-uom (4)  | 2.50    | 0.15     |
| GISS-E2-1-H_r1i1p1f1 (3)| MCE-v1-1 (3)            | 3.07    | 0.15     |
|                        | MAGICC-v7-1-0-beta (3)  | 3.20    | 0.16     |
|                        | ar5ir-2box (3)          | 16.68   | 0.16     |
|                        | ar5ir-3box (3)          | 8.05    | 0.15     |
|                        | held-two-layer-uom (3)  | 2.48    | 0.14     |
| GISS-E2-2-G_r1i1p1f1 (3)| MAGICC-v7-1-0-beta (3)  | 2.88    | 0.19     |
|                        | ar5ir-2box (3)          | 3.70    | 0.16     |
|                        | ar5ir-3box (3)          | 18.86   | 0.66     |
|                        | held-two-layer-uom (3)  | 1.90    | 0.14     |
| IPSL-CM6A-LR_r1i1p1f1 (9)| MCE-v1-1 (4)            | 3.83    | 0.25     |
|                        | hector62381e71 (6)      | 3.07    | 0.67     |
|                        | MAGICC-v7-1-0-beta (9)  | 4.53    | 0.25     |
|                        | ar5ir-2box (4)          | 13.57   | 0.34     |
|                        | ar5ir-3box (4)          | 5.71    | 0.26     |
|                        | held-two-layer-uom (4)  | 4.57    | 0.29     |
| IPSL-CM6A-LR_r1i1p1f2 (2)| MAGICC-v7-1-0-beta (2)  | 4.43    | 0.21     |
| IPSL-CM6A-LR_r10i1p1f1 (3)| MCE-v1-1 (1)            | 3.83    | 0.21     |
|                        | hector62381e71 (1)      | 3.07    | 0.40     |
|                        | MAGICC-v7-1-0-beta (3)  | 3.77    | 0.32     |
| MCM-UA-1-0_r1i1p1f2 (4)| MAGICC-v7-1-0-beta (4)  | 3.45    | 0.16     |

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| Target CMIP6 model                | RCMIP model                        | ECS (K) | RMSE (K) |
|----------------------------------|------------------------------------|---------|----------|
| MIROC6_r1i1p1f1 (14)            | MCE-v1-1 (4)                       | 2.44    | 0.28     |
|                                  | MAGICC-v7-1-0-beta (12)            | 2.20    | 0.19     |
| MPI-ESM1-2-HR_r1i1p1f1 (2)      | MAGICC-v7-1-0-beta (2)             | 2.90    | 0.15     |
|                                  | ar5ir-2box (2)                     | 8.02    | 0.16     |
|                                  | ar5ir-3box (2)                     | 6.08    | 0.16     |
|                                  | held-two-layer-uom (2)             | 2.17    | 0.12     |
| NorCPM1_r1i1p1f1 (2)            | MAGICC-v7-1-0-beta (2)             | 2.73    | 0.29     |
|                                  | ar5ir-2box (2)                     | 7.24    | 0.13     |
|                                  | ar5ir-3box (2)                     | 8.60    | 0.23     |
|                                  | held-two-layer-uom (2)             | 4.15    | 0.18     |
| NorESM2-LM_r1i1p1f1 (3)         | MCE-v1-1 (2)                       | 2.19    | 0.32     |
|                                  | MAGICC-v7-1-0-beta (2)             | 2.27    | 0.22     |
|                                  | ar5ir-2box (2)                     | 13.37   | 0.19     |
|                                  | ar5ir-3box (2)                     | 12.48   | 0.19     |
| SAM0-UNICON_r1i1p1f1 (2)        | MCE-v1-1 (2)                       | 3.80    | 0.15     |
|                                  | MAGICC-v7-1-0-beta (2)             | 3.42    | 0.24     |
| UKESM1-0-LL_r1i1p1f2 (9)        | MCE-v1-1 (2)                       | 5.31    | 0.16     |
|                                  | MAGICC-v7-1-0-beta (9)             | 6.05    | 0.30     |
|                                  | ar5ir-2box (2)                     | 16.92   | 0.26     |
|                                  | ar5ir-3box (2)                     | 7.22    | 0.19     |
|                                  | held-two-layer-uom (2)             | 4.11    | 0.19     |
Figure S2. Probabilistic estimate of CO$_2$ effective radiative forcing for ssp119 and ssp585 (note, for Hector CO$_2$ radiative forcing is shown as effective radiative forcing is not available). (a) - historical period (1850-2025); (b) - projections (2000-2110).
Figure S3. Comparison of effective radiative forcing projections under the RCPs and SSPs up until 2100. The coloured solid lines are RCMIP output where the RCP/SSP pair has been run with the same model in the same configuration. The plumes show the standard deviation of the available model results whilst the lines show the mean.
Figure S4. Comparison of CO₂ effective radiative forcing projections under the RCPs and SSPs up until 2100. The coloured solid lines are RCMIP output where the RCP/SSP pair has been run with the same model in the same configuration. The plumes show the standard deviation of the available model results whilst the lines show the mean.
Figure S5. Comparison of aerosols effective radiative forcing projections under the RCPs and SSPs up until 2100. The coloured solid lines are RCMIP output where the RCP/SSP pair has been run with the same model in the same configuration. The plumes show the standard deviation of the available model results whilst the lines show the mean.
**Figure S6.** Response of RCMIP models to a reduction in near-term climate forcers. Results are from RCMIP models, except for temperature lines with natural variability which are CMIP6 results. The ssp370-lowNTCF scenario results in a small warming signal relative to ssp370, the magnitude of which varies by RCM. For comparison, we also include ssp370-lowNTCF as quantified by Gidden et al. (2019) (labelled ‘ssp370-lowNTCF-gidden’). This implementation also includes reductions in methane and so a strong cooling signal is seen instead.
**Figure S7.** Emulation of CanESM5_r1i1p2f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CanESM5_r1i1p2f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S8. Emulation of BCC-ESM1_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from BCC-ESM1_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S9. Emulation of CanESM5_r10i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CanESM5_r10i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S10. Emulation of generic by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from generic). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S11. Emulation of FGOALS-g3_rli1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from FGOALS-g3_rli1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S12. Emulation of MPI-ESM1-2-HR_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from MPI-ESM1-2-HR_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S13. Emulation of BCC-CSM2-MR_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from BCC-CSM2-MR_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
**Figure S14.** Emulation of SAM0-UNICON_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from SAM0-UNICON_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S15. Emulation of EC-Earth3-Veg_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from EC-Earth3-Veg_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S16. Emulation of CanESM5_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CanESM5_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S17. Emulation of GISS-E2-1-H_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from GISS-E2-1-H_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S18. Emulation of CESM2_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CESM2_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S19. Emulation of UKESM1-0-LL_r1i1p1f2 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from UKESM1-0-LL_r1i1p1f2). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S20. Emulation of MIROC6_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from MIROC6_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S21. Emulation of E3SM-1-0_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from E3SM-1-0_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S22. Emulation of GISS-E2-2-G_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from GISS-E2-2-G_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S23. Emulation of NorESM2-LM_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from NorESM2-LM_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S24. Emulation of IPSL-CM6A-LR_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from IPSL-CM6A-LR_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S25. Emulation of IPSL-CM6A-LR_r1i1p1f2 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from IPSL-CM6A-LR_r1i1p1f2). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S26. Emulation of IPSL-CM6A-LR_r10i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from IPSL-CM6A-LR_r10i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S27. Emulation of AWI-CM-1-1-MR_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from AWI-CM-1-1-MR_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
**Figure S28.** Emulation of CESM2-WACCM_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CESM2-WACCM_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S29. Emulation of CNRM-ESM2-1_r1i1p1f2 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CNRM-ESM2-1_r1i1p1f2). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S30. Emulation of MCM-UA-1-0_r1i1p1f2 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from MCM-UA-1-0_r1i1p1f2). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S31. Emulation of GISS-E2-1-G_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from GISS-E2-1-G_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S32. Emulation of CNRM-CM6-1_r1i1p1f2 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from CNRM-CM6-1_r1i1p1f2). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Figure S33. Emulation of NorCPM1_r1i1p1f1 by RCMs in RCMIP Phase 1. The thick transparent lines are the target CMIP6 model output (here from NorCPM1_r1i1p1f1). The thin lines are emulations from different RCMs. Panel (a) shows results for scenario based experiments while panels (b) - (e) show results for idealised CO2-only experiments (note that panels (b) - (e) share the same legend).
Table S3. RCMIP Phase 1 experiment overview (also available at rcmip.org). In the ‘drivers’ column, the acronyms show the inputs which are provided to the models in order to perform the run. CC: CO₂ concentrations; CO: non-CO₂ WMGHG concentrations; EC: CO₂ emissions; EO: non-CO₂ WMGHG emissions; A: aerosol emissions; S: solar effective radiative forcing; V: volcanic effective radiative forcing. ESDOC refers to the Earth System Documentation service (https://search.es-doc.org/).

| ID              | Drivers  | Summary                                                                 | Further information | Tier |
|-----------------|----------|-------------------------------------------------------------------------|---------------------|------|
| piControl       | CC, CO, A, S, V | Pre-industrial control simulation.                                      | ESDOC               | 1    |
| esm-piControl   | EC, CO, A, S, V | Pre-industrial control simulation with zero anthropogenic perturbation to CO₂ emissions. | ESDOC               | 1    |
| esm-piControl-allGHG | EC, EO, A, S, V | Pre-industrial control simulation with zero anthropogenic perturbation to GHG emissions. | RCMIP specific experiment | 2    |
| 1pctCO2         | CC       | 1 % per year increase in atmospheric CO₂ concentrations.               | ESDOC               | 1    |
| 1pctCO2-4xext   | CC       | 1 % per year increase in atmospheric CO₂ concentrations until atmospheric CO₂ concentrations quadruple, constant CO₂ concentrations thereafter. | ESDOC               | 1    |
| 1pctCO2-cdr     | CC       | 1 % per year increase in atmospheric CO₂ concentrations until atmospheric CO₂ concentrations quadruple and then 1% per year decrease in atmospheric CO₂ concentrations until CO₂ returns to pre-industrial levels, constant thereafter. | ESDOC               | 2    |
| abrupt-4xCO2    | CC       | Abrupt quadrupling of atmospheric CO₂ concentrations.                  | ESDOC               | 1    |
| abrupt-2xCO2    | CC       | Abrupt doubling of atmospheric CO₂ concentrations.                     | ESDOC               | 1    |
| abrupt-0p5xCO2  | CC       | Abrupt halving of atmospheric CO₂ concentrations.                      | ESDOC               | 1    |
| esm-pi-cdr-pulse| EC       | Removal of 100 GtC in a single year from pre-industrial atmosphere, zero CO₂ emissions thereafter. | ESDOC               | 2    |
| ID            | Drivers | Summary                                                                 | Further information | Tier |
|---------------|---------|-------------------------------------------------------------------------|---------------------|------|
| esm-pi-CO2pulse | EC      | Addition of 100 GtC in a single year from pre-industrial atmosphere, zero CO2 emissions thereafter. | ESDOC               | 2    |
| esm-bell-1000PgC | EC      | Cumulative addition of 1000 PgC following a bell-curved shaped emissions timeseries. | ESDOC               | 3    |
| esm-bell-2000PgC | EC      | Cumulative addition of 2000 PgC following a bell-curved shaped emissions timeseries. | ESDOC               | 3    |
| esm-bell-750PgC  | EC      | Cumulative addition of 750 PgC following a bell-curved shaped emissions timeseries. | ESDOC               | 3    |
| historical    | CC, CO, A, S, V | Simulation of 1850-2014.                                                                 | ESDOC               | 1    |
| historical-cmip5 | CC, CO, A, S, V | Simulation of 1850-2004, matching forcings as estimated in CMIP5.               | http://www.pik-potsdam.de/~mmalte/rcps/ | 2    |
| hist-aer      | A       | Simulation of 1850-2014 with aerosol emissions only.                       | ESDOC               | 3    |
| hist-CO2      | CC      | Simulation of 1850-2014 with changing CO2 concentrations only.             | ESDOC               | 3    |
| hist-GHG      | CC, CO  | Simulation of 1850-2014 with changing GHG concentrations only.             | ESDOC               | 3    |
| hist-nat      | S, V    | Simulation of 1850-2014 with changing natural forcings only.              | ESDOC               | 3    |
| hist-sol      | S       | Simulation of 1850-2014 with changing solar forcing only.                 | ESDOC               | 3    |
| hist-volc     | V       | Simulation of 1850-2014 with changing volcanic forcing only.              | ESDOC               | 3    |
| ssp119        | CC, CO, A, S, V | Low-end scenario reaching radiative forcing ~1.9 Wm$^{-2}$ in 2100 (using the SSP1 socioeconomic storyline). | ESDOC               | 1    |
| esm-ssp119    | EC, CO, A, S, V | As above except CO2 emissions driven.                                      | ESDOC               | 1    |
| esm-ssp119-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.                                  | ESDOC               | 2    |
| ID          | Drivers | Summary                                                                 | Further information | Tier |
|-------------|---------|-------------------------------------------------------------------------|---------------------|------|
| ssp126      | CC, CO, A, S, V | Update of RCP2.6 based on the SSP1 socioeconomic storyline.             | ESDOC               | 2    |
| esm-ssp126  | EC, CO, A, S, V | As above except CO2 emissions driven.                                    | ESDOC               | 3    |
| esm-ssp126-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.                                | ESDOC               | 3    |
| ssp245      | CC, CO, A, S, V | Update of RCP4.5 based on the SSP2 socioeconomic storyline.             | ESDOC               | 2    |
| esm-ssp245  | EC, CO, A, S, V | As above except CO2 emissions driven.                                    | ESDOC               | 3    |
| esm-ssp245-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.                                | ESDOC               | 3    |
| ssp370      | CC, CO, A, S, V | Gap-filling scenario reaching radiative forcing $\sim$7.0 Wm$^{-2}$ in 2100 (using the SSP3 socioeconomic storyline). | ESDOC               | 2    |
| esm-ssp370  | EC, CO, A, S, V | As above except CO2 emissions driven.                                    | ESDOC               | 3    |
| esm-ssp370-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.                                | ESDOC               | 3    |
| ssp370-lowNTCF | CC, CO, A, S, V | Gap-filling scenario reaching radiative forcing $\sim$7.0 Wm$^{-2}$ in 2100 with low near-term climate forcers (using the SSP3 socioeconomic storyline). | ESDOC               | 2    |
| esm-ssp370-lowNTCF | EC, CO, A, S, V | As above except CO2 emissions driven.                                    | ESDOC               | 3    |
| esm-ssp370-lowNTCF-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.                                | ESDOC               | 3    |
| ssp370-lowNTCF-gidden | CC, CO, A, S, V | Comparison scenario, follows the ssp370-lowNTCF quantification presented in Gidden et al. (2019). | RCMIP specific      | 3    |
| ID                      | Drivers       | Summary                                                                 | Further information | Tier |
|-------------------------|---------------|-------------------------------------------------------------------------|---------------------|------|
| esm-ssp370-lowNTCF-gidden | EC, CO, A, S, V | As above except CO2 emissions driven.                                   | RCMIP specific      | 3    |
| esm-ssp370-lowNTCF-gidden-allGHG | EC, CO, A, S, V | As above except all GHG emissions driven.                               | RCMIP specific      | 3    |
| ssp434                  | CC, CO, A, S, V | Gap-filling scenario reaching radiative forcing $\sim 3.4 \text{ W/m}^{-2}$ in 2100 with low near-term climate forcers (using the SSP4 socioeconomic storyline). | ESDOC               | 2    |
| esm-ssp434              | EC, CO, A, S, V | As above except CO2 emissions driven.                                   | ESDOC               | 3    |
| esm-ssp434-allGHG       | EC, CO, A, S, V | As above except all GHG emissions driven.                               | ESDOC               | 3    |
| ssp460                  | CC, CO, A, S, V | Update of RCP6.0 based on the SSP4 socioeconomic storyline.             | ESDOC               | 2    |
| esm-ssp460              | EC, CO, A, S, V | As above except CO2 emissions driven.                                   | ESDOC               | 3    |
| esm-ssp460-allGHG       | EC, CO, A, S, V | As above except all GHG emissions driven.                               | ESDOC               | 3    |
| ssp534-over             | CC, CO, A, S, V | Overshoot scenario reaching radiative forcing $\sim 3.4 \text{ W/m}^{-2}$ in 2100 having followed the ssp585 pathway until 2030 (using the SSP5 socioeconomic storyline). | ESDOC               | 2    |
| esm-ssp534-over         | EC, CO, A, S, V | As above except CO2 emissions driven.                                   | ESDOC               | 3    |
| esm-ssp534-over-allGHG  | EC, CO, A, S, V | As above except all GHG emissions driven.                               | ESDOC               | 3    |
| ssp585                  | CC, CO, A, S, V | Update of RCP8.5 based on the SSP5 socioeconomic storyline.             | ESDOC               | 1    |
| esm-ssp585              | EC, CO, A, S, V | As above except CO2 emissions driven.                                   | ESDOC               | 1    |
Table S3. Continued.

| ID            | Drivers | Summary                                      | Further information                                      | Tier |
|---------------|---------|----------------------------------------------|----------------------------------------------------------|------|
| esm-ssp585-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven. | ESDOC                                                   | 2    |
| rcp26         | CC, CO, A, S, V | RCP2.6 (from CMIP5).                       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp26     | EC, CO, A, S, V | As above except CO2 emissions driven.       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp26-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.   | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| rcp45         | CC, CO, A, S, V | RCP4.5 (from CMIP5).                       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp45     | EC, CO, A, S, V | As above except CO2 emissions driven.       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp45-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.   | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| rcp60         | CC, CO, A, S, V | RCP6.0 (from CMIP5).                       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp60     | EC, CO, A, S, V | As above except CO2 emissions driven.       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp60-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.   | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| rcp85         | CC, CO, A, S, V | RCP8.5 (from CMIP5).                       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp85     | EC, CO, A, S, V | As above except CO2 emissions driven.       | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| esm-rcp85-allGHG | EC, EO, A, S, V | As above except all GHG emissions driven.   | http://www.pik-potsdam.de/~mmalte/rcps/                  | 3    |
| Category                  | Variable                                    | Unit | Definition                                                                 | Tier |
|---------------------------|---------------------------------------------|------|----------------------------------------------------------------------------|------|
| Atmospheric Concentrations| Atmospheric Concentrations| CH4   | ppb                          | 1    |
|                           | Concentrations| CO2   | ppm                          | 1    |
|                           | Concentrations| F-Gases | ppm                          | 3    |
|                           | Concentrations| F-Gases| HFC125 | ppt                          | 2    |
|                           | Concentrations| F-Gases| HFC134a | ppt                          | 2    |
|                           | Concentrations| F-Gases| HFC143a | ppt                          | 2    |
|                           | Concentrations| F-Gases| HFC152a | ppt                          | 2    |
|                           | Concentrations| F-Gases| HFC227ea | ppt                          | 2    |
|                           | Concentrations| F-Gases| HFC23  | ppt                          | 2    |
|                           | Concentrations| F-Gases| HFC236fa | ppt                          | 2    |
| Category               | Variable                     | Unit | Definition                                      | Tier |
|-----------------------|------------------------------|------|------------------------------------------------|------|
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of HFC245fa        | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of HFC32          | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of HFC365mfc      | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of HFC43-10mee    | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of nitrogen trifluoride (NF₃) | 2 |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | equivalent species atmospheric concentrations of perfluorocarbons (PFCs, as defined by Table 8.A.1 of AR5), provided as aggregate CO₂-equivalents | 3 |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of C₂F₆          | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of C₃F₈          | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of C₄F₁₀         | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of C₅F₁₂         | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt  | atmospheric concentrations of C₆F₁₄         | 2    |
| Category                  | Variable                  | Unit  | Definition                                                      | Tier |
|--------------------------|---------------------------|-------|----------------------------------------------------------------|------|
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of C<sub>7</sub>F<sub>16</sub>        | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of C<sub>8</sub>F<sub>18</sub>        | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of c-C<sub>4</sub>F<sub>8</sub>      | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of CF<sub>4</sub>                   | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of sulfur hexafluoride (SF<sub>6</sub>) | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of sulfuryl fluoride (SO<sub>2</sub>F<sub>2</sub>) | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppm   | equivalent species atmospheric concentrations of Montreal gases, expressed as CO<sub>2</sub> equivalent | 3    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of CCl<sub>4</sub>                  | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppm   | atmospheric concentrations of CFC gases, expressed as CO<sub>2</sub> equivalent | 3    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of CFC11                           | 2    |
| Atmospheric Concentrations | Atmospheric Concentrations | ppt   | atmospheric concentrations of CFC113                         | 2    |
| Category               | Variable                                      | Unit | Definition                                      | Tier |
|------------------------|-----------------------------------------------|------|------------------------------------------------|------|
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CFC114          | 2    |
| Gases|CFC1|CFC114                                    |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CFC115          | 2    |
| Gases|CFC1|CFC115                                    |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CFC12           | 2    |
| Gases|CFC1|CFC12                                     |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CH$_2$Cl$_2$    | 2    |
| Gases|CH2Cl2                                  |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CH$_3$Br       | 2    |
| Gases|CH3Br                                   |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CH$_3$CCl$_3$  | 2    |
| Gases|CH3CCl3                                 |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CH$_3$Cl       | 2    |
| Gases|CH3Cl                                    |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of CHCl$_3$       | 2    |
| Gases|CHCl3                                    |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of Halon-1202     | 2    |
| Gases|Halon1202                                |      |                                               |      |
| Atmospheric Concentrations | Atmospheric Concentrations| ppt  | atmospheric concentrations of Halon-1211     | 2    |
| Gases|Halon1211                                |      |                                               |      |
| Category                     | Variable                                     | Unit  | Definition                                                                 | Tier |
|------------------------------|----------------------------------------------|-------|---------------------------------------------------------------------------|------|
| Atmospheric Concentrations   | Atmospheric Concentrations|Montreal| atmospheric concentrations of Halon-1301                                  | 2    |
|                              | GasesHalon1301                              | ppt   |                                                                           |      |
|                              | Atmospheric Concentrations|Montreal| atmospheric concentrations of Halon-2402                                  | 2    |
|                              | GasesHalon2402                              | ppt   |                                                                           |      |
|                              | Atmospheric Concentrations|Montreal| atmospheric concentrations of HCFC141b                                   | 2    |
|                              | GasesHCFC141b                              | ppt   |                                                                           |      |
|                              | Atmospheric Concentrations|Montreal| atmospheric concentrations of HCFC22                                     | 2    |
|                              | GasesHCFC142b                              | ppt   |                                                                           |      |
|                              | Atmospheric Concentrations|Montreal| atmospheric concentrations of HCFC22                                     | 2    |
|                              | GasesHCFC22                                | ppt   |                                                                           |      |
|                              | Atmospheric ConcentrationsN2O               | ppb   | atmospheric concentrations of N2O                                        | 2    |
| Carbon Cycle                 | Net Land to Atmosphere FluxCH4              | MtCH4yr⁻¹| net flux of CH4 from the land to the atmosphere (not including AFOLU and other anthropogenic emissions). A positive value indicates release of CH4 from the land, a negative value indicates a net land uptake. | 2    |
| Carbon Cycle                 | Net Land to Atmosphere FluxCH4|Earth System Feedbacks| MtCH4yr⁻¹| net flux of CH4 from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to Earth System Feedbacks. A positive value indicates release of CH4 from the land, a negative value indicates a net land uptake. | 2    |
| Carbon Cycle                 | Net Land to Atmosphere FluxCH4|Earth System Feedbacks| MtCH4yr⁻¹| net flux of CH4 from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to non-permafrost feedbacks. A positive value indicates release of CH4 from the land, a negative value indicates a net land uptake. Please specify in a comment on the comments sheet, which feedbacks are included here. | 2    |
**Table S4.** Continued.

| Category                  | Variable                     | Unit             | Definition                                                                                                                                                                                                 | Tier |
|---------------------------|------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Carbon Cycle              | Net Land to Atmosphere       | MtCH$_4$yr$^{-1}$| net flux of CH$_4$ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to the permafrost feedback. A positive value indicates release of CH$_4$ from the land, a negative value indicates a net land uptake. | 2    |
|                           | Flux|CH4|Earth System Feedbacks|Permafrost                                                                                                                                                |      |
| Carbon Cycle              | Net Land to Atmosphere       | MtCO$_2$yr$^{-1}$| net flux of CO$_2$ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions). A positive value indicates release of CO$_2$ from the land, a negative value indicates a net land uptake. | 2    |
|                           | Flux|CO2|Earth System Feedbacks                                                                                                                                           |      |
| Carbon Cycle              | Net Land to Atmosphere       | MtCO$_2$yr$^{-1}$| net flux of CO$_2$ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to Earth System Feedbacks. A positive value indicates release of CO$_2$ from the land, a negative value indicates a net land uptake. | 2    |
|                           | Flux|CO2|Earth System Feedbacks                                                                                                                                           |      |
| Carbon Cycle              | Net Land to Atmosphere       | MtCO$_2$yr$^{-1}$| net flux of CO$_2$ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to non-permafrost feedbacks. A positive value indicates release of CO$_2$ from the land, a negative value indicates a net land uptake. | 2    |
|                           | Flux|CO2|Earth System Feedbacks|Other                                                                                                                                                 |      |
| Category       | Variable                                      | Unit             | Definition                                                                                                                                                                                                 | Tier |
|----------------|-----------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Carbon Cycle   | Net Land to Atmosphere Flux|CO2|Earth System Feedbacks/Permafrost | net flux of CO\(_2\) from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to the permafrost feedback. A positive value indicates release of CO\(_2\) from the land, a negative value indicates a net land uptake. | 2    |
| Carbon Cycle   | Net Ocean to Atmosphere Flux|CH4 | MtCH\(_4\)yr\(^{-1}\) | net flux of CH\(_4\) from the ocean to the atmosphere (not including anthropogenic emissions). A positive value indicates release of CH\(_4\) from the ocean, a negative value indicates a net ocean uptake. | 2    |
| Carbon Cycle   | Net Ocean to Atmosphere Flux|CO2 | MtCO\(_2\)yr\(^{-1}\) | cumulative net flux of CO\(_2\) from the ocean to the atmosphere (not including anthropogenic emissions). A positive value indicates release of CO\(_2\) from the ocean, a negative value indicates a net ocean uptake. | 2    |
| Carbon Cycle   | Cumulative Net Land to Atmosphere Flux|CH4 | MtCH\(_4\) | cumulative net flux of CH\(_4\) from the land to the atmosphere (not including AFOLU and other anthropogenic emissions). A positive value indicates release of CH\(_4\) from the land, a negative value indicates a net land uptake. | 2    |
| Carbon Cycle   | Cumulative Net Land to Atmosphere Flux|CH4| Earth System Feedbacks | cumulative net flux of CH\(_4\) from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to Earth System Feedbacks. A positive value indicates release of CH\(_4\) from the land, a negative value indicates a net land uptake. | 2    |
### Table S4. Continued.

| Category             | Variable                                      | Unit     | Definition                                                                                                                                                                                                                                                                                                                                                      | Tier |
|----------------------|-----------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Carbon Cycle         | Cumulative Net Land to Atmosphere Flux| MtCH₄    | cumulative net flux of CH₄ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to non-permafrost feedbacks. A positive value indicates release of CH₄ from the land, a negative value indicates a net land uptake. Please specify in a comment on the comments sheet, which feedbacks are included here. | 2    |
| Carbon Cycle         | Cumulative Net Land to Atmosphere Flux| MtCH₄    | cumulative net flux of CH₄ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to the permafrost feedback. A positive value indicates release of CH₄ from the land, a negative value indicates a net land uptake.                                                                                                                                     | 2    |
| Carbon Cycle         | Cumulative Net Land to Atmosphere Flux| MtCO₂    | cumulative net flux of CO₂ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions). A positive value indicates release of CO₂ from the land, a negative value indicates a net land uptake.                                                                                                                                                  | 2    |
| Carbon Cycle         | Cumulative Net Land to Atmosphere Flux| MtCO₂    | cumulative net flux of CO₂ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to Earth System Feedbacks. A positive value indicates release of CO₂ from the land, a negative value indicates a net land uptake.                                                                                          | 2    |
| Category       | Variable                                                                 | Unit     | Definition                                                                                                                                                                                                 | Tier |
|----------------|--------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Carbon Cycle   | Cumulative Net Land to Atmosphere Flux|CO2|Earth System Feedbacks|Other | MtCO₂ | cumulative net flux of CO₂ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to non-permafrost feedbacks. A positive value indicates release of CO₂ from the land, a negative value indicates a net land uptake. Please specify in a comment on the comments sheet, which feedbacks are included here. | 2    |
| Carbon Cycle   | Cumulative Net Land to Atmosphere Flux|CO2|Earth System Feedbacks|Permafrost | MtCO₂ | cumulative net flux of CO₂ from the land to the atmosphere (not including AFOLU and other anthropogenic emissions) due to the permafrost feedback. A positive value indicates release of CO₂ from the land, a negative value indicates a net land uptake. | 2    |
| Carbon Cycle   | Cumulative Net Ocean to Atmosphere Flux|CH₄ | MtCH₄ | cumulative net flux of CH₄ from the ocean to the atmosphere (not including anthropogenic emissions). A positive value indicates release of CH₄ from the ocean, a negative value indicates a net ocean uptake. | 2    |
| Carbon Cycle   | Cumulative Net Ocean to Atmosphere Flux|CO2 | MtCO₂ | cumulative net flux of CO₂ from the ocean to the atmosphere (not including anthropogenic emissions). A positive value indicates release of CO₂ from the ocean, a negative value indicates a net ocean uptake. | 2    |
Table S4. Continued.

| Category        | Variable          | Unit         | Definition                                                                 | Tier |
|-----------------|-------------------|--------------|-----------------------------------------------------------------------------|------|
| Carbon Cycle    | Carbon Pool|Atmosphere    | MtCO₂                      | total amount of CO₂ in the atmospheric carbon pool                  | 2    |
| Carbon Cycle    | Carbon Pool|Soil          | MtCO₂                      | total amount of CO₂ in the soil carbon pool                         | 2    |
| Carbon Cycle    | Carbon Pool|Detritus      | MtCO₂                      | total amount of CO₂ in the detritus carbon pool                     | 2    |
| Carbon Cycle    | Carbon Pool|Plant         | MtCO₂                      | total amount of CO₂ in the plant carbon pool                        | 2    |
| Carbon Cycle    | Net Primary Productivity |     | MtCO₂ yr⁻¹                   | global total net primary productivity                              | 2    |
| CCS             | Carbon Sequestration |     | MtCO₂ yr⁻¹                 | total carbon dioxide emissions captured and stored                  | 1    |
| CCS             | Carbon Sequestration|CCS   | MtCO₂ yr⁻¹                 | total carbon dioxide emissions captured and stored in geological deposits (e.g. in depleted oil and gas fields, unmined coal seams, saline aquifers) and the deep ocean, stored amounts should be reported as positive numbers | 2    |
| CCS             | Carbon Sequestration|CCS| Biomass        | MtCO₂ yr⁻¹                      | total carbon dioxide emissions captured from bioenergy use and stored in geological deposits (e.g. in depleted oil and gas fields, unmined coal seams, saline aquifers) and the deep ocean, stored amounts should be reported as positive numbers | 2    |
| CCS             | Carbon Sequestration|CCS| Fossil         | MtCO₂ yr⁻¹                      | total carbon dioxide emissions captured from fossil fuel use and stored in geological deposits (e.g. in depleted oil and gas fields, unmined coal seams, saline aquifers) and the deep ocean, stored amounts should be reported as positive numbers | 2    |
| Category   | Variable                                      | Unit             | Definition                                                                 | Tier |
|------------|-----------------------------------------------|------------------|----------------------------------------------------------------------------|------|
| CCS        | Carbon Sequestration| Direct Air Capture| MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through direct air capture               | 2    |
| CCS        | Carbon Sequestration| Enhanced Weathering| MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through enhanced weathering              | 2    |
| CCS        | Carbon Sequestration| Feedstocks       | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered in feedstocks (e.g., lubricants, asphalt, plastics) | 2    |
| CCS        | Carbon Sequestration| Land Use         | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through land-based sinks (e.g., afforestation, soil carbon enhancement, biochar) | 2    |
| CCS        | Carbon Sequestration| Land Use| Afforestation | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through afforestation                      | 2    |
| CCS        | Carbon Sequestration| Land Use| Biochar       | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through biochar                             | 2    |
| CCS        | Carbon Sequestration| Land Use| Other        | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through other land-based mitigation techniques | 2    |
| CCS        | Carbon Sequestration| Land Use| Soil Carbon Management       | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through soil carbon management techniques | 2    |
| CCS        | Carbon Sequestration| Other            | MtCO$_2$yr$^{-1}$ | total carbon dioxide sequestered through other techniques (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Climate    | Airborne Fraction| CO2                | Dimensionless | fraction of (cumulative) emitted CO$_2$ which is still in the atmosphere  | 2    |
| Climate    | Effective Climate Sensitivity | K |                     | effective climate sensitivity over time, here defined as ECS$_\text{eff}(t)$ = Delta T(t) * RF2x / (RF(t) - dH/dt) where ECS$_\text{eff}$ is effective climate sensitivity, Delta T(t) is Surface Air Temperature Change, RF2x is radiative forcing due to a doubling of atmospheric CO$_2$ concentrations, RF(t) is radiative forcing and dH/dt is the energy imbalance at the top of the atmosphere (likely equal to ocean heat uptake in most of our reduced complexity models) | 2    |
| Category    | Variable                      | Unit         | Definition                                                                                                                                                                                                 | Tier |
|-------------|-------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Climate     | Effective Climate Feedback    | $\text{Wm}^{-2}\text{K}^{-1}$ | effective climate feedback over time, here defined as $\lambda_{\text{eff}}(t) = (\text{RF}(t) - \frac{dH}{dt}) / \Delta T(t)$ where $\lambda_{\text{eff}}$ is effective climate feedback, $\Delta T(t)$ is Surface Air Temperature Change, RF(t) is radiative forcing and $\frac{dH}{dt}$ is the energy imbalance at the top of the atmosphere (likely equal to ocean heat uptake in most of our reduced complexity models) | 2    |
| Climate     | Heat Uptake                   | $\text{ZJyr}^{-1}$ | total Heat Uptake of the Earth System ($\text{ZJ}$ is zetta joules i.e. $10^{21}\text{J}$), equivalent to the the energy imbalance at the top of the atmosphere.                                                                 | 1    |
| Climate     | Heat UptakeIce                | $\text{ZJyr}^{-1}$ | ice Heat Uptake ($\text{ZJ}$ is zetta joules i.e. $10^{21}\text{J}$)                                                                                                                                       | 2    |
| Climate     | Heat UptakeLand               | $\text{ZJyr}^{-1}$ | land Heat Uptake ($\text{ZJ}$ is zetta joules i.e. $10^{21}\text{J}$)                                                                                                                                 | 2    |
| Climate     | Heat UptakeOcean              | $\text{ZJyr}^{-1}$ | ocean Heat Uptake through surface layer of the ocean ($\text{ZJ}$ is zetta joules i.e. $10^{21}\text{J}$)                                                                                                   | 1    |
| Climate     | Heat UptakeOther              | $\text{ZJyr}^{-1}$ | other Heat Uptake ($\text{ZJ}$ is zetta joules i.e. $10^{21}\text{J}$). Please specify what "other" is in the Comments sheet.                                                                          | 2    |
| Climate     | Heat ContentOcean             | $\text{ZJ}$ | total ocean heat content                                                                                                                                                                                  | 2    |
| Climate     | Heat ContentOcean0-700m       | $\text{ZJ}$ | ocean heat content between 0 and 700m                                                                                                                                                                   | 2    |
| Climate     | Heat ContentOcean700-2000m    | $\text{ZJ}$ | ocean heat content between 700 and 2000m                                                                                                                                                                 | 2    |
| Category           | Variable                                    | Unit              | Definition                                                                                                                                                                                                 | Tier |
|--------------------|---------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Climate            | Instantaneous TCRE                          | K/MtCO$_2$       | warming per unit cumulative CO$_2$ (this should simply be your ‘Surface Air Temperature Change’ divided by ‘Cumulative Emissions|CO$_2$’)  | 2    |
| Climate            | Surface Air Ocean Blended Temperature Change | K                 | change in blended surface air/ocean temperature (i.e. quantity which is directly comparable with observational datasets e.g. HadCRUT4 or best proxy thereof). Please note reference period in comment sheet. | 2    |
| Climate            | Surface Air Temperature Change              | K                 | change in surface air temperature (i.e. 2m air temperature or best proxy thereof). Please note reference period in comment sheet.                                                                          | 1    |
| Climate            | Surface Ocean Temperature Change            | K                 | change in surface layer ocean temperature. Please note reference period in comment sheet.                                                                                                                    | 1    |
| Cumulative Emissions | Cumulative Emissions| MtCO$_2$       | cumulative carbon dioxide emissions                                                                                                                                                                       | 1    |
| Cumulative Emissions | Cumulative Emissions|MtCO$_2$       | cumulative carbon dioxide emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Cumulative Emissions | Cumulative Emissions|MtCO$_2$       | cumulative carbon dioxide emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Cumulative Emissions | Cumulative Emissions|MtCO$_2$       | cumulative carbon dioxide emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab)                                                              | 2    |
| Category          | Variable                                    | Unit          | Definition                                                                                                                                                                                                 | Tier |
|-------------------|---------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Radiative Forcing                  | Wm$^{-2}$     | effective radiative forcing from all anthropogenic and natural sources (after stratospheric temperature adjustments and rapid adjustments)                                                                          | 1    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from all anthropogenic sources (after stratospheric temperature adjustments and rapid adjustments)                                                                                      | 1    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from aerosols (after stratospheric temperature adjustments and rapid adjustments)                                                                                               | 1    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from indirect effects of aerosols on clouds (after stratospheric temperature adjustments and rapid adjustments)                                                               | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects (after stratospheric temperature adjustments and rapid adjustments), note that the breakdown of this variable can come in multiple different forms | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from black carbon emissions (after stratospheric temperature adjustments and rapid adjustments)                                                        | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from black carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
Table S4. Continued.

| Category                  | Variable                                      | Unit     | Definition                                                                                                                                                                                                 | Tier |
|---------------------------|-----------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from black carbon fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
|                           | Forcing\|Anthropogenic\|Aerosols\|Aerosols-radiation Interactions\|BC and OC| BC and Fossil and Industrial | Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from organic carbon emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
|                           | Forcing\|Anthropogenic\|Aerosols\|Aerosols-radiation Interactions\|BC and OC| OC \| OC \| Biomass Burning | Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
|                           | Forcing\|Anthropogenic\|Aerosols\|Aerosols-radiation Interactions\|BC and OC| OC \| OC \| Biomass Burning | Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Category              | Variable                           | Unit   | Definition                                                                                                                                                                                                 | Tier |
|-----------------------|------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Radiative forcing       | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from black and organic carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative forcing       | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from black carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative forcing       | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative forcing       | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from ammonia biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative forcing       | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from nitrate precursor biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Category          | Variable                           | Unit      | Definition                                                                 | Tier |
|-------------------|------------------------------------|-----------|---------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Radiative Forcing | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from sulfate precursor biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from black and organic carbon fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from black carbon fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from organic carbon fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Category          | Variable                                      | Unit      | Definition                                                                                                                                                                                                 | Tier |
|-------------------|-----------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from ammonia fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from nitrate precursor fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from sulfate precursor fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from mineral dust emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm\(^{-2}\) | effective radiative forcing from aerosol-radiative effects from ammonia emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Category          | Variable                      | Unit       | Definition                                                                 | Tier |
|-------------------|-------------------------------|------------|---------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective | Radiative | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from ammonia biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective | Radiative | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from ammonia fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective | Radiative | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from nitrate precursor emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective | Radiative | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from nitrate precursor biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective | Radiative | Wm$^{-2}$ | effective radiative forcing from aerosol-radiative effects from nitrate fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Category                  | Variable                                                                 | Unit          | Definition                                                                                                                                                                                                 | Tier |
|--------------------------|--------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Other | $\text{Wm}^{-2}$ | effective radiative forcing from aerosol-radiative effects not covered in the other categories (after stratospheric temperature adjustments and rapid adjustments) (please specify in comments) | 2    |
| Effective Radiative Forcing | Effective Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Sulfate | $\text{Wm}^{-2}$ | effective radiative forcing from aerosol-radiative effects from sulfate precursor emissions (after stratospheric temperature adjustments and rapid adjustments)                                                                 | 2    |
| Effective Radiative Forcing | Effective Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Sulfate\Biomass Burning | $\text{Wm}^{-2}$ | effective radiative forcing from aerosol-radiative effects from sulfate precursor biomass burning emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Sulfate\Fossil and Industrial | $\text{Wm}^{-2}$ | effective radiative forcing from aerosol-radiative effects from sulfate precursor fossil and industrial emissions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Forcing\Anthropogenic\Albedo Change                           | $\text{Wm}^{-2}$ | effective radiative forcing from albedo change (after stratospheric temperature adjustments and rapid adjustments)                                                                                   | 2    |
| Category | Variable | Unit | Definition | Tier |
|----------|----------|------|------------|------|
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CH₄ | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CO₂ | 1 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of F-gases | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of hydrofluorocarbons (HFCs, as defined by Table 8.A.1 of AR5) not controlled under the Montreal protocol | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC125 | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC134a | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC143a | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC152a | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing | Wm⁻² | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC227ea | 2 |
Table S4. Continued.

| Category               | Variable                      | Unit    | Definition                                                                 | Tier |
|------------------------|-------------------------------|---------|-----------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC23 | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC236fa | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC245fa | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC32 | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC365mfc | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HFC4310mee | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of nitrogen trifluoride (NF$_3$) | 2    |
| Effective Radiative Forcing | Effective Forcing| Radiative | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of perfluorocarbons (PFCs, as defined by Table 8.A.1 of AR5) | 2    |
Table S4. Continued.

| Category               | Variable                        | Unit       | Definition                                                                 | Tier |
|------------------------|---------------------------------|------------|---------------------------------------------------------------------------|------|
| Effective Radiative    | Effective                        | Wm$^{-2}$  | effective radiative forcing (after stratospheric temperature adjustments  | 2    |
| Forcing                | Forcing|Anthropogenic| Gases|PFC|C2F6                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | of C$_2$F$_6$                                                             |      |
|                        | Forcing|Anthropogenic| Gases|PFC|C3F8                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | effective radiative forcing (after stratospheric temperature adjustments  | 2    |
|                        | Forcing|Anthropogenic| Gases|PFC|C4F10                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | of C$_4$F$_{10}$                                                          |      |
|                        | Forcing|Anthropogenic| Gases|PFC|C5F12                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | effective radiative forcing (after stratospheric temperature adjustments | 2    |
|                        | Forcing|Anthropogenic| Gases|PFC|C6F14                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | of C$_6$F$_{14}$                                                          |      |
|                        | Forcing|Anthropogenic| Gases|PFC|C7F16                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | effective radiative forcing (after stratospheric temperature adjustments | 2    |
|                        | Forcing|Anthropogenic| Gases|PFC|C8F18                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | of C$_7$F$_{16}$                                                          |      |
|                        | Forcing|Anthropogenic| Gases|PFC|cC4F8                                                                 |      |
|                        | Effective                        | Wm$^{-2}$  | effective radiative forcing (after stratospheric temperature adjustments | 2    |
|                        | Forcing|Anthropogenic| Gases|PFC|C4F8                                                                 |      |
Table S4. Continued.

| Category                  | Variable                      | Unit     | Definition                                                                 | Tier |
|---------------------------|-------------------------------|----------|-----------------------------------------------------------------------------|------|
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing| Effective Radiative Forcing| Wm$^{-2}$| effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |

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Table S4. Continued.

| Category                        | Variable                                      | Unit | Definition                                                                 | Tier |
|---------------------------------|-----------------------------------------------|------|---------------------------------------------------------------------------|------|
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CFC114 | 2    |
| Anthropogenic Montreal Gases    | CFC                                           |      |                                                                           |      |
| CFC114                          |                                               |      |                                                                           |      |
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CFC115 | 2    |
| Anthropogenic Montreal Gases    | CFC                                           |      |                                                                           |      |
| CFC115                          |                                               |      |                                                                           |      |
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CFC12 | 2    |
| Anthropogenic Montreal Gases    | CFC                                           |      |                                                                           |      |
| CFC12                           |                                               |      |                                                                           |      |
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CH$_2$Cl$_2$ | 2    |
| Anthropogenic Montreal Gases    | CH$_2$Cl$_2$                                  |      |                                                                           |      |
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CH$_3$Br | 2    |
| Anthropogenic Montreal Gases    | CH$_3$Br                                      |      |                                                                           |      |
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CH$_3$CCl$_3$ | 2    |
| Anthropogenic Montreal Gases    | CH$_3$CCl$_3$                                 |      |                                                                           |      |
| Effective Radiative Forcing     | Effective Radiative Forcing                  | Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CH$_3$Cl | 2    |
| Anthropogenic Montreal Gases    | CH$_3$Cl                                      |      |                                                                           |      |
| Category                          | Variable                                                      | Unit  | Definition                                                                 | Tier |
|----------------------------------|---------------------------------------------------------------|-------|---------------------------------------------------------------------------|------|
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of CHCl₃ | 2    |
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of Halon-1202 | 2    |
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of Halon-1211 | 2    |
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of Halon-1301 | 2    |
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of Halon-2402 | 2    |
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HCFC141b | 2    |
| Effective Radiative Forcing      | Effective Radiative Forcing| \(Wm^{-2}\) | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HCFC22 | 2    |
| Category | Variable | Unit | Definition | Tier |
|----------|----------|------|------------|-----|
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of HCFC22 | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing (after stratospheric temperature adjustments and rapid adjustments) of N$_2$O | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from factors not covered in other categories (after stratospheric temperature adjustments and rapid adjustments) | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from black carbon on snow (after stratospheric temperature adjustments and rapid adjustments) | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from contrails and contrail-induced cirrus (after stratospheric temperature adjustments and rapid adjustments) | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from methane oxidation of stratospheric H2O (after stratospheric temperature adjustments and rapid adjustments) | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from WMGHG not covered in other categories (after stratospheric temperature adjustments and rapid adjustments) | 2 |
| Effective Radiative Forcing | Effective Radiative Forcing| Wm$^{-2}$ | effective radiative forcing from stratospheric ozone (after stratospheric temperature adjustments and rapid adjustments) | 2 |
Table S4. Continued.

| Category            | Variable                          | Unit       | Definition                                                                 | Tier |
|---------------------|-----------------------------------|------------|---------------------------------------------------------------------------|------|
| Effective Radiative Forcing | Effective Radiative Forcing/Anthropogenic/Tropospheric Ozone | Wm\(^{-2}\) | effective radiative forcing from tropospheric ozone (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing/Natural | Wm\(^{-2}\) | effective radiative forcing from all natural drivers, i.e. solar and volcanic forcing (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing/Natural/Solar | Wm\(^{-2}\) | effective radiative forcing from variations in solar irradiance (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Effective Radiative Forcing | Effective Radiative Forcing/Natural/Volcanic | Wm\(^{-2}\) | effective radiative forcing due to volcanic eruptions (after stratospheric temperature adjustments and rapid adjustments) | 2    |
| Emissions           | Emissions/BC                       | MtBC\(_{yr}^{-1}\) | total black carbon emissions                                               | 1    |
| Emissions           | Emissions/BC/MAGICC AFOLU          | MtBC\(_{yr}^{-1}\) | black carbon emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Emissions           | Emissions/BC/MAGICC Fossil and Industrial | MtBC\(_{yr}^{-1}\) | black carbon emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Emissions           | Emissions/BC/Other                 | MtBC\(_{yr}^{-1}\) | black carbon emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Emissions           | Emissions/CH4                      | MtCH\(_4\)\(_{yr}^{-1}\) | total methane emissions                                                    | 1    |
| Emissions           | Emissions/CH4/MAGICC AFOLU         | MtCH\(_4\)\(_{yr}^{-1}\) | methane emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
### Table S4. Continued.

| Category | Variable | Unit      | Definition                                                                 | Tier |
|----------|----------|-----------|----------------------------------------------------------------------------|------|
| Emissions| Emissions CH4 | MtCH4yr⁻¹ | methane emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Emissions| Emissions CH4 | MtCH4yr⁻¹ | methane emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Emissions| Emissions CO | MtCOyr⁻¹  | total carbon monoxide emissions                                               | 1    |
| Emissions| Emissions CO | MtCOyr⁻¹  | carbon monoxide emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Emissions| Emissions CO | MtCOyr⁻¹  | carbon monoxide emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Emissions| Emissions CO | MtCOyr⁻¹  | carbon monoxide emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Emissions| Emissions CO2 | MtCO₂yr⁻¹ | total carbon dioxide emissions                                               | 1    |
| Emissions| Emissions CO2 | MtCO₂yr⁻¹ | carbon dioxide emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Category | Variable | Unit | Definition | Tier |
|----------|----------|------|------------|------|
| Emissions | Emissions\|CO2\|MAGICC Fossil and Industrial | MtCO$_2$yr$^{-1}$ | carbon dioxide emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2 |
| Emissions | Emissions\|CO2\|Other | MtCO$_2$yr$^{-1}$ | carbon dioxide emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2 |
| Emissions | Emissions\|F-Gases | MtCO$_2$yr$^{-1}$ | total F-gas emissions, including sulfur hexafluoride (SF$_6$), nitrogen trifluoride (NF$_3$), sulfuryl fluoride (SO$_2$F$_2$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) | 3 |
| Emissions | Emissions\|F-Gases\|HFC | MtCO$_2$yr$^{-1}$ | equivalent species total emissions of hydrofluorocarbons (HFCs and HCFCs), provided as aggregate CO$_2$-equivalents | 3 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC125 | ktHFC125yr$^{-1}$ | total emissions of HFC125 | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC134a | ktHFC134ayr$^{-1}$ | total emissions of HFC134a | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC143a | ktHFC143ayr$^{-1}$ | total emissions of HFC143a | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC152a | ktHFC152ayr$^{-1}$ | total emissions of HFC152a | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC227ea | ktHFC227eayr$^{-1}$ | total emissions of HFC227ea | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC23 | ktHFC23yr$^{-1}$ | total emissions of HFC23 | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC236fa | ktHFC236fayr$^{-1}$ | total emissions of HFC236fa | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC245fa | ktHFC245fayr$^{-1}$ | total emissions of HFC245fa | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC32 | ktHFC32yr$^{-1}$ | total emissions of HFC32 | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC365mfc | ktHFC365mfcyr$^{-1}$ | total emissions of HFC365mfc | 2 |
| Emissions | Emissions\|F-Gases\|HFC\|HFC4310mee | ktHFC4310meeyr$^{-1}$ | total emissions of HFC43-10mee | 2 |
| Emissions | Emissions\|F-Gases\|NF3 | ktNF$_3$yr$^{-1}$ | total emissions of nitrogen trifluoride (NF$_3$) | 2 |
| Emissions | Emissions\|F-Gases\|PFC | ktCF$_4$yr$^{-1}$ | equivalent species total emissions of perfluorocarbons (PFCs, as defined by Table 8.A.1 of AR5), provided as aggregate CF$_4$-equivalents | 3 |
### Table S4. Continued.

| Category         | Variable                     | Unit                        | Definition                                                                                                                                  | Tier |
|------------------|------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------|
| Emissions        | Emissions|F-Gases|PFC|C2F6                       | ktC₂F₆ yr⁻¹ | total emissions of C₂F₆ | 2   |
| Emissions        | Emissions|F-Gases|PFC|C₃F₈                       | ktC₃F₈ yr⁻¹ | total emissions of C₃F₈ | 2   |
| Emissions        | Emissions|F-Gases|PFC|C₄F₁₀                       | ktC₄F₁₀ yr⁻¹ | total emissions of C₄F₁₀ | 2   |
| Emissions        | Emissions|F-Gases|PFC|C₅F₁₂                       | ktC₅F₁₂ yr⁻¹ | total emissions of C₅F₁₂ | 2   |
| Emissions        | Emissions|F-Gases|PFC|C₆F₁₄                       | ktC₆F₁₄ yr⁻¹ | total emissions of C₆F₁₄ | 2   |
| Emissions        | Emissions|F-Gases|PFC|C₇F₁₆                       | ktC₇F₁₆ yr⁻¹ | total emissions of C₇F₁₆ | 2   |
| Emissions        | Emissions|F-Gases|PFC|C₈F₁₈                       | ktC₈F₁₈ yr⁻¹ | total emissions of C₈F₁₈ | 2   |
| Emissions        | Emissions|F-Gases|PFC|cC₄F₈                       | ktC₄F₈ yr⁻¹ | total emissions of cC₄F₈ | 2   |
| Emissions        | Emissions|F-Gases|PFC|CF₄                        | ktCF₄ yr⁻¹  | total emissions of CF₄  | 2   |
| Emissions        | Emissions|F-Gases|SF₆                         | ktSF₆ yr⁻¹  | total emissions of sulfur hexafluoride (SF₆) | 2   |
| Emissions        | Emissions|F-Gases|SO₂F₂                       | ktSO₂F₂ yr⁻¹ | total emissions of sulfuryl fluoride (SO₂F₂) | 2   |
| Emissions        | Emissions|Montreal Gases               | MtCO₂ yr⁻¹  | equivalent species total Montreal gas emissions, provided as CFC-11 equivalents | 3   |
| Emissions        | Emissions|Montreal Gases|CCl₄                       | ktCCl₄ yr⁻¹ | total emissions of CCl₄ | 2   |
| Emissions        | Emissions|Montreal Gases|CFC                        | MtCO₂ yr⁻¹  | equivalent species total CFC emissions, provided as CFC-11 equivalents | 3   |
| Emissions        | Emissions|Montreal Gases|CFC|CFC₁₁                       | ktCFC₁₁ yr⁻¹ | total emissions of CFC₁₁ | 2   |
| Emissions        | Emissions|Montreal Gases|CFC|CFC₁₁₃                      | ktCFC₁₁₃ yr⁻¹ | total emissions of CFC₁₁₃ | 2   |
| Emissions        | Emissions|Montreal Gases|CFC|CFC₁₁₄                      | ktCFC₁₁₄ yr⁻¹ | total emissions of CFC₁₁₄ | 2   |
| Category       | Variable                        | Unit                | Definition                                | Tier |
|----------------|---------------------------------|---------------------|-------------------------------------------|------|
| Emissions      | Emissions|Montreal Gases|CFC|CFC115                                        | ktCFC115yr⁻¹ | total emissions of CFC115 | 2    |
| Emissions      | Emissions|Montreal Gases|CFC|CFC12                                         | ktCFC12yr⁻¹  | total emissions of CFC12  | 2    |
| Emissions      | Emissions|Montreal Gases|CH2Cl2                                    | ktCH₂Cl₂yr⁻¹ | total emissions of CH₂Cl₂ | 2    |
| Emissions      | Emissions|Montreal Gases|CH3Br                                      | ktCH₃Bryr⁻¹  | total emissions of CH₃Br  | 2    |
| Emissions      | Emissions|Montreal Gases|CH3CCl3                                    | ktCH₃CCl₃yr⁻¹ | total emissions of CH₃CCl₃ | 2    |
| Emissions      | Emissions|Montreal Gases|CH3Cl                                      | ktCH₃Clyr⁻¹  | total emissions of CH₃Cl  | 2    |
| Emissions      | Emissions|Montreal Gases|CHCl3                                      | ktCHCl₃yr⁻¹  | total emissions of CHCl₃  | 2    |
| Emissions      | Emissions|Montreal Gases|Halon1202                                   | ktHalon1202yr⁻¹ | total emissions of Halon-1202 | 2    |
| Emissions      | Emissions|Montreal Gases|Halon1211                                   | ktHalon1211yr⁻¹ | total emissions of Halon-1211 | 2    |
| Emissions      | Emissions|Montreal Gases|Halon1301                                   | ktHalon1301yr⁻¹ | total emissions of Halon-1301 | 2    |
| Emissions      | Emissions|Montreal Gases|Halon2402                                   | ktHalon2402yr⁻¹ | total emissions of Halon-2402 | 2    |
| Emissions      | Emissions|Montreal Gases|HCFC141b                                    | ktHCFC141byr⁻¹ | total emissions of HCFC141b  | 2    |
| Emissions      | Emissions|Montreal Gases|HCFC142b                                    | ktHCFC142byr⁻¹ | total emissions of HCFC22   | 2    |
| Emissions      | Emissions|Montreal Gases|HCFC22                                      | ktHCFC22yr⁻¹  | total emissions of HCFC22   | 2    |

Table S4. Continued.
| Category | Variable                                    | Unit                        | Definition                                                                                                                                  | Tier |
|----------|---------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------|
| Emissions| Emissions\text|N2O                          | ktN₂Oyr⁻¹                                                                                                                                  | 1    |
|          | Emissions\text|N2O|MAGICC AFOLU                | ktN₂Oyr⁻¹                                                                                                                                  | 2    |
|          | Emissions\text|N2O|MAGICC Fossil and Industrial | ktN₂Oyr⁻¹                                                                                                                                  | 2    |
|          | Emissions\text|N2O|Other                        | ktN₂Oyr⁻¹                                                                                                                                  | 2    |
| Emissions| Emissions\text|NH3                          | MtNH₃yr⁻¹                                                                                                                                  | 1    |
|          | Emissions\text|NH3|MAGICC AFOLU                | MtNH₃yr⁻¹                                                                                                                                  | 2    |
|          | Emissions\text|NH3|MAGICC Fossil and Industrial | MtNH₃yr⁻¹                                                                                                                                  | 2    |
|          | Emissions\text|NH3|Other                        | MtNH₃yr⁻¹                                                                                                                                  | 2    |
### Table S4. Continued.

| Category      | Variable                  | Unit          | Definition                                                                 | Tier |
|---------------|---------------------------|---------------|---------------------------------------------------------------------------|------|
| Emissions     | Emissions|NOx                  | MtNOxyr⁻¹      | total nitrous oxide emissions                                              | 1    |
| Emissions     | Emissions|NOx|MAGICC AFOLU         | MtNOxyr⁻¹      | nitrous oxide emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Emissions     | Emissions|NOx|MAGICC Fossil and Industrial | MtNOxyr⁻¹ | nitrous oxide emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Emissions     | Emissions|NOx|Other                 | MtNOxyr⁻¹      | nitrous oxide emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Emissions     | Emissions|OC                   | MtOCyr⁻¹      | total organic carbon emissions                                             | 1    |
| Emissions     | Emissions|OC|MAGICC AFOLU         | MtOCyr⁻¹      | organic carbon emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Emissions     | Emissions|OC|MAGICC Fossil and Industrial | MtOCyr⁻¹ | organic carbon emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Emissions     | Emissions|OC|Other                 | MtOCyr⁻¹      | organic carbon emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Category       | Variable                  | Unit        | Definition                                                                                                                                                                                                 | Tier |
|---------------|---------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Emissions     | Emissions|Sulfur          | MtSO₂yr⁻¹               | total sulfur (as a precursor for sulfates) emissions                                                                                                                                                    | 1    |
| Emissions     | Emissions|Sulfur|MAGICC AFOLU | MtSO₂yr⁻¹               | sulfur (as a precursor for sulfates) emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Emissions     | Emissions|Sulfur|MAGICC Fossil and Industrial | MtSO₂yr⁻¹                  | sulfur (as a precursor for sulfates) emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Emissions     | Emissions|Sulfur|Other          | MtSO₂yr⁻¹               | sulfur (as a precursor for sulfates) emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab)                                                      | 2    |
| Emissions     | Emissions|VOC           | MtVOCyr⁻¹            | total (non-methane) volatile organic compounds emissions                                                                                                                                              | 1    |
| Emissions     | Emissions|VOC|MAGICC AFOLU | MtVOCyr⁻¹            | (non-methane) volatile organic compounds emissions from agriculture, forestry and other land use (IPCC category 3), excluding any fossil-fuel based emissions in the Agricultural sector (hence not identical to WG3 AFOLU) | 2    |
| Emissions     | Emissions|VOC|MAGICC Fossil and Industrial | MtVOCyr⁻¹              | (non-methane) volatile organic compounds emissions from energy use on supply and demand side (IPCC category 1A, 1B), industrial processes (IPCC category 2), waste (IPCC category 4) and other (IPCC category 5) | 2    |
| Category           | Variable                                           | Unit     | Definition                                                                 | Tier |
|-------------------|----------------------------------------------------|----------|---------------------------------------------------------------------------|------|
| Emissions         | Emissions|VOC|Other                                                                 | MtVOCyr⁻¹  |
|                   |                                                    |          | (non-methane) volatile organic compounds emissions from other sources (please provide a definition of other sources in this category in the ‘comments’ tab) | 2    |
| Methane Cycle     | Atmospheric Lifetime|CH4       | yr                       | total atmospheric lifetime of methane                                      | 3    |
| Nitrogen Cycle    | Atmospheric Lifetime|N2O       | yr                        | total atmospheric lifetime of nitrogen                                       | 3    |
| Ocean             | Ocean pH                                          | Dimensionless | pH of the ocean’s surface layer                                          | 3    |
| Radiative Forcing | Radiative Forcing                                 | Wm⁻²     | radiative forcing from all anthropogenic and natural sources (after stratospheric temperature adjustments) | 1    |
|                   | Radiative Forcing|Anthropogenic | Wm⁻²                   | radiative forcing from all anthropogenic sources (after stratospheric temperature adjustments) | 1    |
|                   | Radiative Forcing|Anthropogenic|Aerosols | Wm⁻²                        | radiative forcing from aerosols (after stratospheric temperature adjustments) | 1    |
|                   | Radiative Forcing|Anthropogenic|Aerosols|Aerosols-cloud Interactions | Wm⁻²                        | radiative forcing from indirect effects of aerosols on clouds (after stratospheric temperature adjustments) | 2    |
|                   | Radiative Forcing|Anthropogenic|Aerosols|Aerosols-radiation Interactions | Wm⁻²                        | radiative forcing from aerosol-radiative effects (after stratospheric temperature adjustments), note that the breakdown of this variable can come in multiple different forms | 2    |
|                   | Radiative Forcing|Anthropogenic|Aerosols|Aerosols-radiation Interactions|BC and OC|BC | Wm⁻² | radiative forcing from aerosol-radiative effects from black carbon emissions (after stratospheric temperature adjustments) | 2    |
|                   | Radiative Forcing|Anthropogenic|Aerosols|Aerosols-radiation Interactions|BC and OC|BC|Biomass Burning | Wm⁻² | radiative forcing from aerosol-radiative effects from black carbon biomass burning emissions (after stratospheric temperature adjustments) | 2    |
| Category     | Variable                                                                 | Unit  | Definition                                                                 | Tier |
|--------------|--------------------------------------------------------------------------|-------|---------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Anthropogenic| Aerosols| Aerosol-radiation Interactions| BC and OC | BC and Fossil and Industrial | Wm$^{-2}$ | radiative forcing from aerosol-radiative effects from black carbon fossil and industrial emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing| Anthropogenic| Aerosols| Aerosol-radiation Interactions| BC and OC | OC | Wm$^{-2}$ | radiative forcing from aerosol-radiative effects from organic carbon emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing| Anthropogenic| Aerosols| Aerosol-radiation Interactions| BC and OC | OC | Wm$^{-2}$ | radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing| Anthropogenic| Aerosols| Aerosol-radiation Interactions| BC and OC | OC | Wm$^{-2}$ | radiative forcing from aerosol-radiative effects from organic carbon fossil and industrial emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing| Anthropogenic| Aerosols| Aerosol-radiation Interactions| BC and OC | Biomass Burning | Wm$^{-2}$ | radiative forcing from aerosol-radiative effects from biomass burning emissions (after stratospheric temperature adjustments) | 2 |
| Category   | Variable                                                                 | Unit    | Definition                                                                                           | Tier |
|------------|--------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------|------|
| Radiative  | Radiative Forcing/Anthropogenic/Aerosols/Anthropogenic/Aerosols-radiation| Wm$^{-2}$| radiative forcing from aerosol-radiative effects from black and organic carbon biomass burning emissions (after stratospheric temperature adjustments) | 2    |
|            | Interactions/Biomass Burning/BC and OC                                    |         | radiative forcing from aerosol-radiative effects from black carbon biomass burning emissions (after stratospheric temperature adjustments) | 2    |
|            | Radiative Forcing/Anthropogenic/Aerosols/Anthropogenic/Aerosols-radiation| Wm$^{-2}$| radiative forcing from aerosol-radiative effects from organic carbon biomass burning emissions (after stratospheric temperature adjustments) | 2    |
|            | Interactions/Biomass Burning/BC and OCIC                                |         |                                                                                                      |      |
| Radiative  | Radiative Forcing/Anthropogenic/Aerosols/Anthropogenic/Aerosols-radiation| Wm$^{-2}$| radiative forcing from aerosol-radiative effects from ammonia biomass burning emissions (after stratospheric temperature adjustments) | 2    |
|            | Interactions/Biomass Burning/NH3                                         |         |                                                                                                      |      |
| Radiative  | Radiative Forcing/Anthropogenic/Aerosols/Anthropogenic/Aerosols-radiation| Wm$^{-2}$| radiative forcing from aerosol-radiative effects from nitrate biomass burning emissions (after stratospheric temperature adjustments) | 2    |
|            | Interactions/Biomass Burning/Nitrate                                      |         |                                                                                                      |      |
| Category       | Variable                                                                 | Unit     | Definition                                                                 | Tier |
|----------------|--------------------------------------------------------------------------|----------|---------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects                           | 2    |
|                | Forcing| Anthropogenic| Aerosols| Aerosols-radiation Interactions| Biomass Burning| Sulfate |                                   |      |
|                | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects                           | 2    |
|                | Forcing| Anthropogenic| Aerosols| Aerosols-radiation Interactions| Biomass Burning| Sulfate | from sulfate biomass burning emissions (after stratospheric temperature adjustments) |      |
|                | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects                           | 2    |
|                | Forcing| Anthropogenic| Aerosols| Aerosols-radiation Interactions| Fossil and Industrial |                               | from fossil and industrial emissions (after stratospheric temperature adjustments) |      |
|                | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects                           | 2    |
|                | Forcing| Anthropogenic| Aerosols| Aerosols-radiation Interactions| Fossil and Industrial| BC and OC | from black and organic carbon fossil and industrial emissions (after stratospheric temperature adjustments) |      |
|                | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects                           | 2    |
|                | Forcing| Anthropogenic| Aerosols| Aerosols-radiation Interactions| Fossil and Industrial| BC and OC | from black carbon fossil and industrial emissions (after stratospheric temperature adjustments) |      |
|                | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects                           | 2    |
|                | Forcing| Anthropogenic| Aerosols| Aerosols-radiation Interactions| Fossil and Industrial| BC and OC | from organic carbon fossil and industrial emissions (after stratospheric temperature adjustments) |      |
| Category | Variable | Unit | Definition | Tier |
|----------|----------|------|------------|------|
| Radiative Forcing | Radiative Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Fossil and Industrial\NH3 | $Wm^{-2}$ | radiative forcing from aerosol-radiative effects from ammonia fossil and industrial emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Fossil and Industrial\Nitrate | $Wm^{-2}$ | radiative forcing from aerosol-radiative effects from nitrate fossil and industrial emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Fossil and Industrial\Sulfate | $Wm^{-2}$ | radiative forcing from aerosol-radiative effects from sulfate fossil and industrial emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\Mineral Dust | $Wm^{-2}$ | radiative forcing from aerosol-radiative effects from mineral dust emissions (after stratospheric temperature adjustments) | 2 |
| Radiative Forcing | Radiative Forcing\Anthropogenic\Aerosols\Aerosols-radiation Interactions\NH3 | $Wm^{-2}$ | radiative forcing from aerosol-radiative effects from ammonia emissions (after stratospheric temperature adjustments) | 2 |
| Category       | Variable                      | Unit    | Definition                                                                 | Tier |
|---------------|-------------------------------|---------|----------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing from aerosol-radiative effects after stratospheric temperature adjustments | 2    |
|               | Anthropogenic| Aerosols| Aerosol-radiation Interactions| NH3| Biomass Burning | | | | | |
|               | Fossil and Industrial | | | | | | | | | |
|               | Nitrate | | | | | | | | | |
|               | Nitrate| Biomass Burning | | | | | | | | |
|               | Nitrate| Fossil and Industrial | | | | | | | | |
|               | Nitrate| Fossil and Industrial | | | | | | | | |

Table S4. Continued.
### Table S4. Continued.

| Category            | Variable                                                      | Unit       | Definition                                                                 | Tier |
|---------------------|---------------------------------------------------------------|------------|---------------------------------------------------------------------------|------|
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/Other| Wm$^{-2}$  | radiative forcing from aerosol-radiative effects not covered in the other categories (after stratospheric temperature adjustments) (please specify in comments) | 2    |
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/Sulfate| Wm$^{-2}$  | radiative forcing from aerosol-radiative effects from sulfate emissions (after stratospheric temperature adjustments) | 2    |
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/Sulfate/Biomass Burning| Wm$^{-2}$  | radiative forcing from aerosol-radiative effects from sulfate biomass burning emissions (after stratospheric temperature adjustments) | 2    |
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/Sulfate/Fossil and Industrial| Wm$^{-2}$  | radiative forcing from aerosol-radiative effects from sulfate fossil and industrial emissions (after stratospheric temperature adjustments) | 2    |
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/Albedo Change| Wm$^{-2}$  | radiative forcing from albedo change (after stratospheric temperature adjustments) | 2    |
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/CH4 | Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of CH$_4$ | 2    |
| Radiative Forcing   | Radiative Forcing/Aerosols/Aerosol-radiation Interactions/CO$_2$ | Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of CO$_2$ | 1    |
Table S4. Continued.

| Category          | Variable                  | Unit       | Definition                                                                                   | Tier |
|-------------------|---------------------------|------------|---------------------------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of F-gases                   | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of hydrofluorocarbons (HFCs, as defined by Table 8.A.1 of AR5) not controlled under the Montreal protocol | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC125                   | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC134a                  | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC143a                  | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC152a                  | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC227ea                 | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC23                    | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC236fa                 | 2    |
|                   | Radiative Forcing| Wm$^{-2}$  | radiative forcing (after stratospheric temperature adjustments) of HFC245fa                 | 2    |
Table S4. Continued.

| Category       | Variable                     | Unit  | Definition                                                                 | Tier |
|----------------|------------------------------|-------|---------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of HFC32 | 2    |
| Gases|HFC|HFC32|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of HFC365mfc | 2    |
| Gases|HFC|HFC365mfc|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of HFC43-10mee | 2    |
| Gases|HFC|HFC4310mee|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of nitrogen trifluoride (NF$_3$) | 2    |
| Gases|NF3|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of perfluorocarbons (PFCs, as defined by Table 8.A.1 of AR5) | 2    |
| Gases|PFC|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of C$_2$F$_6$ | 2    |
| Gases|PFC|C2F6|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of C$_3$F$_8$ | 2    |
| Gases|PFC|C3F8|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of C$_4$F$_{10}$ | 2    |
| Gases|PFC|C4F10|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of C$_5$F$_{12}$ | 2    |
| Gases|PFC|C5F12|                           |     |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of C$_6$F$_{14}$ | 2    |
| Gases|PFC|C6F14|                           |     |
| Category         | Variable                                      | Unit    | Definition                                                                 | Tier |
|------------------|-----------------------------------------------|---------|---------------------------------------------------------------------------|------|
| Radiative Forcing| Radiative Forcing| Anthropogenic| F-Gases| PFC| C7F16| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of C7F16 | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| F-Gases| PFC| C8F18| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of C8F18 | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| F-Gases| PFC| cC4F8| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of cC4F8 | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| F-Gases| SF6| | Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of sulfur hexafluoride (SF6) | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| F-Gases| SO2F2| | Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of sulfuryl fluoride (SO2F2) | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| Montreal Gases| | | Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of Montreal gases | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| Montreal Gases| CCl4| | Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of CCl4 | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| Montreal Gases| CFC| | Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of CFC gases (as defined by Table 8.A.1 of AR5) | 2    |
| Radiative Forcing| Radiative Forcing| Anthropogenic| Montreal Gases| CFC| CFC11| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of CFC11 | 2    |
| Category     | Variable                      | Unit   | Definition                                                                 | Tier |
|--------------|-------------------------------|--------|---------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CFC113 | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CFC114 | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CFC115 | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CFC12  | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CH$_2$Cl$_2$ | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CH$_3$Br | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CH$_3$CCl$_3$ | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CH$_3$Cl | 2    |
| Radiative Forcing | Radiative Forcing | Wm$^{-2}$ | radiative forcing (after stratospheric temperature adjustments) of CHCl$_3$ | 2    |
### Table S4. Continued.

| Category       | Variable                        | Unit  | Definition                                                                 | Tier |
|----------------|---------------------------------|-------|---------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of Halon-1202 | 2    |
|                | Anthropogenic| Montreal Gases| Halon1202                      |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of Halon-1211 | 2    |
|                | Anthropogenic| Montreal Gases| Halon1211                      |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of Halon-1301 | 2    |
|                | Anthropogenic| Montreal Gases| Halon1301                      |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of Halon2402 | 2    |
|                | Anthropogenic| Montreal Gases| Halon2402                      |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of HCFC141b | 2    |
|                | Anthropogenic| Montreal Gases| HCFC141b                       |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of HCFC22 | 2    |
|                | Anthropogenic| Montreal Gases| HCFC142b                       |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of HCFC22 | 2    |
|                | Anthropogenic| Montreal Gases| HCFC22                         |      |
| Radiative Forcing | Radiative Forcing| Wm\(^{-2}\) | radiative forcing (after stratospheric temperature adjustments) of N\(_2\)O | 2    |
|                | Anthropogenic| N\(_2\)O      |                                |      |
| Radiative Forcing | Radiative Forcing| Other | radiative forcing from factors not covered in other categories (after stratospheric temperature adjustments) | 2    |
|                | Anthropogenic| Other         |                                |      |
Table S4. Continued.

| Category     | Variable                        | Unit  | Definition                                                                 | Tier |
|--------------|---------------------------------|-------|-----------------------------------------------------------------------------|------|
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing from stratospheric ozone (after stratospheric temperature adjustments) | 2    |
|              | Anthropogenic|                          |                                                                             |      |
|              | Stratospheric Ozone             |       |                                                                             |      |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing from tropospheric ozone (after stratospheric temperature adjustments) | 2    |
|              | Anthropogenic|                          |                                                                             |      |
|              | Tropospheric Ozone              |       |                                                                             |      |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing from all natural drivers, i.e. solar and volcanic forcing (after stratospheric temperature adjustments) | 2    |
|              | Natural                          |       |                                                                             |      |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing from variations in solar irradiance (after stratospheric temperature adjustments) | 2    |
|              | NaturalSolar                     |       |                                                                             |      |
| Radiative Forcing | Radiative Forcing| Wm$^{-2}$ | radiative forcing due to volcanic eruptions (after stratospheric temperature adjustments) | 2    |
|              | NaturalVolcanic                  |       |                                                                             |      |
References

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