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Annex III: Tables of Historical and Projected Well-mixed Greenhouse Gas Mixing Ratios and Effective Radiative Forcing of All Climate Forcers

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This annex should be cited as:

IPCC, 2021: Annex III: Tables of historical and projected well-mixed greenhouse gas mixing ratios and effective radiative forcing of all climate forcers [Dentener F.J., B. Hall, C. Smith (eds.)]. In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2139–2152, doi:10.1017/9781009157896.017.

AIII.1 Introduction

Annex III presents, in tabulated form, data related to historical and projected changes in greenhouse gas (GHG) mixing ratios and effective radiative forcing (ERF) of all climate forcers as assessed and used throughout Chapters 1–7. Where available 90% confidence level uncertainties on observed GHG mixing ratios are given. For each species, the abundance is given as dry air mole fraction: ppm = micromoles per mole (10^{-6}); ppb = nanomoles per mole (10^{-9}); and ppt = picomoles per mole (10^{-12}). ERF is given in W m^{-2} for CO_2, N_2O, and CH_4 and in 10^{-3} Wm^{-2} (mW m^{-2}) for other components.

Pre-instrumental mixing ratios are estimated from ice-core and firn air records that are described in Machida et al. (1995); Flückiger et al. (1999); Sowers (2001); Siegenthaler et al. (2005); Ahn et al. (2012); Mitchell et al. (2013); Bauska et al. (2015); Meinshausen et al. (2017); Rubino et al. (2020); Ryu et al. (2020).

Observed (instrumental) mixing ratios are described in Masarie and Tans (1995); Trudinger et al. (2004); Worton et al. (2006); Montzka et al. (2009); Dlugokencky et al. (2011); Hall et al. (2011); Rigby et al. (2014); Laube et al. (2016); Simmonds et al. (2017); Adcock et al. (2018); Prinn et al. (2018); Leedham Elvidge et al. (2018); Mühle et al. (2019); Naus et al. (2019); Droste et al. (2020).

Projected concentrations for the five core scenarios discussed in the report (Section 1.6.1) are from Gidden et al. (2019), Meinshausen et al. (2017, 2020) and Velders et al. (2015). These scenarios span a wide range of plausible societal and climatic futures from potentially below 1.5°C best-estimate warming to over 4°C warming by 2100 (Section 4.3.4). Computational methods and assumptions to calculate historical and projected ERF are described in Chapter 7 and detailed information can be found in Chapter 7 Supplementary Material 7.SM.1.3 and 7.SM.1.4.

Extended datasets and further auxiliary data are made available via https://doi.org/10.5281/zenodo.5705391 (Smith et al., 2021).

Tables AIII.Ia–f provide historical abundances (mixing ratios) and effective radiative forcing (ERF) values for greenhouse gases assessed in this report.

Chemical Abbreviations and Symbols of Components Regulated Under the Kyoto[1] and Montreal Protocols.

CO_2	carbon dioxide	Kyoto
CH_4	methane	Kyoto
N_2O	nitrous oxide	Kyoto
HFC	hydrofluorocarbon (a class of compounds: HFC-32, HFC-134a …)	Kyoto, Montreal
PFC	perfluorocarbon (a class of compounds: CF_4, C_2F_6, C_4F_{10} …)	Kyoto
SF_6	sulphur hexafluoride	Kyoto
NF_3	nitrogen trifluoride	Kyoto
CFC	chlorofluorocarbon (a class of compounds: $CFCl_3$, CF_2Cl_2 …)	Montreal
HCFC	hydrochlorofluorocarbon (a class of compounds: HCFC-22, HCFC-141b …)	Montreal
CCl_4	carbon tetrachloride	Montreal
CH_3CCl_3	methyl chloroform	Montreal
CH_3Br	Methyl bromide	Montreal
Halons	bromo(chloro)fluorocarbon (a class of compounds: CF_2ClBr – 'Halon-1211'; $CBrF_3$ – 'Halon-1301'; $C2Br_2F_4$ – 'Halon-2402')	Montreal

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1 The Kyoto protocol (1 December 1997–31 December 2020) regulated a basket of seven GHGs. The term Kyoto gases is widely used in the scientific literature.

Table AIII.1a | Historical abundances and ERF (W m^{-2}) for CO_2 (ppm), CH_4 (ppb) and N_2O (ppb).

Year	CO_2	CH_4	N_2O	Year	CO_2	CH_4	N_2O	Year	CO_2	CH_4	N_2O
1750[a]	278.3	729	270.1	1968	322.5	1372	295.2	1994	358.2	1743	310.8
1850[a]	285.5	808	272.1	1969	323.4	1389	295.6	1995	360.0	1748	311.4
1860[b]	286.8	822	273.2	1970	324.9	1411	296.0	1996	361.8	1750	312.3
1870	288.4	852	274.9	1971	325.5	1431	296.5	1997	362.5	1754	313.1
1880	290.4	868	276.6	1972	327.4	1449	296.9	1998	365.5	1764	313.9
1890	293.3	896	277.6	1973	330.0	1463	297.3	1999	367.6	1772	314.9
1900	296.4	925	278.9	1974	330.8	1476	297.8	2000	368.8	1773	315.9
1905	298.0	947	280.2	1975	330.9	1492	298.3	2001	370.4	1772	316.6
1910	300.0	974	281.8	1976	331.6	1509	298.8	2002	372.4	1773	317.3
1915	302.5	991	283.6	1977	333.4	1528	299.3	2003	375.0	1777	318.0
1920	304.8	1025	284.5	1978	335.0	1547	299.8	2004	376.8	1776	318.6
1925	306.3	1052	285.3	1979	336.6	1566	300.4	2005	378.8	1774	319.3
1930	307.1	1072	285.6	1980	338.8[c]	1585	301.1[c]	2006	381.0	1774	320.2
1935	308.6	1097	286.3	1981	340.0	1603	301.9	2007	382.7	1781	320.9
1940	311.7	1120	287.3	1982	340.8	1619	303.1	2008	384.8	1788	321.8
1945	312.7	1139	289.0	1983	342.4	1633	303.7	2009	386.3	1793	322.6
1950	313.1	1164	289.5	1984	344.0	1645[c]	304.3	2010	388.6	1798	323.4
1955	314.6	1207	290.7	1985	345.5	1657	304.9	2011	390.5	1803	324.4
1960	316.8	1264	292.1	1986	346.9	1670	305.8	2012	392.5	1808	325.3
1961	317.5	1269	292.5	1987	348.6	1680	306.0	2013	395.2	1814	326.2
1962	318.2	1282	292.8	1988	351.2	1693	306.7	2014	397.1	1823	327.4
1963	318.8	1301	293.2	1989	352.8	1707	307.8	2015	399.4	1834	328.3
1964	319.5	1317	293.6	1990	354.0	1714	308.7	2016	402.9	1842	329.1
1965	320.0	1331	293.9	1991	355.3	1728	309.4	2017	405.0	1849	330.0
1966	321.0	1342	294.4	1992	356.0	1735	309.9	2018	407.4	1858	331.2
1967	321.6	1354	294.8	1993	356.7	1737	310.3	2019	409.9	1866	332.1
								***ERF*[d]**	**2.16**	**0.54**	**0.21**

Notes: [a] 1750/1850 CO_2, CH_4 and N_2O from multiple ice cores assessed in Chapter 2. Uncertainties (90% CI) for 1750 are 2.9 ppm, 9.4 ppb and 6.0 ppb for CO_2, CH_4 and N_2O, respectively. Uncertainties for 1850 are 2.1 ppm, 13.8 ppb and 5.7 ppb, based on variations of ice cores.

[b] Mixing ratios from 1851–1980/1984 are updated from the CMIP6 (Meinshausen et al., 2017) dataset, using a linear time-dependent offset correction function.

[c] CO_2 from NOAA network; CH_4 and N_2O from merged NOAA and AGAGE networks. Uncertainties (90% CI) in 2019, derived from multiple global networks, are 0.36 ppm, 3.3 ppb and 0.4 ppb for CO_2, CH_4 and N_2O, respectively, and do not include estimates of analytical accuracy. Uncertainties for other years may differ.

[d] ERF (2019–1750) from Chapter 7.

Table AIII.1b | Historical abundances (ppt) and ERF (mW m^{-2}) of NF_3, SF_6, SO_2F_2, and perfluorocarbons (PFCs).

Year	NF_3	SF_6	SO_2F_2	CF_4	C_2F_6	C_3F_8	$c\text{-}C_4F_8$	$n\text{-}C_4F_{10}$	$n\text{-}C_5F_{12}$	$n\text{-}C_6F_{14}$	$i\text{-}C_6F_{14}$	C_7F_{16}	C_8F_{18}
1750	0.00	0.00	0.00	34.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1850	0.00	0.00	0.00	34.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1900	0.00	0.00	0.00	34.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1910	0.00	0.00	0.00	34.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1920	0.00	0.00	0.00	34.4	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1930	0.00	0.00	0.00	34.9	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1940	0.00	0.00	0.00	35.8	0.19	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1950	0.00	0.00	0.00	38.0	0.40	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1960	0.00	0.09	0.00	40.1	0.51	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.32	0.01	43.4	0.62	0.03	0.14	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.86	0.35	53.5	1.22	0.05	0.38	0.02	0.02	0.01	0.00	0.01	0.01
1990	0.01	2.35	0.68	63.8	2.07	0.12	0.76	0.07	0.05	0.03	0.015	0.03	0.02

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Year	NF_3	SF_6	SO_2F_2	CF_4	C_2F_6	C_3F_8	c-C_4F_8	n-C_4F_{10}	n-C_5F_{12}	n-C_6F_{14}	i-C_6F_{14}	C_7F_{16}	C_8F_{18}
2000	0.17	4.56	1.07	71.5	3.11	0.28	0.98	0.13	0.10	0.14	0.038	0.07	0.06
2010	0.73	7.01	1.63	78.3	4.09	0.54	1.26	0.17	0.12	0.21	0.055	0.10	0.09
2015	1.30	8.57	2.11	81.9	4.49	0.62	1.50	0.19	0.14	0.22	0.062	0.11	n.a.
2019	2.05	9.95	2.50	85.5	4.85	0.68	1.75	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Unc.	*0.03*	*0.03*	*0.05*	*0.2*	*0.05*	*0.01*	*0.01*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
ERF	0.4	5.6	0.5	5.1	1.3	0.2	0.5	0.1	0.1	0.1	0.0[a]	0.1	0.1

Notes: Data merged from AR5 (1750; 1850); CMIP6 compilation by Meinshausen et al. (2017) until about 1995, and data directly taken from merged AGAGE and NOAA networks, depending on date of availability. Perfluorocarbons from CMIP6 dataset (Meinshausen et al., 2017) or estimated from Droste et al. (2020), with CMIP6 n-C_6F_{14} and C_7F_{16} scaled to account for calibration changes in Droste et al. (2020). Uncertainties pertain to 2019, derived from observations made by global networks and literature, and do not include estimates of analytical accuracy. Uncertainties are not available for n-C_4F_{10}, n-C_5F_{12}, n-C_6F_{14}, i-C_6F_{14}, C_7F_{16} or C_8F_{18}. ERF (2019–1750) from Chapter 7, except for n-C_4F10, n-C_5F_{12}, n-C_6F_{14}, i-C_6F_{14} and C_7F_{16}, uses 2015 abundances and C_8F_{18} which uses 2010 abundance.

[a] Below <0.5 m Wm^{-2}. n.a. Not available.

Table AIII.1c | Historical abundances (ppt) and ERF (mW m^{-2}) of hydrofluorocarbons (HFCs).

Year	HFC-134a	HFC-23	HFC-32	HFC-125	HFC-143a	HFC-152a	HFC-227ea	HFC-236fa	HFC-245fa	HFC-365mfc	HFC-43-10mee
1750	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1850	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1900	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1910	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1920	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1930	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1960	0.0	0.5	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1970	0.0	1.8	0.0	0.	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1980	0.2	3.9	0.0	0.1	0.1	0.0	0.01	0.00	0.00	0.00	0.00
1990	0.5	8.3	0.1	0.1	0.5	0.2	0.01	0.00	0.00	0.01	0.00
2000	14.2	15.2	0.2	1.5	2.5	1.6	0.11	0.02	0.02	0.01	0.03
2010	57.5	23.3	3.8	8.8	10.8	6.2	0.66	0.09	1.34	0.55	0.20
2015	83.4	28.0	10.0	18.1	17.6	6.6	1.10	0.14	2.23	0.86	0.25
2019	107.6	32.4	20.0	29.4	24.0	7.1	1.59	0.19	3.06	1.09	0.29
Unc.	*0.5*	*0.1*	*1.4*	*0.6*	*0.4*	*0.4*	*0.06*	*n.a.*	*0.06*	*0.14*	*n.a.*
ERF	18.0	6.2	2.2	6.9	4.0	0.7	0.4	0.0	0.7	0.2	0.1

Notes: Data merged from AR5 (1750; 1850); CMIP6 compilation by Meinshausen et al. (2017) until about 1995, and data directly taken from merged AGAGE and NOAA networks, depending on the date of availability for various components. Uncertainties pertain to 2019, derived from observations made by global networks, and do not include estimates of analytical accuracy. n.a.: not available. ERF (2019–1750) from Chapter 7.

Table AIII.1d | Historical abundances (ppt) and ERF (mW m^{-2}) of hydrochlorofluorocarbons (HCFCs).

Year	HCFC-22	HCFC-141b	HCFC-142b	HCFC-133a	HCFC-31	HCFC-124
1750	0.0	0.0	0.0	0.00	0.00	0.00
1850	0.0	0.0	0.0	0.00	0.00	0.00
1900	0.0	0.0	0.0	0.00	0.00	0.00
1910	0.0	0.0	0.0	0.00	0.00	0.00
1920	0.0	0.0	0.0	0.00	0.00	0.00
1930	0.0	0.0	0.0	0.00	0.00	0.00
1940	0.3	0.0	0.0	0.00	0.00	0.00
1950	0.9	0.0	0.0	0.00	0.00	0.00
1960	2.3	0.0	0.0	0.00	0.00	0.00

Year	HCFC-22	HCFC-141b	HCFC-142b	HCFC-133a	HCFC-31	HCFC-124
1970	13.1	0.0	0.0	0.00	0.00	0.00
1980	44.6	0.0	0.4	0.01	0.00	0.00
1990	89.6	0.3	1.5	0.05	0.00	0.00
2000	141.8	12.7	11.4	0.11	0.027	0.00
2010	206.3	20.5	20.4	0.31	0.084	1.10
2015	233.3	24.2	22.2	0.40	0.084	1.02
2019	246.8	24.4	22.3	n.a.	n.a.	n.a.
Unc.	*0.6*	*0.3*	*0.4*	*n.a.*	*n.a.*	*n.a.*
ERF	52.8	3.9	4.3	0.1	0.0	0.2

Notes: 1750/1850 from AR5; 1900–1970 from CMIP6 dataset in Meinshausen et al. (2017). 1980–1995 AGAGE, or data directly taken from merged AGAGE and NOAA networks, depending on the date of availability for various components; HCFC-31 from Schoenenberger et al. (2015), HCFC-124 from Simmonds et al. (2017). Uncertainties pertain to 2019, derived from observations made by global networks, and do not include estimates of analytical accuracy. For HCFC-133a, HCFC-31 and HCFC-124 abundances in 2019 and uncertainties are not available. ERF (2019–1750) from Chapter 7, except HCFC-133a, HCFC-31 and HCFC-124 which are for 2015.

Table AIII.1e | Historical abundances (ppt) and ERF (mW m^{-2}) of chlorofluorocarbon (CFCs).

Year	CFC-12	CFC-11	CFC-113	CFC-114	CFC-115	CFC-13	CFC-112	CFC-112a	CFC-113a	CFC-114a
1750	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1850	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1900	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1910	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1920	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1930	0.0	0.0	0.0	0.0	0.00	0.01	0.00	0.00	0.00	0.00
1940	0.0	0.0	0.5	0.0	0.00	0.03	0.00	0.00	0.00	0.00
1950	6.4	0.9	1.0	1.5	0.00	0.04	0.00	0.00	0.00	0.00
1960	31.6	10.2	2.0	3.9	0.00	0.05	0.00	0.00	0.00	0.00
1970	121.7	57.0	5.9	6.7	0.20	0.44	0.00	0.00	0.00	0.00
1980	304.0	166.8	20.8	10.1	1.75	1.20	0.11	0.00	0.06	0.44
1990	483.1	258.1	70.6	15.6	5.46	2.42	0.31	0.00	0.16	0.91
2000	542.3	259.2	82.1	16.4	8.16	2.83	0.49	0.07	0.28	1.03
2010	530.9	239.4	75.2	16.3	8.38	3.04	0.45	0.07	0.41	1.06
2015	516.6	231.0	72.0	16.0	8.46	3.16	0.42	0.07	0.62	1.05
2019	503.1	226.2	69.8	16.0	8.67	3.28	n.a	n.a	n.a	n.a
Unc.	*3.2*	*1.1*	*0.3*	*0.1*	*0.02*	*0.02*	*n.a*	*n.a*	*n.a*	*n.a*
ERF	180.3	66.3	21.0	5.0	2.1	0.9	0.1	0.0	0.2	0.3

Notes: 1750/1850 from AR5; 1900–1970 from CMIP6 dataset in Meinshausen et al. (2017). 1980–1995 AGAGE, or data directly taken from merged AGAGE and NOAA networks, depending on the date of availability for various components; CFC-13 from Vollmer et al. (2018) until 2015, then AGAGE; CFC-114 and CFC-114a from AGAGE and Laube et al. (2016). CFC-112 and CFC-112a from Laube et al. (2014) and Engel et al. (2018); CFC-113a from Adcock et al. (2018). Uncertainties pertain to 2019, derived from observations made by global networks, and do not include estimates of analytical accuracy. For CFC-112, CFC-112a, CFC-113a and CFC-114a abundances and uncertainties for 2019 are not available. ERF (2019–1750) from Chapter 7, except for CFC-112, CFC-112a, CFC-113a and CFC-114a for 2015.

Table AIII.1f | Historical abundances (ppt) and ERF (mW m^{-2}) of CH_3CCl_3, CCl_4, CH_3Cl, CH_3Br, $CHCl_3$ $CHCl_3$ and halons.

Year	CH_3CCl_3	CCl_4	CH_3Cl	CH_3Br	CH_2Cl_2	$CHCl_3$	Halon-1211	Halon-1301	Halon-2402
1750	0.00	0.03	457	5.30	7	4.8	0.00	0.00	0.00
1850	0.00	0.03	457	5.30	7	4.8	0.00	0.00	0.00
1900	0.00	0.03	457	5.30	7	4.8	0.00	0.00	0.00
1910	0.00	0.03	457	5.30	7	4.8	0.00	0.00	0.00
1920	0.00	1.2	457	5.30	7	4.8	0.00	0.00	0.00
1930	0.00	4.1	457	5.30	7	5.0	0.00	0.00	0.00

Year	CH_3CCl_3	CCl_4	CH_3Cl	CH_3Br	CH_2Cl_2	$CHCl_3$	Halon-1211	Halon-1301	Halon-2402
1940	0.00	14.1	457	5.66	7	5.3	0.00	0.00	0.00
1950	0.00	35.5	478	6.06	8	5.7	0.03	0.00	0.00
1960	1.70	53.2	512	6.50	11	6.4	0.02	0.00	0.00
1970	17.7	77.0	540	7.06	14	7.5	0.04	0.00	0.02
1980	85.9	93.8	549	7.77	18	8.8	0.71	0.38	0.15
1990	129.3	106.2	550	8.69	20	10.3	2.44	1.85	0.37
2000	45.4	98.1	547	9.09	20	7.5	4.12	2.82	0.48
2010	7.6	87.3	538	7.14	29	7.3	4.12	3.21	0.46
2015	3.1	81.6	547	6.68	35	8.6	3.66	3.31	0.42
2019	1.6	77.9	551	6.49	41	8.8	3.28	3.32	0.40
Unc.	*0.1*	*0.7*	*5*	*0.07*	*6*	*0.3*	*0.05*	*0.07*	*0.03*
ERF	0.1	12.9	0.4	0.0	1.0	0.3	1.0	1.0	0.1

Notes: 1750 from AR5; 1850–1970 from CMIP6 dataset in Meinshausen et al. (2017). 1980–2019 AGAGE or merged AGAGE and NOAA networks, depending on the date of availability. ERF (2019–1750) from Chapter 7.

Table AIII.2 | Future abundances of CO_2, CH_4 and N_2O for selected SSP scenarios (2020–2500).

	CO_2 (ppm)					CH_4 (ppb)					N_2O (ppb)				
2019[a]	410					1866					332				
Year/ Scenario	SSP1-1.9	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5	SSP1-1.9	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5	SSP1-1.9	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
2020	414	414	414	415	415	1894	1888	1911	1921	1907	332	332	332	332	332
2030	434	440	444	451	452	1796	1810	2002	2099	2018	337	337	340	341	341
2040	440	458	475	493	500	1593	1663	2045	2289	2209	341	341	348	351	350
2050	438	469	507	541	563	1428	1519	2020	2472	2446	344	344	356	362	358
2060	431	474	537	593	643	1305	1402	1942	2655	2613	346	346	363	373	366
2070	424	473	564	652	744	1220	1299	1854	2840	2670	348	348	369	385	374
2080	415	467	585	716	864	1150	1197	1779	3028	2652	350	349	373	397	380
2090	405	457	598	787	998	1088	1112	1719	3208	2549	352	352	376	409	387
2100	394	446	603	867	1135	1036	1056	1683	3372	2415	354	354	377	422	392
2200	343	403	643	1457	2108	929	928	1255	2572	1516	364	363	376	497	414
2300	342	396	621	1483	2162	872	864	1001	1988	1068	361	360	367	511	411
2400	339	389	598	1424	2080	871	864	999	1959	1038	358	358	362	514	408
2500	337	384	579	1371	2010	871	864	997	1938	1019	357	356	360	516	407

Note: [a] Observed from Table AIII.1a. SSP GHG concentrations (Meinshausen et al., 2017, 2020) available at greenhousegases.science.unimelb.edu.au. Concentrations of halogenated compounds in electronic supplement. Major scenarios used in this report are selected.

Table AIII.3 | Effective radiative forcing (W m^{-2}) time series of all climate forcers from 1750–2019.

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land Use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
1750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.10	0.00	0.30	0.30
1850	0.14	0.05	0.01	0.00	0.03	0.00	0.00	–0.01	–0.07	0.01	–0.03	0.19	0.01	0.13	0.20	0.33
1900	0.35	0.12	0.03	0.00	0.08	0.01	0.00	–0.06	–0.29	0.02	–0.08	0.20	–0.04	0.18	0.16	0.34
1910	0.41	0.15	0.04	0.00	0.09	0.01	0.00	–0.10	–0.42	0.03	–0.10	0.20	–0.02	0.12	0.18	0.30

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land Use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
1920	0.50	0.17	0.05	0.00	0.10	0.02	0.00	–0.10	–0.43	0.03	–0.11	0.19	0.01	0.23	0.20	0.43
1930	0.54	0.20	0.06	0.00	0.12	0.02	0.00	–0.11	–0.46	0.03	–0.13	0.19	0.02	0.26	0.21	0.48
1940	0.62	0.22	0.06	0.00	0.14	0.02	0.00	–0.15	–0.52	0.03	–0.14	0.19	0.04	0.29	0.23	0.52
1950	0.65	0.24	0.07	0.01	0.17	0.02	0.00	–0.15	–0.55	0.03	–0.14	0.18	0.06	0.35	0.24	0.59
1960	0.71	0.29	0.08	0.03	0.22	0.03	0.01	–0.25	–0.73	0.04	–0.17	0.18	0.09	0.26	0.27	0.54
1970	0.85	0.36	0.09	0.08	0.28	0.03	0.02	–0.38	–0.92	0.05	–0.18	0.05	0.08	0.29	0.13	0.42
1980	1.09	0.43	0.11	0.20	0.33	0.04	0.02	–0.41	–1.04	0.06	–0.18	0.09	0.11	0.66	0.19	0.86
1990	1.33	0.49	0.13	0.33	0.36	0.04	0.03	–0.38	–1.05	0.07	–0.19	0.14	0.11	1.17	0.24	1.42
2000	1.56	0.51	0.16	0.37	0.40	0.05	0.04	–0.30	–0.92	0.07	–0.19	0.18	0.11	1.74	0.29	2.02
2010	1.85	0.52	0.18	0.39	0.44	0.05	0.04	–0.27	–0.99	0.08	–0.20	0.14	–0.01	2.10	0.13	2.23
2015	2.01	0.53	0.20	0.40	0.47	0.05	0.05	–0.23	–0.89	0.08	–0.20	0.11	0.03	2.47	0.14	2.61
2019	2.16	0.54	0.21	0.41	0.47	0.05	0.06	–0.22	–0.84	0.08	–0.20	0.14	–0.02	2.72	0.12	2.84

Notes: O_3 includes tropospheric and stratospheric O_3, dominated by tropospheric O_3. Stratospheric water vapour from methane oxidation is a linear function of the methane ERF (Section 7.3.2.6). Contrail forcing is a linear scaling of aviation NO_x emissions, scaled to ERF in 2018 (Lee et al., 2021). Present-day aerosol forcing is assessed in Section 7.3.3 as –0.3 [–0.6 to 0.0] W m^{-2} for aerosol–radiation interactions and –1.0 [–1.7 to –0.3] W m^{-2} for aerosol–cloud interactions for the 2005–2014 mean relative to 1750. Land-use change considers albedo and irrigation effects (Section 7.3.4.1). BC on snow forcing is linear with emissions of BC (Section 7.3.4.3). Volcanic forcing is positive in years without large volcanic eruptions, such that the long-term pre-industrial (500 BCE to 1749 CE) mean volcanic forcing is zero. Solar forcing is derived from the ^{14}C reconstruction of total solar irradiance in the combined PMIP4/CMIP6 dataset (Jungclaus et al., 2017; Matthes et al., 2017). Present-day solar forcing is assessed in Section 7.3.4.4 as +0.01 [–0.06 to +0.08] W m^{-2}, based on the mean total solar irradiance from solar cycle 24 (2009–2019) compared a long pre-industrial baseline period (6754 BCE to 1744 CE); the 2019 ERF value differs from this as it represents a single year near the solar minimum. Natural is the sum of volcanic and solar forcing, while anthropogenic includes all others. Further details on methods for computing ERF are in Chapter 7 Supplementary Material 7.SM.1.3.

Table AIII.4a | Effective radiative forcing (W m^{-2}) time series of all climate forcers for SSP1-1.9.

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
2020	2.22	0.55	0.21	0.40	0.42	0.05	0.05	–0.20	–0.81	0.08	–0.20	0.06	–0.02	2.77	0.04	2.81
2030	2.49	0.52	0.23	0.38	0.25	0.05	0.03	–0.16	–0.39	0.03	–0.21	0.00	–0.02	3.22	–0.02	3.20
2040	2.56	0.44	0.24	0.32	0.19	0.04	0.02	–0.16	–0.28	0.02	–0.21	0.00	–0.01	3.18	–0.01	3.18
2050	2.53	0.37	0.25	0.27	0.14	0.03	0.02	–0.17	–0.20	0.01	–0.21	0.00	0.01	3.04	0.01	3.05
2060	2.45	0.31	0.26	0.23	0.12	0.03	0.01	–0.17	–0.16	0.01	–0.21	0.00	0.01	2.87	0.01	2.88
2070	2.35	0.27	0.26	0.21	0.11	0.02	0.01	–0.16	–0.13	0.00	–0.20	0.00	0.02	2.74	0.02	2.76
2080	2.23	0.24	0.27	0.19	0.09	0.02	0.01	–0.15	–0.09	0.00	–0.19	0.00	0.02	2.62	0.02	2.64
2090	2.09	0.21	0.28	0.17	0.09	0.02	0.01	–0.14	–0.05	0.00	–0.19	0.00	0.01	2.48	0.01	2.48
2100	1.92	0.18	0.28	0.15	0.08	0.02	0.01	–0.13	–0.01	0.00	–0.18	0.00	0.00	2.33	0.00	2.33
2200	1.16	0.12	0.32	0.07	0.06	0.01	0.00	–0.10	0.08	–0.01	–0.17	0.00	0.03	1.55	0.03	1.58
2300	1.14	0.09	0.31	0.04	0.03	0.01	0.00	–0.09	0.14	–0.01	–0.17	0.00	0.00	1.49	0.00	1.49
2400	1.09	0.09	0.30	0.03	0.03	0.01	0.00	–0.09	0.14	–0.01	–0.17	0.00	0.00	1.42	0.00	1.42
2500	1.05	0.09	0.30	0.02	0.03	0.01	0.00	–0.09	0.14	–0.01	–0.17	0.00	0.00	1.38	0.00	1.38

Notes: ERF based on future abundancies of well-mixed greenhouse gases (WMGHGs) listed in AIII.2. See notes of AIII.3. Future ozone forcing uses projected emissions of carbon monoxide, volatile organic carbon, nitrogen oxides, and concentrations of methane, nitrous oxide and halogenated compounds with relationships to forcing derived from Thornhill et al. (2021a, b). Future contrail forcing is a linear scaling of future NO_x emissions (Smith et al., 2018) and scaled to year-2018 ERF (Lee et al., 2021). Future aerosol forcing is based on emissions of black carbon, organic carbon, sulphur dioxide and ammonia using a method described in Smith et al. (2018). Land-use forcing scales with cumulative emissions of future land-use CO_2 (Smith et al., 2018). Future volcanic forcing set to zero from a 10-year linear transition from the end of the historical period following Eyring et al. (2016). Solar forcing is set to zero from 2300 CE. Further details on methods for computing SSP-projection ERF are in Chapter 7 Supplementary Material 7.SM.1.4.

Table AIII.4b | Effective radiative forcing (W m^{-2}) time series of all climate forcers for SSP1-2.6.

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
2020	2.22	0.55	0.21	0.40	0.42	0.05	0.05	–0.20	–0.81	0.08	–0.20	0.06	–0.02	2.76	0.04	2.80
2030	2.56	0.52	0.22	0.39	0.30	0.05	0.04	–0.19	–0.51	0.04	–0.21	0.00	–0.02	3.23	–0.02	3.21
2040	2.79	0.46	0.24	0.34	0.26	0.04	0.04	–0.16	–0.36	0.03	–0.20	0.00	–0.01	3.49	–0.01	3.48
2050	2.93	0.41	0.25	0.28	0.21	0.04	0.04	–0.15	–0.26	0.02	–0.20	0.00	0.01	3.56	0.01	3.58
2060	2.99	0.35	0.25	0.24	0.18	0.03	0.04	–0.13	–0.20	0.02	–0.20	0.00	0.01	3.58	0.01	3.58
2070	2.98	0.31	0.26	0.21	0.15	0.03	0.04	–0.13	–0.16	0.02	–0.19	0.00	0.02	3.52	0.02	3.54
2080	2.91	0.26	0.27	0.19	0.12	0.02	0.04	–0.13	–0.10	0.01	–0.18	0.00	0.02	3.40	0.02	3.42
2090	2.78	0.22	0.28	0.17	0.10	0.02	0.03	–0.13	–0.06	0.01	–0.17	0.00	0.01	3.24	0.01	3.25
2100	2.63	0.19	0.28	0.16	0.08	0.02	0.03	–0.12	–0.01	0.00	–0.17	0.00	0.00	3.10	0.00	3.10
2200	2.06	0.12	0.32	0.07	0.04	0.01	0.01	–0.10	0.08	–0.01	–0.15	0.00	0.03	2.47	0.03	2.50
2300	1.96	0.08	0.31	0.04	0.01	0.01	0.00	–0.09	0.14	–0.01	–0.15	0.00	0.00	2.30	0.00	2.30
2400	1.87	0.08	0.30	0.03	0.01	0.01	0.00	–0.09	0.14	–0.01	–0.15	0.00	0.00	2.19	0.00	2.19
2500	1.79	0.08	0.29	0.02	0.01	0.01	0.00	–0.09	0.14	–0.01	–0.15	0.00	0.00	2.11	0.00	2.11

Notes: See Table AIII.3 and Table AIII.4a.

Table AIII.4c | Effective radiative forcing (W m^{-2}) time series of all climate forcers for SSP2-4.5.

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
2020	2.22	0.56	0.21	0.40	0.45	0.05	0.05	–0.18	–0.88	0.10	–0.20	0.06	–0.02	2.79	0.04	2.83
2030	2.62	0.59	0.23	0.40	0.47	0.05	0.07	–0.21	–0.84	0.09	–0.21	0.00	–0.02	3.25	–0.02	3.24
2040	3.01	0.61	0.26	0.37	0.45	0.06	0.09	–0.20	–0.74	0.07	–0.22	0.00	–0.01	3.76	–0.01	3.75
2050	3.38	0.60	0.28	0.34	0.43	0.06	0.09	–0.18	–0.61	0.06	–0.22	0.00	0.01	4.23	0.01	4.24
2060	3.72	0.57	0.30	0.32	0.39	0.05	0.10	–0.18	–0.51	0.05	–0.22	0.00	0.01	4.59	0.01	4.60
2070	4.01	0.54	0.32	0.30	0.35	0.05	0.12	–0.19	–0.43	0.04	–0.21	0.00	0.02	4.89	0.02	4.91
2080	4.23	0.51	0.33	0.29	0.31	0.05	0.15	–0.19	–0.34	0.02	–0.20	0.00	0.02	5.15	0.02	5.16
2090	4.35	0.49	0.34	0.28	0.28	0.04	0.16	–0.19	–0.25	0.01	–0.19	0.00	0.01	5.32	0.01	5.33
2100	4.40	0.47	0.35	0.27	0.25	0.04	0.18	–0.19	–0.21	0.01	–0.18	0.00	0.00	5.40	0.00	5.40
2200	4.79	0.29	0.35	0.14	0.08	0.03	0.06	–0.13	–0.01	–0.01	–0.15	0.00	0.03	5.43	0.03	5.46
2300	4.59	0.16	0.32	0.05	–0.02	0.01	0.00	–0.11	0.09	–0.01	–0.15	0.00	0.00	4.94	0.00	4.94
2400	4.35	0.16	0.31	0.03	–0.02	0.01	0.00	–0.11	0.09	–0.01	–0.15	0.00	0.00	4.67	0.00	4.67
2500	4.17	0.16	0.30	0.03	–0.02	0.01	0.00	–0.11	0.09	–0.01	–0.15	0.00	0.00	4.47	0.00	4.47

Notes: See Table AIII.3 and Table AIII.4a.

Table AIII.4d | Effective radiative forcing (W m^{-2}) time series of all climate forcers for SSP3-7.0.

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land Use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
2020	2.23	0.56	0.21	0.40	0.51	0.05	0.05	–0.19	–1.02	0.12	–0.20	0.06	–0.02	2.72	0.04	2.76
2030	2.71	0.63	0.23	0.39	0.57	0.06	0.07	–0.19	–1.04	0.12	–0.21	0.00	–0.02	3.33	–0.02	3.31
2040	3.22	0.69	0.26	0.37	0.62	0.06	0.08	–0.19	–1.06	0.13	–0.22	0.00	–0.01	3.97	–0.01	3.96
2050	3.76	0.75	0.29	0.36	0.66	0.07	0.09	–0.20	–1.06	0.13	–0.23	0.00	0.01	4.61	0.01	4.63
2060	4.31	0.80	0.33	0.35	0.69	0.07	0.09	–0.20	–1.03	0.12	–0.24	0.00	0.01	5.30	0.01	5.30
2070	4.87	0.86	0.36	0.35	0.71	0.08	0.10	–0.20	–0.99	0.12	–0.25	0.00	0.02	6.00	0.02	6.02
2080	5.45	0.91	0.39	0.35	0.73	0.08	0.10	–0.20	–0.95	0.11	–0.26	0.00	0.02	6.71	0.02	6.72
2090	6.04	0.96	0.42	0.35	0.75	0.09	0.10	–0.21	–0.92	0.11	–0.26	0.00	0.01	7.43	0.01	7.44
2100	6.64	1.00	0.45	0.36	0.77	0.09	0.11	–0.20	–0.87	0.10	–0.27	0.00	0.00	8.18	0.00	8.18
2200	10.00	0.77	0.64	0.22	0.38	0.07	0.04	–0.16	–0.32	0.03	–0.29	0.00	0.03	11.37	0.03	11.40
2300	10.11	0.58	0.68	0.08	0.15	0.05	0.00	–0.14	0.02	–0.01	–0.29	0.00	0.00	11.24	0.00	11.24
2400	9.84	0.57	0.69	0.06	0.14	0.05	0.00	–0.14	0.02	–0.01	–0.29	0.00	0.00	10.94	0.00	10.94
2500	9.60	0.56	0.70	0.06	0.13	0.05	0.00	–0.14	0.02	–0.01	–0.29	0.00	0.00	10.68	0.00	10.68

Note: See Table AIII.3 and Table AIII.4a.

Table AIII.4e | Effective radiative forcing (W m^{-2}) time series of all climate forcers for SSP5-8.5.

Year	CO_2	CH_4	N_2O	Halogenated Compounds	O_3	Stratospheric Water Vapour	Contrail-cirrus	Aerosol–radiation Interactions	Aerosol–cloud Interactions	Black Carbon on Snow	Land Use	Volcanic	Solar	Total Anthropogenic	Total Natural	Total
2020	2.23	0.56	0.21	0.40	0.48	0.05	0.06	–0.14	–0.86	0.11	–0.20	0.06	–0.02	2.90	0.04	2.94
2030	2.71	0.60	0.23	0.41	0.49	0.06	0.08	–0.13	–0.71	0.09	–0.21	0.00	–0.02	3.61	–0.02	3.59
2040	3.30	0.66	0.26	0.41	0.54	0.06	0.09	–0.14	–0.67	0.09	–0.23	0.00	–0.01	4.37	–0.01	4.37
2050	4.00	0.74	0.28	0.42	0.56	0.07	0.10	–0.15	–0.57	0.07	–0.23	0.00	0.01	5.29	0.01	5.30
2060	4.79	0.79	0.30	0.45	0.60	0.07	0.12	–0.18	–0.58	0.06	–0.24	0.00	0.01	6.21	0.01	6.22
2070	5.68	0.81	0.32	0.50	0.60	0.07	0.14	–0.20	–0.55	0.06	–0.24	0.00	0.02	7.19	0.02	7.21
2080	6.62	0.80	0.34	0.55	0.56	0.07	0.15	–0.20	–0.48	0.05	–0.23	0.00	0.02	8.24	0.02	8.25
2090	7.54	0.77	0.36	0.58	0.49	0.07	0.15	–0.21	–0.38	0.03	–0.23	0.00	0.01	9.18	0.01	9.19
2100	8.38	0.73	0.37	0.60	0.40	0.07	0.15	–0.21	–0.27	0.02	–0.23	0.00	0.00	10.01	0.00	10.00
2200	12.30	0.40	0.42	0.32	0.06	0.04	0.05	–0.16	–0.07	0.00	–0.22	0.00	0.03	13.14	0.03	13.17
2300	12.46	0.19	0.42	0.08	–0.11	0.02	0.00	–0.14	0.03	–0.01	–0.22	0.00	0.00	12.72	0.00	12.72
2400	12.22	0.18	0.42	0.06	–0.13	0.02	0.00	–0.14	0.03	–0.01	–0.22	0.00	0.00	12.43	0.00	12.43
2500	12.01	0.17	0.41	0.06	–0.14	0.02	0.00	–0.14	0.03	–0.01	–0.22	0.00	0.00	12.19	0.00	12.19

Note: See Table AIII.3 and Table AIII.4a.

Table AIII.4f | Effective radiative forcing (mW m^{-2}) time series of halogenated compounds for selected scenarios and Kyoto and Montreal gases.

	SSP1-1.9						SSP3-7.0						SSP5-8.5					
Year	HFCs	NF_3, SF_6, PFCs	CFCs, HCFCs	CH_3CCl_3, CCl_4, CH_3Br, halons	Kyoto gases	Montreal gases	HFCs	NF_3, SF_6, PFCs	CFCs, HCFCs	CH_3CCl_3, CCl_4, CH_3Br, halons	Kyoto gases	Montreal gases	HFCs	NF_3, SF_6, PFCs	CFCs, HCFCs	CH_3CCl_3, CCl_4, CH_3Br, halons	Kyoto gases	Montreal gases
2019 (obs)	40	13	338	17	53	392	40	13	338	17	53	392	40	13	338	17	53	392
2020	43	13	330	15	56	388	42	14	330	15	56	387	43	14	330	15	57	388
2030	53	16	296	12	69	361	68	17	295	12	85	375	83	17	294	12	100	389
2040	41	17	249	9	58	299	92	20	248	9	113	349	130	20	246	9	150	385
2050	33	18	209	7	51	249	116	23	208	7	139	330	180	24	207	6	204	393
2060	28	18	180	5	47	213	138	26	178	5	164	321	238	27	177	5	265	420
2070	25	19	157	4	44	186	157	29	155	3	186	316	304	31	154	3	335	462
2080	24	19	139	3	43	165	176	31	136	2	208	315	370	34	135	2	405	507
2090	23	20	123	2	43	148	195	34	119	2	229	316	420	37	118	2	458	540
2100	22	20	110	1	43	134	212	37	105	1	249	319	447	41	104	1	488	552
2200	12	22	38	0	34	50	132	55	31	0	187	162	225	60	29	0	286	254

Notes: ERF for 2019 was calculated using the concentrations list in Table AIII.1; 2020 and onward are scenario projections. ERF was calculated using concentrations of individual halogenated compounds. Updated from Meinshausen et al. (2017, 2020) available at greenhousegases.science.unimelb.edu.au. Minor halogenated compounds SO_2F_2, CH_3Cl, CH_2Cl_2, $CHCl_3$ and Kyoto gases CO_2, CH_4, and N_2O are not included in this table.

Table AIII.5 | Total anthropogenic and natural effective radiative forcing relative to 1750 assessed in AR5 (RCP scenarios) and AR6 (SSP scenarios).

		2030			2050			2090		
		Anthropogenic	Natural	Total	Anthropogenic	Natural	Total	Anthropogenic	Natural	Total
AR5	RCP2.6[a]	2.52		2.50 ± 0.51	2.64		2.65 ± 0.47	2.35		2.44 ± 0.49
	RCP4.5[a]	2.67		2.61 ± 0.54	3.42		3.25 ± 0.56	3.91		3.78 ± 0.58
	RCP6.0[a]	2.52		2.41 ± 0.60	3.20		3.07 ± 0.61	4.93		4.64 ± 0.71
	RCP8.5[a]	2.91		2.92 ± 0.57	4.37		4.21 ± 0.63	7.32		7.13 ± 0.89
AR6	RCP2.6[b]	2.85	–0.02	2.83 (1.93–3.61)	3.11	0.01	3.12 (2.33–3.76)	2.70	0.01	2.71 (2.04–3.22)
	RCP4.5[b]	3.01	–0.02	2.99 (2.12–3.84)	3.90	0.01	3.91 (3.07–4.68)	4.48	0.01	4.49 (3.75–5.15)
	RCP6.0[b]	2.84	–0.02	2.82 (1.88–3.69)	3.56	0.01	3.58 (2.59–4.47)	5.51	0.01	5.52 (4.50–6.38)
	RCP8.5[b]	3.36	–0.02	3.34 (2.40–4.23)	5.01	0.01	5.03 (4.06–5.92)	8.46	0.01	8.46 (7.23–9.61)
	SSP1-1.9[c]	3.22	–0.02	3.20 (2.62–3.75)	3.04	0.01	3.05 (2.58–3.50)	2.48	0.01	2.48 (2.12–2.83)
	SSP1-2.6[c]	3.23	–0.02	3.21 (2.57–3.84)	3.56	0.01	3.58 (3.02–4.11)	3.24	0.01	3.25 (2.81–3.67)
	SSP2-4.5[c]	3.25	–0.02	3.24 (2.40–4.08)	4.23	0.01	4.24 (3.46–5.02)	5.32	0.01	5.33 (4.56–6.05)
	SSP3-7.0[c]	3.33	–0.02	3.31 (2.30–4.31)	4.61	0.01	4.63 (3.51–5.73)	7.43	0.01	7.44 (6.17–8.70)
	SSP3-7.0-low NTCF[d]	3.40	–0.02	3.48 (2.53–4.24)	4.91	0.01	4.92 (4.13–5.70)	7.73	0.01	7.74 (6.70–8.76)
	SSP3-7.0-low NTCFCH4[e]	3.26	–0.02	3.24 (2.40–4.09)	4.28	0.01	4.29 (3.56–5.01)	6.67	0.01	6.67 (5.75–7.57)

		2030			2050			2090		
		Anthropogenic	Natural	Total	Anthropogenic	Natural	Total	Anthropogenic	Natural	Total
AR6	SSP4-3.4[c]	3.26	–0.02	3.24 (2.33–4.11)	3.90	0.01	3.91 (3.06–4.68)	4.18	0.01	4.19 (3.49–4.83)
	SSP4-6.0[c]	3.31	–0.02	3.30 (2.35–4.23)	4.44	0.01	4.46 (3.49–5.42)	6.12	0.01	6.13 (5.21–7.02)
	SSP5-3.4-over[c]	3.62	–0.02	3.60 (2.82–4.40)	5.04	0.01	5.05 (4.29–5.79)	3.93	0.01	3.93 (3.40–4.45)
	SSP5-8.5[c]	3.61	–0.02	3.59 (2.80–4.38)	5.29	0.01	5.30 (4.44–6.17)	9.18	0.01	9.19 (7.96–10.40)

Notes: [a] Tables AII.6.8 and 6.10 in Annex II of the IPCC AR5 WG1 report (IPCC, 2013), for which total ERF is derived from CMIP5 models and anthropogenic ERF from a simple climate model emulator. [b] RCPs calculated for ERF as described in Chapter 7 Supplementary Material 7.SM.1.4. Similar to AR5, an emulator was used in AR6 to derive anthropogenic ERF (Cross-Chapter Box 7.1 and Chapter 7 Supplementary Material 7.SM.1.4). Further discussion on the difference between AR5 and AR6 radiative forcing is in Section 4.6.2. [c] ScenarioMIP (O'Neill et al., 2016), [d] AerChemMIP (Collins et al., 2017), [e] Allen et al. (2021).

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