Supporting Information

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SI Text

A simple model based on Oeschger et al. (10, 13) was used to simulate carbon cycling in atmospheric, oceanic, and biospheric reservoirs. The model includes one atmospheric box, one biospheric box, and a one-dimensional box diffusion ocean model with 43 ocean boxes. The one-box atmosphere does not resolve horizontal gradients or gradients between the troposphere and stratosphere. The model was run in single deconvolution mode using RCP-specified CO_2 and emissions from 1765 to 2100 (34) after a 30,000-y spin-up time.

For $\Delta^{14}C$, spatially averaged tropospheric observations were used to specify atmospheric $\Delta^{14}C$ up to 2005 (10). After 2005, atmospheric $\Delta^{14}C$ was simulated by model fluxes. Radioactive decay was included, and natural ^{14}C production was specified by the simulated total ^{14}C inventory after model spin-up, specific to the model parameters. Production of ^{14}C by the nuclear industry was assumed to remain constant at 2008 values (37) for 2005–2100. Negative emissions occur by biomass energy with carbon capture and storage (BECCS) (11), such that carbon with the isotopic composition of that entering the biospheric reservoir was removed from the system. Data on BECCS in the RCPs was provided by the RCP Task Group. To calculate fossil fuel CO_2 emitted to the atmosphere (Fig. 1), BECCS fluxes were added to net fossil fuel emissions. Since the BECCS data is based on nonharmonized emissions, there may be some discrepancy with net fossil fuel emissions before 2040 in RCP2.6, however this is unlikely to have a significant impact on the simulations.

Separate simulations were run using 117 sets of model parameters. The parameter sets were selected to explore carbon cycle dynamics across a range of parameter space that is consistent with CO_2 and $\Delta^{14}C$ observations, within the context of the simple model running in single deconvolution mode. Parameter sets were chosen from a larger ensemble by examining the simulated oceanic $\Delta^{14}C$ and oceanic bomb ^{14}C and anthropogenic CO_2 inventories and the simulated total bomb ^{14}C inventories, and selecting those sets that matched 20th-century observations, within their uncertainties (10). The parameter sets include values for the eddy diffusivity (K_{eddy}) of 3,000–6,000 $m^2 \cdot y^{-1}$, atmospheric CO_2 residence time with respect to exchange with the mixed layer of 9–11 y (τ_{am}, corresponding to piston velocities of 14.8–18.1 $cm \cdot h^{-1}$), atmospheric CO_2 residence time with respect to biospheric exchange (τ_{ab}) of 18–25 y, biospheric residence time (τ_{ba}) of 20–35 y, and CO_2 fertilization factor (β) of 0–0.4 (10). The model neglects the rapidly overturned biospheric carbon that is returned to the atmosphere within 1–3 y, one-third or more of net primary productivity (10, 14).

The governing equations of the model follow Oeschger et al. (13), and a brief presentation is included here. The single deconvolution residual (S) is given by the difference between the prescribed atmospheric growth rate (dC_a/dt) and the sum of net fossil fuel (F) and land use (L) emissions and the simulated oceanic and biospheric uptake:

$$S = \left[\frac{1}{2.12}\left(F + L + \frac{1}{\tau_{ba}}C_b\right) - \frac{1}{\tau_{am}}\left(C_a - C_{eq}\right) - \frac{1}{\tau_{ab}}\left(C_a + \beta\left(C_a - C_a^{PI}\right)\right)\right] - \frac{dC_a}{dt},$$

where C_a is the atmospheric CO_2 concentration (in ppm) and C_a^{PI} is the preindustrial CO_2 concentration, C_b is the total carbon in the biospheric reservoir in PgC, C_{eq} is the pCO_2 of the mixed layer box of the box diffusion model, calculated following Peng et al. (38) using temperature of 18 °C and salinity of 35 per mille. Units of $mol \cdot m^{-3}$ are used for carbon in ocean boxes. The factor 2.12 converts between ppm and PgC units. S is added to the biospheric reservoir.

The model simulates ^{14}C using the following equations for the atmosphere, biosphere, ocean mixed layer, and a representative ocean subsurface box. The atmospheric equation shows the prognostic ^{14}C simulation used after 2005; atmospheric ^{14}C (C_a^{14}) was prescribed by observations before 2005. B is carbon removed by BECCS. The model also simulates ^{13}C using similar equations, and simulated $\delta^{13}C$ is used to calculate $\Delta^{14}C$ in each reservoir (5).

Atmosphere:

$$\frac{dC_a^{14}}{dt} = \frac{1}{\tau_{am}}\left(\alpha_{ma}^{14}R_m^{14}C_{eq} - \alpha_{am}^{14}C_a^{14}\right) - \frac{1}{\tau_{ab}}\alpha_{ab}^{14}R_a^{14}\left(C_a + \beta\left(C_a - C_a^{PI}\right)\right) + \frac{1}{2.12}\left(\frac{1}{\tau_{ba}}C_b^{14} + LR_b^{14}\right) - S\alpha_{ab}^{14}R_a^{14} - \lambda C_a^{14} + P_{nat} + P_{nuc} - \frac{1}{2.12}\alpha_{ab}^{14}R_a^{14}B$$

Biosphere:

$$\frac{dC_b^{14}}{dt} = 2.12\left(\frac{1}{\tau_{ab}}\alpha_{ab}^{14}R_a^{14}\left(C_a + \beta\left(C_a - C_a^{PI}\right)\right) + S\alpha_{ab}^{14}R_a^{14}\right) - \frac{1}{\tau_{ba}}C_b^{14} - LR_b^{14} - \lambda C_b^{14}$$

Mixed layer, subscripts $m-1$ and $m-2$ denote the two ocean boxes below the mixed layer:

$$\frac{dC_m^{14}}{dt} = k_{ma}\left(\alpha_{am}^{14}C_a^{14} - \alpha_{ma}^{14}R_m^{14}C_{eq}\right) + K_m\left(-3C_m^{14} + 4C_{m-1}^{14} - C_{m-2}^{14}\right) - \lambda C_m^{14}$$

Representative subsurface box s, subscripts $s+1$ and $s-1$ denote ocean boxes above and below box s:

$$\frac{dC_s^{14}}{dt} = K_s\left(C_{s-1}^{14} - 2C_s^{14} + C_{s+1}^{14}\right) - \lambda C_s^{14}$$

R^{14} denotes the ratio $^{14}C/C$. The decay constant of ^{14}C is represented with λ, and P_{nat} and P_{nuc} denote production by natural cosmic radiation and by nuclear power plants. Fractionation factors are given by α. The parameter k_{ma} is related to τ_{am}, accounting for the mixed layer thickness and unit conversion. The exchange coefficients between ocean boxes (K_{m}, K_{s}) are determined by the eddy diffusivity parameter (K_{eddy}) and the thickness of the boxes, 75 m in the mixed layer, 25 m in the thermocline, and 546 m in the deep ocean (13). In the form of the equations given above, the single deconvolution residual and the land use emissions are positive; slightly different forms are used if these terms are negative, relating to uptake or release from the biosphere and the associated fractionation.

The model was run in MATLAB R2013b using the ode23tb routine with default settings. An annual time step was used in the model output, although the ode23tb routine uses variable time steps in calculating the solution.

Simulated $\Delta^{14}C$ are plotted in Figs. 1 and 2, including the range across different parameter sets. Fig. S1 shows the simulated inventory of radiocarbon atoms, relative to 1950, in atmospheric, biospheric, and oceanic reservoirs. Table S2 lists midrange values for simulated $\Delta^{14}CO_2$ in addition to upper and lower bounds of the simulated ranges. Table S1 lists the 117 parameter sets that were used in the simulations.

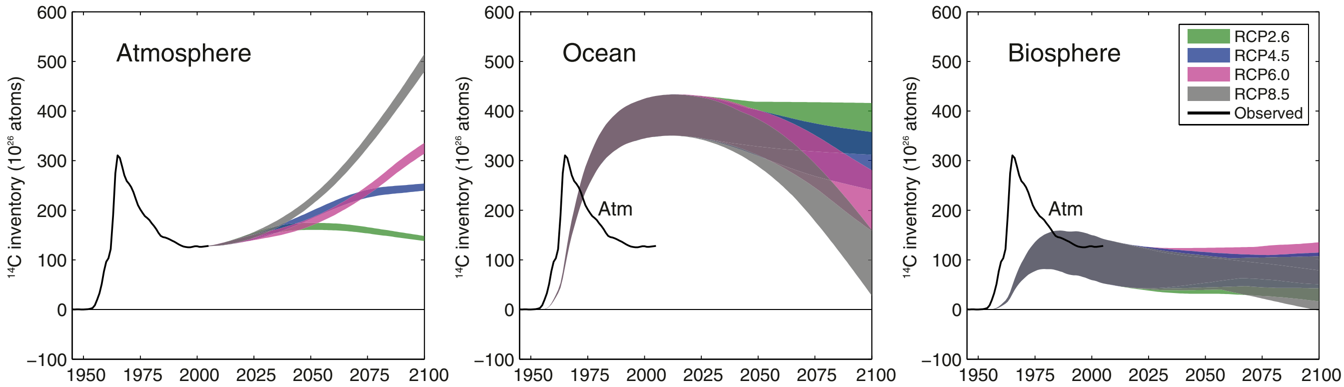

Fig. S1. Simulated radiocarbon inventories, relative to 1950, in atmospheric, oceanic, and biospheric reservoirs for the simulations shown in Figs. 1 and 2. The atmospheric radiocarbon inventory over 1950–2005 is shown in each panel.

Table S1. Parameter sets used in the carbon cycle model simulations

K_{eddy}, $m^2 \cdot y^{-1}$	τ_{am}, y	τ_{ab}, y	τ_{ba}, y	β
3,000	9	25	30	0
3,000	9	25	30	0.2
3,000	9	25	35	0
3,000	9	25	35	0.2
3,000	9	25	35	0.4
3,000	10	18	35	0
3,000	10	25	28	0
3,000	10	25	28	0.2
3,000	10	25	28	0.4
3,000	10	25	30	0
3,000	10	25	30	0.2
3,000	10	25	30	0.4
3,000	10	25	35	0
3,000	10	25	35	0.2
3,000	10	25	35	0.4
3,000	11	18	30	0
3,000	11	18	30	0.2
3,000	11	18	35	0
3,000	11	18	35	0.2
3,000	11	18	35	0.4
3,000	11	25	35	0
3,000	11	25	35	0.2
3,000	11	25	35	0.4
4,000	9	25	20	0
4,000	9	25	20	0.2
4,000	9	25	25	0
4,000	9	25	25	0.2
4,000	9	25	25	0.4
4,000	9	25	30	0
4,000	9	25	30	0.2
4,000	9	25	30	0.4
4,000	9	25	35	0
4,000	9	25	35	0.2
4,000	9	25	35	0.4
4,000	10	18	28	0
4,000	10	18	28	0.2
4,000	10	18	30	0
4,000	10	18	30	0.2
4,000	10	18	35	0
4,000	10	25	23	0
4,000	10	25	23	0.2
4,000	10	25	23	0.4
4,000	10	25	25	0
4,000	10	25	25	0.2
4,000	10	25	25	0.4
4,000	10	25	28	0
4,000	10	25	28	0.2
4,000	10	25	28	0.4
4,000	10	25	30	0
4,000	10	25	30	0.2
4,000	10	25	30	0.4
4,000	10	25	35	0
4,000	10	25	35	0.2
4,000	10	25	35	0.4
4,000	11	18	28	0
4,000	11	18	28	0.2
4,000	11	18	28	0.4
4,000	11	18	30	0
4,000	11	18	30	0.2
4,000	11	18	30	0.4
4,000	11	18	35	0
4,000	11	18	35	0.2

Table S1. Cont.

K_{eddy}, $m^2{\cdot}y^{-1}$	τ_{am}, y	τ_{ab}, y	τ_{ba}, y	β
4,000	11	18	35	0.4
4,000	11	25	28	0
4,000	11	25	28	0.2
4,000	11	25	28	0.4
4,000	11	25	30	0
4,000	11	25	30	0.2
4,000	11	25	30	0.4
4,000	11	25	35	0.4
5,000	9	25	20	0
5,000	9	25	20	0.2
5,000	9	25	25	0
5,000	9	25	25	0.2
5,000	9	25	25	0.4
5,000	9	25	30	0
5,000	9	25	30	0.2
5,000	9	25	30	0.4
5,000	9	25	35	0
5,000	10	18	28	0
5,000	10	18	28	0.2
5,000	10	18	28	0.4
5,000	10	18	30	0
5,000	10	18	30	0.2
5,000	10	25	20	0
5,000	10	25	20	0.2
5,000	10	25	20	0.4
5,000	10	25	23	0
5,000	10	25	23	0.2
5,000	10	25	23	0.4
5,000	10	25	25	0
5,000	10	25	25	0.2
5,000	10	25	25	0.4
5,000	10	25	28	0
5,000	10	25	28	0.2
5,000	10	25	28	0.4
5,000	10	25	30	0.2
5,000	10	25	30	0.4
5,000	10	25	35	0.4
5,000	11	18	28	0
5,000	11	18	28	0.2
5,000	11	18	28	0.4
5,000	11	18	30	0
5,000	11	18	30	0.2
5,000	11	18	30	0.4
5,000	11	18	35	0
5,000	11	18	35	0.2
5,000	11	18	35	0.4
6,000	10	25	20	0.4
6,000	10	25	23	0.4
6,000	10	25	25	0.4
6,000	11	18	28	0
6,000	11	18	28	0.2
6,000	11	18	28	0.4
6,000	11	18	30	0
6,000	11	18	30	0.2
6,000	11	18	30	0.4

Table S2. Tabulated annual midrange (Mid), maximum (Max), and minimum (Min) $\Delta^{14}CO_2$ simulated for each RCP, 2005–2100 (in ‰)

	RCP2.6			RCP4.5			RCP6.0			RCP8.5		
Year	Mid	Min	Max	Mid	Min	Max	Mid	Min	Max	Mid	Min	Max
2005	66.3	64.8	67.7	66.3	64.8	67.7	66.3	64.8	67.7	66.3	64.8	67.7
2006	62.0	60.5	63.4	62.0	60.5	63.4	62.0	60.5	63.4	62.0	60.5	63.4
2007	57.2	55.4	59.0	57.3	55.5	59.1	57.3	55.5	59.1	57.2	55.4	59.0
2008	52.9	50.4	55.3	53.0	50.6	55.5	53.1	50.6	55.5	52.8	50.3	55.2
2009	48.5	45.3	51.6	48.8	45.6	51.9	48.9	45.7	52.1	48.3	45.2	51.5
2010	44.1	40.3	48.0	44.6	40.7	48.4	44.8	40.9	48.6	43.9	40.1	47.7
2011	39.9	35.4	44.3	40.5	36.0	44.9	40.8	36.3	45.2	39.5	35.1	44.0
2012	35.8	30.8	40.8	36.4	31.4	41.4	36.9	31.9	41.9	35.1	30.1	40.1
2013	31.9	26.3	37.4	32.5	27.0	38.1	33.2	27.7	38.8	30.7	25.1	36.2
2014	28.2	22.1	34.3	28.7	22.6	34.7	29.7	23.7	35.8	26.3	20.2	32.4
2015	24.7	18.1	31.2	25.0	18.4	31.5	26.3	19.8	32.9	22.0	15.4	28.6
2016	21.3	14.2	28.3	21.3	14.3	28.3	23.1	16.0	30.1	17.6	10.5	24.7
2017	18.0	10.5	25.4	17.7	10.2	25.2	19.9	12.4	27.3	13.3	5.7	20.8
2018	14.8	6.9	22.6	14.2	6.3	22.0	16.8	9.0	24.7	8.9	1.0	16.9
2019	11.6	3.4	19.9	10.7	2.4	18.9	13.8	5.6	22.0	4.6	−3.7	12.9
2020	8.6	0.0	17.2	7.2	−1.4	15.8	10.9	2.3	19.5	0.3	−8.4	9.0
2021	5.7	−3.2	14.6	3.8	−5.1	12.7	8.0	−0.9	16.9	−4.0	−13.0	5.0
2022	3.0	−6.2	12.3	0.4	−8.8	9.7	5.2	−4.0	14.3	−8.3	−17.6	1.1
2023	0.6	−8.9	10.1	−2.8	−12.4	6.7	2.3	−7.2	11.8	−12.5	−22.1	−2.8
2024	−1.6	−11.3	8.2	−6.1	−15.8	3.7	−0.5	−10.3	9.2	−16.6	−26.5	−6.7
2025	−3.6	−13.6	6.4	−9.3	−19.3	0.8	−3.4	−13.3	6.6	−20.7	−30.9	−10.6
2026	−5.4	−15.7	4.8	−12.4	−22.6	−2.1	−6.2	−16.4	4.0	−24.8	−35.2	−14.4
2027	−7.1	−17.5	3.3	−15.5	−25.9	−5.0	−9.0	−19.4	1.4	−28.8	−39.4	−18.3
2028	−8.7	−19.3	1.9	−18.5	−29.1	−7.9	−11.8	−22.3	−1.2	−32.8	−43.6	−22.0
2029	−10.1	−20.9	0.7	−21.5	−32.3	−10.7	−14.5	−25.3	−3.8	−36.8	−47.7	−25.8
2030	−11.4	−22.3	−0.5	−24.4	−35.4	−13.5	−17.3	−28.2	−6.3	−40.7	−51.8	−29.6
2031	−12.6	−23.7	−1.5	−27.3	−38.5	−16.2	−20.0	−31.1	−8.9	−44.6	−55.8	−33.3
2032	−13.6	−24.9	−2.4	−30.1	−41.4	−18.9	−22.8	−34.1	−11.6	−48.5	−59.8	−37.1
2033	−14.6	−25.9	−3.2	−32.9	−44.3	−21.5	−25.6	−37.0	−14.2	−52.4	−63.9	−40.9
2034	−15.4	−26.8	−3.9	−35.5	−47.0	−24.0	−28.4	−40.0	−16.9	−56.3	−67.9	−44.7
2035	−16.1	−27.6	−4.5	−38.1	−49.7	−26.5	−31.3	−42.9	−19.6	−60.2	−71.9	−48.5
2036	−16.7	−28.3	−5.0	−40.6	−52.3	−28.9	−34.1	−45.9	−22.3	−64.1	−75.9	−52.3
2037	−17.2	−28.9	−5.5	−43.0	−54.8	−31.2	−37.0	−48.9	−25.1	−68.0	−79.9	−56.1
2038	−17.6	−29.4	−5.8	−45.4	−57.3	−33.5	−39.8	−51.8	−27.8	−71.9	−83.9	−59.9
2039	−17.9	−29.8	−6.1	−47.7	−59.7	−35.8	−42.7	−54.8	−30.6	−75.8	−87.8	−63.7
2040	−18.2	−30.1	−6.2	−50.0	−62.0	−38.0	−45.5	−57.7	−33.4	−79.6	−91.7	−67.6
2041	−18.4	−30.4	−6.4	−52.2	−64.3	−40.2	−48.4	−60.6	−36.1	−83.5	−95.6	−71.4
2042	−18.6	−30.6	−6.5	−54.4	−66.5	−42.3	−51.2	−63.5	−38.9	−87.3	−99.4	−75.2
2043	−18.8	−30.8	−6.7	−56.4	−68.6	−44.3	−54.0	−66.4	−41.7	−91.2	−103.3	−79.1
2044	−19.0	−31.1	−6.9	−58.4	−70.6	−46.2	−56.9	−69.3	−44.4	−95.0	−107.2	−82.9
2045	−19.2	−31.3	−7.1	−60.3	−72.5	−48.1	−59.6	−72.1	−47.2	−98.9	−111.0	−86.8
2046	−19.4	−31.6	−7.3	−62.1	−74.3	−49.9	−62.4	−74.9	−49.9	−102.8	−114.9	−90.6
2047	−19.7	−31.8	−7.5	−63.9	−76.1	−51.7	−65.2	−77.7	−52.6	−106.6	−118.7	−94.4
2048	−19.9	−32.0	−7.7	−65.6	−77.8	−53.4	−67.9	−80.5	−55.3	−110.4	−122.5	−98.2
2049	−20.0	−32.2	−7.9	−67.2	−79.5	−55.0	−70.6	−83.2	−58.0	−114.1	−126.3	−101.9
2050	−20.2	−32.4	−8.1	−68.9	−81.0	−56.7	−73.3	−85.9	−60.7	−117.9	−130.1	−105.7
2051	−20.4	−32.5	−8.2	−70.4	−82.6	−58.2	−76.0	−88.6	−63.4	−121.6	−133.8	−109.4
2052	−20.5	−32.7	−8.4	−71.8	−84.0	−59.6	−78.7	−91.3	−66.1	−125.3	−137.6	−113.1
2053	−20.6	−32.7	−8.5	−73.1	−85.2	−61.0	−81.4	−94.0	−68.8	−129.1	−141.5	−116.8
2054	−20.7	−32.8	−8.6	−74.3	−86.4	−62.1	−84.1	−96.6	−71.5	−132.9	−145.3	−120.4
2055	−20.7	−32.8	−8.6	−75.3	−87.5	−63.2	−86.7	−99.3	−74.2	−136.6	−149.1	−124.1
2056	−20.7	−32.8	−8.7	−76.3	−88.4	−64.1	−89.4	−101.9	−76.8	−140.3	−152.9	−127.7
2057	−20.7	−32.7	−8.7	−77.2	−89.3	−65.0	−92.0	−104.6	−79.4	−144.0	−156.7	−131.3
2058	−20.7	−32.7	−8.6	−78.0	−90.1	−65.8	−94.6	−107.2	−82.1	−147.6	−160.4	−134.9
2059	−20.6	−32.6	−8.6	−78.7	−90.8	−66.6	−97.2	−109.8	−84.7	−151.3	−164.1	−138.4
2060	−20.5	−32.4	−8.5	−79.4	−91.5	−67.3	−99.8	−112.3	−87.3	−154.9	−167.8	−142.0
2061	−20.3	−32.3	−8.4	−80.0	−92.1	−67.9	−102.4	−114.9	−89.9	−158.4	−171.4	−145.4
2062	−20.2	−32.1	−8.3	−80.5	−92.6	−68.5	−105.0	−117.4	−92.5	−161.9	−174.9	−148.9
2063	−20.1	−31.9	−8.3	−81.0	−93.0	−68.9	−107.5	−120.0	−95.0	−165.3	−178.4	−152.2
2064	−19.9	−31.7	−8.1	−81.4	−93.3	−69.4	−110.0	−122.4	−97.6	−168.6	−181.8	−155.5
2065	−19.8	−31.5	−8.0	−81.7	−93.6	−69.7	−112.5	−124.9	−100.1	−171.9	−185.1	−158.7

Table S2. Cont.

	RCP2.6			RCP4.5			RCP6.0			RCP8.5		
Year	Mid	Min	Max	Mid	Min	Max	Mid	Min	Max	Mid	Min	Max
2066	−19.6	−31.3	−7.9	−81.9	−93.8	−70.0	−115.0	−127.4	−102.7	−175.1	−188.4	−161.8
2067	−19.4	−31.1	−7.8	−82.1	−94.0	−70.2	−117.5	−129.9	−105.2	−178.3	−191.6	−165.0
2068	−19.2	−30.8	−7.7	−82.2	−94.1	−70.4	−120.0	−132.3	−107.7	−181.4	−194.7	−168.0
2069	−19.0	−30.5	−7.5	−82.3	−94.2	−70.5	−122.5	−134.8	−110.2	−184.4	−197.8	−171.0
2070	−18.8	−30.3	−7.3	−82.4	−94.2	−70.6	−124.9	−137.2	−112.6	−187.4	−200.9	−174.0
2071	−18.6	−30.0	−7.2	−82.4	−94.2	−70.6	−127.4	−139.7	−115.1	−190.4	−203.9	−176.9
2072	−18.4	−29.7	−7.0	−82.3	−94.1	−70.6	−129.8	−142.2	−117.4	−193.3	−206.8	−179.8
2073	−18.2	−29.4	−6.9	−82.2	−93.9	−70.5	−132.2	−144.6	−119.8	−196.1	−209.6	−182.6
2074	−18.0	−29.2	−6.8	−82.0	−93.7	−70.3	−134.5	−146.9	−122.0	−198.9	−212.4	−185.3
2075	−17.8	−29.0	−6.7	−81.7	−93.4	−70.1	−136.7	−149.2	−124.3	−201.5	−215.1	−188.0
2076	−17.7	−28.8	−6.6	−81.4	−93.0	−69.8	−138.9	−151.4	−126.4	−204.2	−217.7	−190.6
2077	−17.6	−28.6	−6.6	−81.0	−92.6	−69.4	−141.1	−153.6	−128.6	−206.7	−220.3	−193.2
2078	−17.4	−28.3	−6.5	−80.6	−92.1	−69.0	−143.2	−155.8	−130.6	−209.3	−222.9	−195.7
2079	−17.3	−28.1	−6.4	−80.1	−91.6	−68.6	−145.3	−157.9	−132.7	−211.8	−225.4	−198.1
2080	−17.1	−27.9	−6.4	−79.5	−91.0	−68.1	−147.3	−160.0	−134.7	−214.2	−227.8	−200.6
2081	−17.0	−27.7	−6.3	−79.0	−90.4	−67.6	−149.3	−161.9	−136.7	−216.6	−230.2	−203.0
2082	−16.9	−27.6	−6.3	−78.5	−89.9	−67.2	−151.1	−163.7	−138.4	−219.0	−232.6	−205.3
2083	−16.8	−27.4	−6.3	−78.2	−89.5	−66.9	−152.6	−165.3	−140.0	−221.3	−234.9	−207.6
2084	−16.8	−27.3	−6.3	−77.9	−89.1	−66.6	−154.0	−166.7	−141.3	−223.5	−237.1	−209.9
2085	−16.7	−27.1	−6.3	−77.7	−88.9	−66.5	−155.2	−167.9	−142.5	−225.7	−239.4	−212.1
2086	−16.6	−27.0	−6.3	−77.5	−88.7	−66.4	−156.2	−168.9	−143.5	−227.9	−241.5	−214.3
2087	−16.6	−26.9	−6.3	−77.4	−88.5	−66.4	−157.1	−169.8	−144.4	−230.0	−243.6	−216.4
2088	−16.6	−26.8	−6.4	−77.4	−88.4	−66.4	−157.9	−170.6	−145.1	−232.1	−245.7	−218.5
2089	−16.5	−26.7	−6.4	−77.4	−88.4	−66.5	−158.5	−171.3	−145.8	−234.1	−247.8	−220.5
2090	−16.5	−26.6	−6.5	−77.5	−88.3	−66.6	−159.1	−171.9	−146.3	−236.1	−249.8	−222.4
2091	−16.5	−26.5	−6.5	−77.5	−88.4	−66.7	−159.6	−172.4	−146.8	−238.1	−251.8	−224.3
2092	−16.5	−26.4	−6.6	−77.7	−88.4	−66.9	−160.1	−172.9	−147.4	−240.0	−253.8	−226.2
2093	−16.5	−26.3	−6.7	−77.8	−88.5	−67.1	−160.7	−173.4	−147.9	−241.9	−255.8	−228.0
2094	−16.5	−26.3	−6.8	−77.9	−88.5	−67.4	−161.3	−174.0	−148.5	−243.8	−257.9	−229.8
2095	−16.6	−26.2	−6.9	−78.1	−88.6	−67.6	−161.9	−174.6	−149.1	−245.7	−259.8	−231.5
2096	−16.6	−26.2	−7.0	−78.3	−88.8	−67.9	−162.5	−175.2	−149.8	−247.5	−261.8	−233.3
2097	−16.7	−26.2	−7.1	−78.5	−88.9	−68.1	−163.1	−175.8	−150.4	−249.3	−263.7	−235.0
2098	−16.7	−26.2	−7.3	−78.8	−89.2	−68.4	−163.8	−176.4	−151.1	−251.1	−265.5	−236.6
2099	−16.8	−26.2	−7.4	−79.1	−89.4	−68.7	−164.4	−177.1	−151.8	−252.8	−267.4	−238.3
2100	−16.8	−26.2	−7.5	−79.3	−89.6	−69.0	−165.1	−177.7	−152.5	−254.5	−269.2	−239.9