

*Global Biogeochemical Cycles*

Supporting Information for

**Climatological distribution of aragonite saturation state in the global oceans**

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**Introduction**

The supporting information contains 9 tables detailing the area-averaged Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale in the designated latitudinal bands of the global oceans, from surface (Table S1) to 50 m (Table S2), 100 m (Table S3), 200 m (Table S4), 500 m (Table S5), 1000 m (Table S6), 2000 m (Table S7), 3000 m (Table S8), and 4000 m (Table S9) water depth.

**Table S1.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale in surface waters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | 1.05 (–3.93 - 8.41) | n/a | n/a | -0.07 (–4.04 - 7.53) |
| S | 33.62 (31.88 - 34.90) | n/a | n/a | 31.73 (28.15 - 34.55) |
| DIC | 2082.1 (2029.4 - 2109.3) | n/a | n/a | 2029.7 (1900.3 - 2108.4) |
| TA | 2248.7 (2180.4 - 2305.7) | n/a | n/a | 2178.9 (2020.3 - 2290.4) |
| [CO32–] | 118.2 (79.5 - 158.3) | n/a | n/a | 107.4 (70.9 - 157.7) |
| Ωarag | 1.79 (1.21 - 2.40) | n/a | n/a | 1.63 (1.08 - 2.39) |
| Ωcalc | 2.84 (1.94 - 3.77) | n/a | n/a | 2.61 (1.75 - 3.77) |
| pH | 8.16 (8.10 - 8.20) | n/a | n/a | 8.16 (8.10 - 8.22) |
| 50°N to 70°N | T | 8.59 (0.44 - 15.38) | 8.06 (5.66 - 10.21) | n/a | n/a |
| S | 34.59 (32.28 - 35.77) | 32.24 (30.97 - 32.78) | n/a | n/a |
| DIC | 2072.5 (2025.0 - 2101.2) | 2008.3 (1968.0 - 2044.0) | n/a | n/a |
| TA | 2293.5 (2193.4 - 2356.5) | 2191.2 (2131.6 - 2223.4) | n/a | n/a |
| [CO32–] | 153.5 (114.3 - 188.7) | 130.3 (117.5 - 143.8) | n/a | n/a |
| Ωarag | 2.33 (1.73 - 2.88) | 1.99 (1.79 - 2.19) | n/a | n/a |
| Ωcalc | 3.66 (2.77 - 4.47) | 3.15 (2.86 - 3.48) | n/a | n/a |
| pH | 8.14 (8.12 - 8.18) | 8.11 (8.08 - 8.19) | n/a | n/a |
| 30°N to 50°N | T | 19.47 (10.00 - 25.49) | 16.49 (8.02 - 25.31) | n/a | n/a |
| S | 35.75 (33.31 - 37.09) | 33.73 (31.86 - 35.02) | n/a | n/a |
| DIC | 2052.4 (1978.0 - 2100.9) | 1999.8 (1953.1 - 2045.6) | n/a | n/a |
| TA | 2352.3 (2232.5 - 2423.7) | 2245.7 (2155.3 - 2302.3) | n/a | n/a |
| [CO32–] | 208.7 (153.1 - 247.6) | 172.6 (125.5 - 225.4) | n/a | n/a |
| Ωarag | 3.23 (2.34 - 3.88) | 2.68 (1.91 - 3.58) | n/a | n/a |
| Ωcalc | 4.96 (3.68 - 5.87) | 4.15 (3.03 - 5.43) | n/a | n/a |
| pH | 8.10 (8.08 - 8.14) | 8.08 (8.06 - 8.14) | n/a | n/a |

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| 10°N to 30°N | T | 25.53 (20.62 - 28.08) | 25.98 (17.77 - 29.11) | 26.91 (25.30 - 28.22) | n/a |
| S | 36.42 (34.25 - 37.26) | 34.52 (33.40 - 35.19) | 34.90 (32.78 - 36.42) | n/a |
| DIC | 2031.2 (1920.9 - 2100.9) | 1949.0 (1871.3 - 2013.8) | 1968.5 (1856.9 - 2059.7) | n/a |
| TA | 2386.4 (2262.0 - 2435.6) | 2275.2 (2206.8 - 2312.6) | 2299.5 (2183.8 - 2389.5) | n/a |
| [CO32–] | 245.9 (217.8 - 257.7) | 227.2 (175.9 - 243.1) | 228.3 (220.6 - 238.7) | n/a |
| Ωarag | 3.87 (3.35 - 4.07) | 3.64 (2.74 - 3.92) | 3.65 (3.53 - 3.83) | n/a |
| Ωcalc | 5.85 (5.13 - 6.12) | 5.50 (4.23 - 5.88) | 5.51 (5.37 - 5.75) | n/a |
| pH | 8.08 (8.07 - 8.09) | 8.08 (8.05 - 8.12) | 8.05 (8.02 - 8.09) | n/a |
| 10°S to 10°N | T | 26.91 (25.48 - 27.96) | 27.66 (22.80 - 29.45) | 28.41 (27.11 - 29.18) | n/a |
| S | 35.64 (33.95 - 36.68) | 34.59 (33.24 - 35.85) | 34.71 (32.90 - 36.11) | n/a |
| DIC | 1992.7 (1912.4 - 2050.7) | 1950.4 (1860.7 - 2045.4) | 1933.1 (1856.9 - 2021.4) | n/a |
| TA | 2342.0 (2245.6 - 2409.4) | 2276.4 (2195.4 - 2359.9) | 2276.7 (2184.8 - 2357.6) | n/a |
| [CO32–] | 239.9 (230.1 - 249.8) | 225.9 (194.4 - 250.7) | 235.7 (225.2 - 241.7) | n/a |
| Ωarag | 3.82 (3.72 - 3.96) | 3.64 (3.08 - 4.05) | 3.81 (3.68 - 3.89) | n/a |
| Ωcalc | 5.76 (5.61 - 5.95) | 5.48 (4.68 - 6.06) | 5.72 (5.54 - 5.83) | n/a |
| pH | 8.07 (8.05 - 8.08) | 8.05 (8.01 - 8.09) | 8.06 (8.03 - 8.08) | n/a |
| 30°S to 10°S | T | 24.57 (20.59 - 27.44) | 24.80 (19.51 - 29.30) | 25.50 (20.65 - 28.23) | n/a |
| S | 36.46 (35.58 - 37.14) | 35.51 (34.43 - 36.26) | 35.09 (34.18 - 35.78) | n/a |
| DIC | 2056.5 (2015.6 - 2077.6) | 2005.4 (1910.1 - 2059.7) | 1964.6 (1906.9 - 2038.3) | n/a |
| TA | 2395.6 (2336.5 - 2438.2) | 2337.6 (2260.3 - 2388.7) | 2301.4 (2244.4 - 2350.8) | n/a |
| [CO32–] | 234.0 (208.4 - 253.9) | 232.0 (195.3 - 257.0) | 231.7 (213.8 - 237.1) | n/a |
| Ωarag | 3.67 (3.23 - 4.01) | 3.67 (3.03 - 4.12) | 3.68 (3.32 - 3.83) | n/a |
| Ωcalc | 5.56 (4.95 - 6.02) | 5.56 (4.66 - 6.18) | 5.58 (5.09 - 5.76) | n/a |
| pH | 8.07 (8.05 - 8.10) | 8.08 (8.03 - 8.12) | 8.09 (8.05 - 8.12) | n/a |
| 50°S to30°S | T | 14.69 (3.75 - 22.17) | 15.51 (7.60 - 21.43) | 14.02 (4.82 - 22.40) | n/a |
| S | 34.91 (33.98 - 36.13) | 34.79 (34.04 - 35.57) | 34.95 (33.79 - 35.78) | n/a |
| DIC | 2055.8 (2020.4 - 2117.5) | 2047.8 (2014.1 - 2099.8) | 2061.5 (2000.8 - 2112.9) | n/a |
| TA | 2315.6 (2283.2 - 2374.0) | 2297.8 (2264.7 - 2329.7) | 2314.5 (2278.8 - 2350.9) | n/a |
| [CO32–] | 178.8 (117.6 - 225.5) | 175.0 (131.7 - 216.6) | 175.1 (120.1 - 226.5) | n/a |
| Ωarag | 2.75 (1.78 - 3.51) | 2.69 (1.99 - 3.36) | 2.69 (1.81 - 3.54) | n/a |
| Ωcalc | 4.26 (2.82 - 5.36) | 4.17 (3.15 - 5.16) | 4.17 (2.88 - 5.41) | n/a |
| pH | 8.11 (8.07 - 8.14) | 8.09 (8.06 - 8.12) | 8.11 (8.08 - 8.12) | n/a |
| Southernmost to 50°S | T | 1.42 (–2.04 - 9.15) | 3.80 (–2.89 - 10.29) | 1.92 (–2.20 - 8.17) | n/a |
| S | 33.91 (33.82 - 34.13) | 33.98 (33.78 - 34.50) | 33.92 (33.72 - 34.35) | n/a |
| DIC | 2136.0 (2065.1 - 2164.0) | 2121.6 (2066.2 - 2196.4) | 2142.2 (2094.4 - 2182.4) | n/a |
| TA | 2298.3 (2283.2 - 2310.9) | 2285.2 (2267.2 - 2321.1) | 2289.9 (2278.3 - 2302.9) | n/a |
| [CO32–] | 112.2 (99.0 - 150.5) | 116.7 (92.1 - 150.7) | 106.3 (88.5 - 135.4) | n/a |
| Ωarag | 1.69 (1.49 - 2.29) | 1.76 (1.39 - 2.29) | 1.60 (1.33 - 2.05) | n/a |
| Ωcalc | 2.70 (2.39 - 3.60) | 2.80 (2.22 - 3.60) | 2.55 (2.13 - 3.23) | n/a |
| pH | 8.12 (8.10 - 8.14) | 8.10 (8.07 - 8.12) | 8.08 (8.06 - 8.12) | n/a |

**Table S2.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 50 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

|  |  |  |  |  |  |
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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | 0.39 (–3.05 - 6.50) | n/a | n/a | -0.70 (–3.17 - 5.80) |
| S | 34.05 (32.75 - 35.03) | n/a | n/a | 33.26 (31.86 - 34.91) |
| DIC | 2125.6 (2099.8 - 2137.4) | n/a | n/a | 2123.4 (2088.8 - 2146.8) |
| TA | 2270.7 (2226.6 - 2311.0) | n/a | n/a | 2253.8 (2218.5 - 2306.5) |
| [CO32–] | 105.7 (79.6 - 136.2) | n/a | n/a | 97.2 (76.3 - 134.8) |
| Ωarag | 1.58 (1.20 - 2.04) | n/a | n/a | 1.46 (1.15 - 2.02) |
| Ωcalc | 2.52 (1.92 - 3.22) | n/a | n/a | 2.32 (1.84 - 3.18) |
| pH | 8.11 (8.04 - 8.15) | n/a | n/a | 8.09 (8.03 - 8.16) |
| 50°N to 70°N | T | 6.58 (–0.71 - 13.72) | 4.26 (1.55 - 7.44) | n/a | n/a |
| S | 34.77 (33.05 - 35.80) | 32.61 (32.15 - 33.01) | n/a | n/a |
| DIC | 2114.0 (2094.4 - 2134.7) | 2076.1 (2030.0 - 2127.9) | n/a | n/a |
| TA | 2301.2 (2233.2 - 2355.2) | 2209.2 (2180.7 - 2237.5) | n/a | n/a |
| [CO32–] | 132.3 (89.3 - 173.7) | 100.6 (84.4 - 116.4) | n/a | n/a |
| Ωarag | 1.98 (1.34 - 2.62) | 1.51 (1.26 - 1.76) | n/a | n/a |
| Ωcalc | 3.13 (2.14 - 4.08) | 2.41 (2.02 - 2.78) | n/a | n/a |
| pH | 8.09 (8.07 - 8.12) | 8.04 (8.01 - 8.09) | n/a | n/a |
| 30°N to 50°N | T | 17.03 (5.79 - 23.61) | 13.07 (1.97 - 22.45) | n/a | n/a |
| S | 35.91 (34.06 - 37.01) | 33.85 (32.43 - 34.99) | n/a | n/a |
| DIC | 2078.2 (2048.0 - 2110.0) | 2029.8 (1970.4 - 2127.2) | n/a | n/a |
| TA | 2360.1 (2272.8 - 2418.3) | 2250.5 (2181.6 - 2300.9) | n/a | n/a |
| [CO32–] | 196.8 (120.8 - 246.1) | 158.2 (86.7 - 219.2) | n/a | n/a |
| Ωarag | 3.00 (1.82 - 3.80) | 2.42 (1.30 - 3.42) | n/a | n/a |
| Ωcalc | 4.63 (2.87 - 5.78) | 3.77 (2.07 - 5.23) | n/a | n/a |
| pH | 8.10 (8.03 - 8.12) | 8.08 (7.94 - 8.13) | n/a | n/a |

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| 10°N to 30°N | T | 24.08 (19.29 - 26.94) | 24.91 (15.46 - 28.86) | 24.55 (21.90 - 26.79) | n/a |
| S | 36.72 (35.86 - 37.20) | 34.63 (33.91 - 35.24) | 35.36 (34.03 - 36.34) | n/a |
| DIC | 2060.2 (2023.5 - 2110.2) | 1970.7 (1913.5 - 2075.2) | 2057.6 (1960.3 - 2145.5) | n/a |
| TA | 2403.2 (2355.8 - 2431.4) | 2281.3 (2241.0 - 2317.4) | 2318.1 (2243.0 - 2382.2) | n/a |
| [CO32–] | 238.7 (193.7 - 258.9) | 220.0 (136.2 - 245.6) | 184.5 (165.0 - 204.7) | n/a |
| Ωarag | 3.71 (3.00 - 4.05) | 3.48 (2.10 - 3.93) | 2.90 (2.56 - 3.23) | n/a |
| Ωcalc | 5.62 (4.57 - 6.10) | 5.28 (3.25 - 5.91) | 4.40 (3.89 - 4.86) | n/a |
| pH | 8.08 (8.01 - 8.11) | 8.06 (7.95 - 8.12) | 7.95 (7.89 - 7.99) | n/a |
| 10°S to 10°N | T | 24.19 (20.11 - 26.93) | 26.49 (20.11 - 29.45) | 26.15 (24.08 - 27.53) | n/a |
| S | 36.09 (35.88 - 36.70) | 34.83 (33.96 - 35.88) | 35.07 (34.04 - 35.95) | n/a |
| DIC | 2058.1 (2026.5 - 2115.8) | 1981.4 (1904.2 - 2108.3) | 1991.6 (1931.5 - 2080.8) | n/a |
| TA | 2370.0 (2356.6 - 2411.6) | 2290.1 (2235.8 - 2359.6) | 2299.3 (2243.1 - 2347.6) | n/a |
| [CO32–] | 216.0 (176.4 - 248.1) | 219.3 (163.5 - 256.6) | 212.9 (188.3 - 231.2) | n/a |
| Ωarag | 3.38 (2.71 - 3.90) | 3.50 (2.54 - 4.12) | 3.38 (2.95 - 3.69) | n/a |
| Ωcalc | 5.12 (4.15 - 5.86) | 5.27 (3.89 - 6.17) | 5.10 (4.46 - 5.57) | n/a |
| pH | 8.03 (7.98 - 8.07) | 8.03 (7.94 - 8.10) | 8.02 (7.94 - 8.07) | n/a |
| 30°S to 10°S | T | 22.99 (18.92 - 26.92) | 23.84 (17.96 - 29.07) | 23.94 (19.39 - 26.98) | n/a |
| S | 36.40 (35.56 - 37.02) | 35.59 (34.62 - 36.21) | 35.19 (34.50 - 35.69) | n/a |
| DIC | 2062.9 (2031.9 - 2082.2) | 2014.4 (1919.6 - 2108.0) | 1983.9 (1931.5 - 2039.4) | n/a |
| TA | 2390.9 (2334.0 - 2432.6) | 2341.1 (2272.0 - 2382.9) | 2308.0 (2265.9 - 2343.9) | n/a |
| [CO32–] | 226.1 (193.4 - 251.1) | 230.9 (172.6 - 259.8) | 223.4 (206.0 - 232.0) | n/a |
| Ωarag | 3.50 (2.98 - 3.94) | 3.62 (2.67 - 4.15) | 3.50 (3.21 - 3.69) | n/a |
| Ωcalc | 5.33 (4.56 - 5.92) | 5.49 (4.08 - 6.22) | 5.32 (4.92 - 5.57) | n/a |
| pH | 8.07 (8.02 - 8.10) | 8.09 (7.96 - 8.13) | 8.08 (8.03 - 8.12) | n/a |
| 50°S to30°S | T | 13.55 (3.29 - 21.04) | 14.62 (7.44 - 20.06) | 13.36 (4.56 - 21.35) | n/a |
| S | 34.97 (34.02 - 36.17) | 34.80 (34.05 - 35.60) | 34.94 (33.80 - 35.69) | n/a |
| DIC | 2066.6 (2031.0 - 2124.5) | 2053.0 (2019.2 - 2101.1) | 2065.5 (2007.9 - 2114.9) | n/a |
| TA | 2318.9 (2282.1 - 2377.8) | 2298.6 (2265.6 - 2330.7) | 2313.3 (2278.8 - 2343.9) | n/a |
| [CO32–] | 174.0 (116.6 - 222.2) | 174.5 (134.0 - 218.3) | 171.4 (117.9 - 221.0) | n/a |
| Ωarag | 2.65 (1.75 - 3.42) | 2.66 (2.01 - 3.36) | 2.60 (1.77 - 3.42) | n/a |
| Ωcalc | 4.12 (2.77 - 5.23) | 4.13 (3.18 - 5.16) | 4.05 (2.80 - 5.23) | n/a |
| pH | 8.11 (8.09 - 8.12) | 8.10 (8.06 - 8.13) | 8.11 (8.09 - 8.12) | n/a |
| Southernmost to 50°S | T | 0.79 (–2.76 - 8.17) | 3.48 (–3.17 - 9.63) | 1.69 (–2.45 - 7.93) | n/a |
| S | 34.00 (33.89 - 34.17) | 34.05 (33.90 - 34.51) | 33.97 (33.73 - 34.37) | n/a |
| DIC | 2152.0 (2081.7 - 2192.8) | 2133.3 (2080.4 - 2221.5) | 2147.5 (2098.2 - 2198.4) | n/a |
| TA | 2301.1 (2282.1 - 2321.3) | 2288.9 (2267.5 - 2333.7) | 2293.1 (2278.8 - 2316.1) | n/a |
| [CO32–] | 105.3 (90.9 - 139.9) | 114.5 (87.5 - 148.7) | 104.8 (86.6 - 133.8) | n/a |
| Ωarag | 1.58 (1.36 - 2.11) | 1.72 (1.31 - 2.24) | 1.57 (1.30 - 2.01) | n/a |
| Ωcalc | 2.51 (2.17 - 3.32) | 2.72 (2.09 - 3.52) | 2.50 (2.07 - 3.17) | n/a |
| pH | 8.10 (8.08 - 8.12) | 8.09 (8.06 - 8.12) | 8.08 (8.05 - 8.10) | n/a |

**Table S3.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 100 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | 0.25 (–2.56 - 5.71) | n/a | n/a | -0.60 (–2.68 - 5.23) |
| S | 34.36 (33.19 - 35.17) | n/a | n/a | 33.88 (32.69 - 35.12) |
| DIC | 2143.4 (2132.2 - 2153.5) | n/a | n/a | 2157.6 (2125.4 - 2183.4) |
| TA | 2280.7 (2242.8 - 2317.4) | n/a | n/a | 2273.5 (2244.9 - 2316.7) |
| [CO32–] | 101.2 (75.6 - 126.4) | n/a | n/a | 89.7 (66.0 - 124.1) |
| Ωarag | 1.50 (1.12 - 1.87) | n/a | n/a | 1.33 (0.98 - 1.84) [0.7%] |
| Ωcalc | 2.38 (1.79 - 2.95) | n/a | n/a | 2.11 (1.57 - 2.90) |
| pH | 8.08 (7.99 - 8.11) | n/a | n/a | 8.04 (7.92 - 8.12) |
| 50°N to 70°N | T | 5.87 (–0.70 - 12.46) | 3.08 (0.34 - 6.70) | n/a | n/a |
| S | 34.86 (33.42 - 35.78) | 33.00 (32.78 - 33.17) | n/a | n/a |
| DIC | 2133.5 (2118.4 - 2143.3) | 2137.0 (2081.7 - 2173.6) | n/a | n/a |
| TA | 2303.5 (2246.7 - 2352.3) | 2229.8 (2209.1 - 2248.7) | n/a | n/a |
| [CO32–] | 121.9 (81.9 - 159.1) | 77.7 (66.1 - 98.2) | n/a | n/a |
| Ωarag | 1.81 (1.21 - 2.37) | 1.15 (0.98 - 1.47) [8.3%] | n/a | n/a |
| Ωcalc | 2.85 (1.94 - 3.70) | 1.84 (1.57 - 2.32) | n/a | n/a |
| pH | 8.06 (8.02 - 8.11) | 7.93 (7.90 - 7.99) | n/a | n/a |
| 30°N to 50°N | T | 15.58 (5.21 - 21.68) | 11.28 (0.84 - 19.63) | n/a | n/a |
| S | 36.01 (34.46 - 36.90) | 33.92 (32.91 - 34.88) | n/a | n/a |
| DIC | 2101.5 (2067.8 - 2131.9) | 2060.9 (2000.4 - 2160.7) | n/a | n/a |
| TA | 2362.3 (2284.6 - 2410.4) | 2253.2 (2208.8 - 2290.8) | n/a | n/a |
| [CO32–] | 182.8 (111.9 - 234.5) | 138.0 (71.7 - 199.3) | n/a | n/a |
| Ωarag | 2.75 (1.66 - 3.57) | 2.08 (1.06 - 3.05) | n/a | n/a |
| Ωcalc | 4.26 (2.63 - 5.45) | 3.25 (1.70 - 4.70) | n/a | n/a |
| pH | 8.08 (8.00 - 8.12) | 8.04 (7.84 - 8.12) | n/a | n/a |

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| 10°N to 30°N | T | 21.39 (16.16 - 24.33) | 20.72 (13.23 - 25.75) | 21.41 (19.26 - 23.09) | n/a |
| S | 36.77 (35.89 - 37.16) | 34.80 (34.07 - 35.67) | 35.56 (34.68 - 36.38) | n/a |
| DIC | 2096.4 (2061.9 - 2168.7) | 2036.2 (1964.8 - 2179.5) | 2145.1 (2100.6 - 2206.5) | n/a |
| TA | 2405.0 (2354.1 - 2427.6) | 2292.8 (2259.3 - 2343.2) | 2327.1 (2279.0 - 2380.2) | n/a |
| [CO32–] | 215.5 (135.9 - 247.9) | 182.7 (96.1 - 230.6) | 136.2 (123.7 - 169.3) | n/a |
| Ωarag | 3.29 (2.04 - 3.80) | 2.83 (1.46 - 3.61) | 2.10 (1.91 - 2.63) | n/a |
| Ωcalc | 5.01 (3.16 - 5.77) | 4.32 (2.26 - 5.48) | 3.20 (2.91 - 3.99) | n/a |
| pH | 8.06 (7.92 - 8.12) | 8.00 (7.75 - 8.12) | 7.83 (7.80 - 7.91) | n/a |
| 10°S to 10°N | T | 18.48 (15.40 - 23.05) | 22.44 (15.81 - 27.97) | 21.38 (20.07 - 23.45) | n/a |
| S | 35.93 (35.62 - 36.63) | 35.16 (34.61 - 36.03) | 35.21 (34.68 - 35.90) | n/a |
| DIC | 2137.1 (2094.4 - 2171.7) | 2066.7 (1975.3 - 2179.5) | 2091.8 (2026.8 - 2130.2) | n/a |
| TA | 2359.3 (2338.5 - 2407.8) | 2312.0 (2276.2 - 2370.0) | 2310.1 (2279.0 - 2344.5) | n/a |
| [CO32–] | 158.9 (127.3 - 216.9) | 175.0 (96.1 - 238.0) | 156.3 (127.4 - 189.8) | n/a |
| Ωarag | 2.42 (1.91 - 3.34) | 2.73 (1.46 - 3.75) | 2.41 (1.97 - 2.95) | n/a |
| Ωcalc | 3.71 (2.97 - 5.06) | 4.14 (2.26 - 5.63) | 3.69 (3.01 - 4.49) | n/a |
| pH | 7.95 (7.91 - 8.03) | 7.95 (7.75 - 8.05) | 7.92 (7.82 - 8.00) | n/a |
| 30°S to 10°S | T | 19.98 (16.67 - 23.44) | 21.99 (16.20 - 27.69) | 20.88 (17.00 - 23.41) | n/a |
| S | 36.18 (35.47 - 36.81) | 35.71 (34.93 - 36.23) | 35.32 (34.86 - 35.61) | n/a |
| DIC | 2087.0 (2060.5 - 2143.8) | 2044.9 (2007.8 - 2162.8) | 2032.4 (2005.8 - 2077.2) | n/a |
| TA | 2375.2 (2328.1 - 2418.0) | 2348.8 (2308.0 - 2382.9) | 2317.5 (2291.7 - 2339.2) | n/a |
| [CO32–] | 200.9 (141.7 - 231.0) | 211.8 (133.5 - 245.4) | 197.9 (157.9 - 217.1) | n/a |
| Ωarag | 3.06 (2.14 - 3.55) | 3.27 (2.03 - 3.84) | 3.04 (2.43 - 3.34) | n/a |
| Ωcalc | 4.69 (3.31 - 5.39) | 4.98 (3.13 - 5.78) | 4.65 (3.72 - 5.10) | n/a |
| pH | 8.05 (7.93 - 8.11) | 8.06 (7.86 - 8.12) | 8.06 (7.94 - 8.12) | n/a |
| 50°S to30°S | T | 11.52 (2.52 - 18.85) | 13.00 (6.36 - 19.31) | 12.01 (3.38 - 19.63) | n/a |
| S | 34.96 (34.08 - 36.04) | 34.79 (34.09 - 35.63) | 34.94 (33.90 - 35.59) | n/a |
| DIC | 2091.7 (2058.3 - 2143.0) | 2067.4 (2030.6 - 2110.9) | 2082.0 (2036.0 - 2137.6) | n/a |
| TA | 2316.3 (2284.9 - 2369.3) | 2297.2 (2267.0 - 2332.8) | 2312.4 (2282.3 - 2338.8) | n/a |
| [CO32–] | 157.0 (107.4 - 207.6) | 161.9 (119.8 - 207.7) | 160.1 (106.6 - 203.6) | n/a |
| Ωarag | 2.36 (1.59 - 3.15) | 2.43 (1.78 - 3.16) | 2.40 (1.58 - 3.10) | n/a |
| Ωcalc | 3.67 (2.53 - 4.84) | 3.80 (2.82 - 4.87) | 3.75 (2.51 - 4.77) | n/a |
| pH | 8.08 (8.05 - 8.11) | 8.09 (8.00 - 8.12) | 8.09 (8.06 - 8.12) | n/a |
| Southernmost to 50°S | T | –0.09 (–2.71 - 5.94) | 2.44 (–2.92 - 8.43) | 1.39 (–1.97 - 7.36) | n/a |
| S | 34.14 (34.03 - 34.34) | 34.15 (34.02 - 34.52) | 34.12 (33.86 - 34.40) | n/a |
| DIC | 2182.5 (2116.9 - 2221.9) | 2155.3 (2096.8 - 2238.9) | 2173.3 (2107.9 - 2228.3) | n/a |
| TA | 2308.4 (2284.9 - 2330.6) | 2294.1 (2269.7 - 2342.7) | 2301.4 (2282.4 - 2329.4) | n/a |
| [CO32–] | 92.6 (81.9 - 118.7) | 102.7 (78.9 - 133.8) | 95.4 (76.9 - 128.4) | n/a |
| Ωarag | 1.37 (1.21 - 1.77) | 1.52 (1.17 - 1.99) | 1.41 (1.14 - 1.91) | n/a |
| Ωcalc | 2.18 (1.93 - 2.79) | 2.42 (1.86 - 3.14) | 2.25 (1.81 - 3.01) | n/a |
| pH | 8.05 (8.03 - 8.07) | 8.05 (7.99 - 8.07) | 8.03 (7.98 - 8.07) | n/a |

**Table S4.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 200 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | 0.67 (–0.84 - 4.87) | n/a | n/a | 0.58 (–1.43 - 4.86) |
| S | 34.64 (33.80 - 35.22) | n/a | n/a | 34.51 (33.80 - 35.24) |
| DIC | 2150.9 (2141.2 - 2170.5) | n/a | n/a | 2168.4 (2135.0 - 2207.8) |
| TA | 2286.7 (2255.3 - 2320.5) | n/a | n/a | 2291.1 (2257.8 - 2326.3) |
| [CO32–] | 100.3 (72.9 - 121.1) | n/a | n/a | 93.7 (68.5 - 119.8) |
| Ωarag | 1.45 (1.06 - 1.76) | n/a | n/a | 1.36 (0.99 - 1.74) [0.1%] |
| Ωcalc | 2.31 (1.68 - 2.77) | n/a | n/a | 2.15 (1.58 - 2.74) |
| pH | 8.06 (7.95 - 8.10) | n/a | n/a | 8.02 (7.90 - 8.10) |
| 50°N to 70°N | T | 5.50 (0.22 - 11.65) | 3.33 (1.42 - 5.96) | n/a | n/a |
| S | 34.95 (33.95 - 35.77) | 33.73 (33.60 - 33.91) | n/a | n/a |
| DIC | 2143.5 (2128.8 - 2163.8) | 2250.0 (2215.1 - 2287.5) | n/a | n/a |
| TA | 2305.5 (2259.2 - 2353.7) | 2277.2 (2262.7 - 2286.5) | n/a | n/a |
| [CO32–] | 117.0 (78.3 - 151.6) | 50.1 (36.7 - 63.9) | n/a | n/a |
| Ωarag | 1.70 (1.13 - 2.22) | 0.73 (0.53 - 0.93) [100%] | n/a | n/a |
| Ωcalc | 2.68 (1.81 - 3.46) | 1.16 (0.85 - 1.47) [16.1%] | n/a | n/a |
| pH | 8.05 (7.97 - 8.09) | 7.69 (7.60 - 7.82) | n/a | n/a |
| 30°N to 50°N | T | 14.29 (5.51 - 19.30) | 9.46 (1.90 - 16.92) | n/a | n/a |
| S | 35.97 (34.81 - 36.69) | 34.08 (33.59 - 34.75) | n/a | n/a |
| DIC | 2120.3 (2090.7 - 2159.5) | 2129.7 (2023.1 - 2286.5) | n/a | n/a |
| TA | 2358.5 (2298.8 - 2396.0) | 2268.3 (2250.1 - 2290.0) | n/a | n/a |
| [CO32–] | 167.8 (109.9 - 211.5) | 108.6 (37.4 - 179.8) | n/a | n/a |
| Ωarag | 2.48 (1.60 - 3.15) | 1.60 (0.54 - 2.69) [20.2%] | n/a | n/a |
| Ωcalc | 3.84 (2.52 - 4.83) | 2.51 (0.86 - 4.16) [2.2%] | n/a | n/a |
| pH | 8.05 (7.96 - 8.10) | 7.91 (7.61 - 8.09) | n/a | n/a |

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| 10°N to 30°N | T | 17.25 (13.02 - 19.95) | 15.32 (10.31 - 18.89) | 15.56 (13.93 - 16.76) | n/a |
| S | 36.33 (35.44 - 36.80) | 34.67 (34.00 - 35.61) | 35.53 (34.92 - 36.52) | n/a |
| DIC | 2134.4 (2090.7 - 2185.7) | 2105.4 (2014.6 - 2237.0) | 2226.3 (2198.0 - 2244.5) | n/a |
| TA | 2378.0 (2329.0 - 2403.2) | 2287.3 (2252.9 - 2342.9) | 2333.5 (2308.4 - 2391.4) | n/a |
| [CO32–] | 172.7 (110.5 - 213.2) | 135.9 (67.9 - 189.4) | 91.7 (79.0 - 116.7) | n/a |
| Ωarag | 2.56 (1.63 - 3.18) | 2.03 (1.00 - 2.84) [0.1%] | 1.36 (1.17 - 1.72) | n/a |
| Ωcalc | 3.95 (2.53 - 4.87) | 3.14 (1.56 - 4.38) | 2.10 (1.82 - 2.65) | n/a |
| pH | 8.01 (7.87 - 8.10) | 7.93 (7.67 - 8.10) | 7.73 (7.70 - 7.79) | n/a |
| 10°S to 10°N | T | 13.12 (12.27 - 14.99) | 14.81 (11.60 - 20.69) | 14.16 (13.10 - 17.10) | n/a |
| S | 35.34 (35.19 - 35.81) | 35.03 (34.57 - 35.81) | 35.09 (34.88 - 35.65) | n/a |
| DIC | 2178.3 (2154.7 - 2186.1) | 2167.5 (2095.8 - 2234.7) | 2182.3 (2117.7 - 2228.5) | n/a |
| TA | 2326.1 (2318.7 - 2351.9) | 2311.2 (2288.7 - 2355.3) | 2315.5 (2308.0 - 2333.3) | n/a |
| [CO32–] | 111.5 (105.1 - 134.4) | 112.2 (68.1 - 177.3) | 103.9 (79.0 - 149.2) | n/a |
| Ωarag | 1.64 (1.55 - 1.99) | 1.67 (1.00 - 2.67) | 1.54 (1.17 - 2.23) | n/a |
| Ωcalc | 2.56 (2.41 - 3.08) | 2.59 (1.57 - 4.09) | 2.39 (1.82 - 3.44) | n/a |
| pH | 7.88 (7.87 - 7.93) | 7.84 (7.68 - 8.00) | 7.83 (7.71 - 7.96) | n/a |
| 30°S to 10°S | T | 15.44 (13.47 - 17.27) | 18.26 (12.76 - 21.51) | 16.82 (14.52 - 18.37) | n/a |
| S | 35.53 (35.28 - 35.81) | 35.49 (34.70 - 35.92) | 35.43 (35.01 - 35.64) | n/a |
| DIC | 2116.5 (2084.8 - 2169.6) | 2098.1 (2057.2 - 2229.6) | 2093.8 (2064.5 - 2158.5) | n/a |
| TA | 2335.2 (2318.7 - 2355.1) | 2334.8 (2291.7 - 2361.4) | 2330.5 (2315.8 - 2340.9) | n/a |
| [CO32–] | 155.2 (114.3 - 180.7) | 170.0 (75.8 - 202.8) | 166.7 (118.6 - 189.0) | n/a |
| Ωarag | 2.30 (1.69 - 2.68) | 2.55 (1.12 - 3.06) | 2.48 (1.76 - 2.82) | n/a |
| Ωcalc | 3.56 (2.62 - 4.15) | 3.92 (1.74 - 4.68) | 3.84 (2.73 - 4.35) | n/a |
| pH | 8.00 (7.88 - 8.07) | 7.99 (7.70 - 8.09) | 8.02 (7.88 - 8.09) | n/a |
| 50°S to30°S | T | 9.99 (2.76 - 16.04) | 11.16 (5.05 - 17.38) | 10.67 (2.70 - 16.60) | n/a |
| S | 34.87 (34.20 - 35.64) | 34.72 (34.16 - 35.52) | 34.90 (34.04 - 35.51) | n/a |
| DIC | 2115.8 (2084.8 - 2178.4) | 2098.6 (2061.7 - 2137.2) | 2102.0 (2068.6 - 2164.4) | n/a |
| TA | 2310.6 (2286.1 - 2344.2) | 2292.8 (2270.3 - 2326.0) | 2309.0 (2287.6 - 2331.3) | n/a |
| [CO32–] | 138.0 (94.0 - 177.1) | 139.1 (105.4 - 184.2) | 145.3 (95.8 - 181.3) | n/a |
| Ωarag | 2.03 (1.37 - 2.63) | 2.05 (1.54 - 2.75) | 2.14 (1.39 - 2.69) | n/a |
| Ωcalc | 3.17 (2.17 - 4.07) | 3.20 (2.43 - 4.24) | 3.34 (2.21 - 4.17) | n/a |
| pH | 8.04 (7.99 - 8.07) | 8.04 (7.91 - 8.08) | 8.06 (8.00 - 8.09) | n/a |
| Southernmost to 50°S | T | 0.58 (–1.58 - 4.73) | 2.82 (–1.66 - 7.70) | 1.89 (–0.47 - 6.97) | n/a |
| S | 34.35 (34.17 - 34.53) | 34.32 (34.13 - 34.64) | 34.34 (34.03 - 34.57) | n/a |
| DIC | 2214.8 (2142.0 - 2251.8) | 2182.3 (2119.4 - 2254.7) | 2205.5 (2127.1 - 2253.9) | n/a |
| TA | 2320.3 (2286.1 - 2344.9) | 2303.8 (2273.4 - 2350.9) | 2314.1 (2289.1 - 2344.5) | n/a |
| [CO32–] | 82.4 (74.4 - 104.6) | 93.4 (74.0 - 122.6) | 85.5 (72.0 - 118.0) | n/a |
| Ωarag | 1.19 (1.08 - 1.52) | 1.36 (1.07 - 1.79) | 1.24 (1.04 - 1.72) | n/a |
| Ωcalc | 1.90 (1.71 - 2.41) | 2.15 (1.70 - 2.82) | 1.97 (1.66 - 2.71) | n/a |
| pH | 7.97 (7.94 - 8.01) | 7.99 (7.92 - 8.04) | 7.96 (7.91 - 8.03) | n/a |

**Table S5.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 500 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | 0.41 (–0.56 - 2.91) | n/a | n/a | 0.92 (–0.63 - 3.25) |
| S | 34.80 (34.35 - 35.26) | n/a | n/a | 34.85 (34.38 - 35.32) |
| DIC | 2157.8 (2147.7 - 2177.3) | n/a | n/a | 2166.2 (2110.7 - 2235.4) |
| TA | 2293.8 (2274.3 - 2322.8) | n/a | n/a | 2300.7 (2272.1 - 2335.7) |
| [CO32–] | 99.8 (80.7 - 116.2) | n/a | n/a | 100.1 (76.5 - 115.2) |
| Ωarag | 1.36 (1.10 - 1.59) | n/a | n/a | 1.37 (1.04 - 1.57) |
| Ωcalc | 2.15 (1.74 - 2.50) | n/a | n/a | 2.16 (1.65 - 2.49) |
| pH | 8.05 (7.96 - 8.08) | n/a | n/a | 8.04 (7.84 - 8.18) |
| 50°N to 70°N | T | 4.50 (0.28 - 10.21) | 3.19 (2.12 - 4.01) | n/a | n/a |
| S | 34.98 (34.44 - 35.67) | 34.20 (34.10 - 34.44) | n/a | n/a |
| DIC | 2154.4 (2146.1 - 2175.7) | 2324.2 (2265.5 - 2361.2) | n/a | n/a |
| TA | 2306.8 (2280.1 - 2350.1) | 2326.5 (2310.3 - 2339.0) | n/a | n/a |
| [CO32–] | 110.6 (83.3 - 138.7) | 43.5 (33.4 - 67.0) | n/a | n/a |
| Ωarag | 1.52 (1.14 - 1.92) | 0.60 (0.46 - 0.91) [100%] | n/a | n/a |
| Ωcalc | 2.39 (1.80 - 3.00) | 0.94 (0.72 - 1.45) [67.3%] | n/a | n/a |
| pH | 8.03 (7.96 - 8.07) | 7.59 (7.51 - 7.76) | n/a | n/a |
| 30°N to 50°N | T | 11.36 (4.72 - 15.68) | 5.96 (2.78 - 10.69) | n/a | n/a |
| S | 35.61 (34.91 - 36.15) | 34.10 (33.99 - 34.43) | n/a | n/a |
| DIC | 2146.2 (2122.9 - 2177.5) | 2250.4 (2123.4 - 2361.2) | n/a | n/a |
| TA | 2340.7 (2305.0 - 2378.7) | 2301.6 (2273.0 - 2339.0) | n/a | n/a |
| [CO32–] | 138.8 (106.7 - 168.8) | 63.0 (33.4 - 113.7) | n/a | n/a |
| Ωarag | 1.94 (1.47 - 2.38) | 0.87 (0.46 - 1.59) [71.2%] | n/a | n/a |
| Ωcalc | 3.01 (2.31 - 3.67) | 1.37 (0.72 - 2.49) [33.0%] | n/a | n/a |
| pH | 8.00 (7.91 - 8.04) | 7.71 (7.51 - 7.95) | n/a | n/a |

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| 10°N to 30°N | T | 12.00 (8.00 - 15.76) | 8.39 (6.20 - 11.33) | 11.31 (9.64 - 12.95) | n/a |
| S | 35.55 (34.81 - 36.16) | 34.33 (33.99 - 34.92) | 35.49 (34.91 - 36.39) | n/a |
| DIC | 2174.0 (2123.1 - 2230.6) | 2222.4 (2113.0 - 2299.2) | 2269.6 (2250.4 - 2279.9) | n/a |
| TA | 2336.9 (2305.1 - 2365.8) | 2296.6 (2271.6 - 2324.2) | 2348.2 (2328.2 - 2397.9) | n/a |
| [CO32–] | 121.5 (74.2 - 168.8) | 73.1 (45.4 - 118.2) | 75.3 (65.9 - 99.9) | n/a |
| Ωarag | 1.70 (1.03 - 2.38) | 1.02 (0.63 - 1.66) [53.9%] | 1.05 (0.91 - 1.39) [42.8%] | n/a |
| Ωcalc | 2.64 (1.61 - 3.67) | 1.59 (0.99 - 2.58) [2.9%] | 1.63 (1.43 - 2.15) | n/a |
| pH | 7.91 (7.76 - 8.04) | 7.75 (7.57 - 7.96) | 7.70 (7.68 - 7.75) | n/a |
| 10°S to 10°N | T | 7.42 (6.80 - 8.80) | 8.03 (7.54 - 8.87) | 9.61 (8.68 - 11.82) | n/a |
| S | 34.72 (34.56 - 35.30) | 34.60 (34.44 - 34.85) | 34.96 (34.69 - 35.69) | n/a |
| DIC | 2221.8 (2208.9 - 2233.3) | 2254.1 (2178.1 - 2297.2) | 2231.8 (2180.6 - 2271.5) | n/a |
| TA | 2301.5 (2294.4 - 2327.1) | 2309.6 (2298.8 - 2318.8) | 2324.7 (2310.9 - 2346.0) | n/a |
| [CO32–] | 73.0 (68.2 - 82.8) | 62.8 (46.2 - 98.3) | 80.3 (65.9 - 101.8) | n/a |
| Ωarag | 1.01 (0.94 - 1.15) [42.3%] | 0.87 (0.64 - 1.37) [75.0%] | 1.12 (0.91 - 1.41) [21.6%] | n/a |
| Ωcalc | 1.58 (1.48 - 1.79) | 1.36 (1.01 - 2.14) | 1.74 (1.43 - 2.21) | n/a |
| pH | 7.78 (7.75 - 7.82) | 7.69 (7.58 - 7.90) | 7.78 (7.68 - 7.90) | n/a |
| 30°S to 10°S | T | 8.53 (6.91 - 10.05) | 8.31 (6.72 - 11.20) | 10.27 (8.70 - 12.26) | n/a |
| S | 34.70 (34.58 - 34.90) | 34.56 (34.34 - 34.88) | 34.87 (34.69 - 35.11) | n/a |
| DIC | 2176.4 (2132.3 - 2224.4) | 2187.0 (2117.3 - 2279.5) | 2138.7 (2094.7 - 2211.2) | n/a |
| TA | 2297.7 (2294.4 - 2307.4) | 2292.1 (2277.7 - 2305.9) | 2309.5 (2296.5 - 2318.8) | n/a |
| [CO32–] | 95.3 (69.4 - 121.2) | 87.8 (48.6 - 129.2) | 123.7 (87.5 - 150.9) | n/a |
| Ωarag | 1.32 (0.96 - 1.69) [4.9%] | 1.22 (0.67 - 1.80) [27.3%] | 1.72 (1.21 - 2.11) | n/a |
| Ωcalc | 2.07 (1.51 - 2.63) | 1.91 (1.06 - 2.81) | 2.69 (1.90 - 3.29) | n/a |
| pH | 7.88 (7.75 - 7.98) | 7.84 (7.60 - 8.00) | 7.98 (7.83 - 8.06) | n/a |
| 50°S to30°S | T | 6.44 (2.46 - 9.94) | 7.40 (4.21 - 11.19) | 8.28 (2.47 - 12.23) | n/a |
| S | 34.52 (34.30 - 34.80) | 34.44 (34.26 - 34.88) | 34.69 (34.35 - 35.10) | n/a |
| DIC | 2157.9 (2131.0 - 2218.7) | 2137.8 (2112.5 - 2179.7) | 2136.9 (2095.2 - 2218.3) | n/a |
| TA | 2298.6 (2290.5 - 2320.0) | 2284.2 (2275.7 - 2299.9) | 2303.1 (2289.6 - 2317.9) | n/a |
| [CO32–] | 104.2 (81.1 - 121.4) | 108.0 (86.6 - 129.6) | 120.1 (79.2 - 150.7) | n/a |
| Ωarag | 1.44 (1.11 - 1.69) | 1.50 (1.20 - 1.81) | 1.67 (1.08 - 2.11) | n/a |
| Ωcalc | 2.26 (1.75 - 2.64) | 2.35 (1.88 - 2.82) | 2.61 (1.71 - 3.28) | n/a |
| pH | 7.97 (7.92 - 7.99) | 7.98 (7.86 - 8.01) | 8.00 (7.91 - 8.06) | n/a |
| Southernmost to 50°S | T | 1.21 (–0.17 - 3.86) | 2.90 (–1.42 - 6.54) | 2.18 (0.12 - 6.12) | n/a |
| S | 34.56 (34.30 - 34.70) | 34.48 (34.26 - 34.78) | 34.56 (34.35 - 34.73) | n/a |
| DIC | 2241.5 (2172.8 - 2265.4) | 2210.9 (2144.8 - 2274.4) | 2233.7 (2161.3 - 2260.7) | n/a |
| TA | 2338.2 (2298.5 - 2359.3) | 2318.3 (2282.3 - 2360.3) | 2331.4 (2296.6 - 2359.8) | n/a |
| [CO32–] | 78.1 (74.5 - 94.3) | 85.5 (71.2 - 105.1) | 79.8 (72.9 - 101.6) | n/a |
| Ωarag | 1.07 (1.01 - 1.29) | 1.17 (0.97 - 1.45) [7.1%] | 1.09 (0.99 - 1.40) [2.2%] | n/a |
| Ωcalc | 1.68 (1.61 - 2.04) | 1.85 (1.54 - 2.28) | 1.73 (1.57 - 2.21) | n/a |
| pH | 7.92 (7.91 - 7.97) | 7.93 (7.88 - 7.99) | 7.91 (7.89 - 7.96) | n/a |

**Table S6.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 1000 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | –0.20 (–0.88 - 1.42) | n/a | n/a | 0.16 (–0.71 - 1.41) |
| S | 34.88 (34.75 - 35.19) | n/a | n/a | 34.91 (34.68 - 35.28) |
| DIC | 2158.3 (2148.3 - 2170.1) | n/a | n/a | 2172.6 (2108.3 - 2248.4) |
| TA | 2296.9 (2288.9 - 2319.1) | n/a | n/a | 2305.7 (2281.6 - 2339.1) |
| [CO32–] | 100.1 (96.5 - 107.1) | n/a | n/a | 98.4 (75.7 - 115.4) |
| Ωarag | 1.23 (1.19 - 1.32) | n/a | n/a | 1.21 (0.94 - 1.42) [1.0%] |
| Ωcalc | 1.94 (1.87 - 2.07) | n/a | n/a | 1.91 (1.47 - 2.24) |
| pH | 8.05 (8.00 - 8.07) | n/a | n/a | 8.02 (7.85 - 8.17) |
| 50°N to 70°N | T | 3.13 (–0.65 - 8.10) | 2.52 (1.54 - 3.11) | n/a | n/a |
| S | 34.95 (34.75 - 35.69) | 34.43 (34.37 - 34.58) | n/a | n/a |
| DIC | 2160.9 (2153.5 - 2186.4) | 2359.6 (2288.2 - 2382.9) | n/a | n/a |
| TA | 2305.9 (2295.3 - 2358.6) | 2369.6 (2345.1 - 2379.0) | n/a | n/a |
| [CO32–] | 105.0 (96.5 - 123.9) | 45.6 (39.2 - 66.4) | n/a | n/a |
| Ωarag | 1.30 (1.19 - 1.56) | 0.57 (0.49 - 0.82) [100%] | n/a | n/a |
| Ωcalc | 2.04 (1.87 - 2.43) | 0.89 (0.77 - 1.29) [80.4%] | n/a | n/a |
| pH | 8.01 (7.98 - 8.06) | 7.60 (7.55 - 7.76) | n/a | n/a |
| 30°N to 50°N | T | 6.95 (3.43 - 10.78) | 3.34 (2.49 - 4.27) | n/a | n/a |
| S | 35.27 (34.85 - 36.28) | 34.35 (34.28 - 34.55) | n/a | n/a |
| DIC | 2179.8 (2156.2 - 2215.4) | 2364.8 (2326.1 - 2383.6) | n/a | n/a |
| TA | 2329.8 (2300.3 - 2399.5) | 2368.8 (2349.9 - 2379.8) | n/a | n/a |
| [CO32–] | 109.8 (90.9 - 137.1) | 41.7 (37.5 - 53.6) | n/a | n/a |
| Ωarag | 1.38 (1.14 - 1.74) | 0.52 (0.47 - 0.67) [100%] | n/a | n/a |
| Ωcalc | 2.16 (1.79 - 2.70) | 0.82 (0.74 - 1.05) [98.6%] | n/a | n/a |
| pH | 7.96 (7.87 - 8.01) | 7.57 (7.54 - 7.66) | n/a | n/a |

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| 10°N to 30°N | T | 6.51 (5.07 - 9.70) | 4.27 (3.67 - 5.05) | 7.86 (6.21 - 9.63) | n/a |
| S | 35.02 (34.73 - 35.94) | 34.46 (34.28 - 34.73) | 35.27 (34.84 - 36.05) | n/a |
| DIC | 2204.6 (2182.4 - 2223.8) | 2333.1 (2272.3 - 2365.3) | 2309.5 (2297.3 - 2317.7) | n/a |
| TA | 2322.3 (2310.6 - 2376.1) | 2362.9 (2342.1 - 2371.2) | 2377.5 (2369.9 - 2413.4) | n/a |
| [CO32–] | 91.8 (78.2 - 122.1) | 51.2 (42.2 - 69.5) | 68.8 (63.0 - 91.1) | n/a |
| Ωarag | 1.16 (0.98 - 1.55) [5.2%] | 0.64 (0.53 - 0.87) [100%] | 0.87 (0.79 - 1.15) [91.3%] | n/a |
| Ωcalc | 1.81 (1.53 - 2.40) | 1.00 (0.83 - 1.36) [51.4%] | 1.35 (1.24 - 1.78) | n/a |
| pH | 7.88 (7.84 - 7.94) | 7.64 (7.57 - 7.76) | 7.70 (7.69 - 7.74) | n/a |
| 10°S to 10°N | T | 4.67 (3.96 - 6.20) | 4.53 (4.20 - 5.30) | 6.38 (4.85 - 8.63) | n/a |
| S | 34.69 (34.55 - 35.22) | 34.56 (34.51 - 34.71) | 34.89 (34.60 - 35.45) | n/a |
| DIC | 2220.7 (2216.1 - 2229.7) | 2299.7 (2262.6 - 2336.3) | 2297.8 (2268.0 - 2308.9) | n/a |
| TA | 2313.4 (2308.0 - 2337.3) | 2354.8 (2337.3 - 2367.4) | 2368.2 (2349.8 - 2373.3) | n/a |
| [CO32–] | 78.1 (75.7 - 89.5) | 61.2 (50.1 - 73.6) | 68.3 (64.3 - 73.0) | n/a |
| Ωarag | 0.98 (0.95 - 1.13) [86.1%] | 0.77 (0.63 - 0.92) [100%] | 0.86 (0.81 - 0.92) [100%] | n/a |
| Ωcalc | 1.53 (1.48 - 1.76) | 1.20 (0.98 - 1.44) [1.0%] | 1.34 (1.26 - 1.43) | n/a |
| pH | 7.84 (7.83 - 7.86) | 7.72 (7.63 - 7.82) | 7.74 (7.70 - 7.80) | n/a |
| 30°S to 10°S | T | 3.90 (3.70 - 4.88) | 4.33 (3.93 - 5.40) | 5.24 (4.80 - 6.13) | n/a |
| S | 34.48 (34.32 - 34.77) | 34.47 (34.34 - 34.56) | 34.59 (34.43 - 34.77) | n/a |
| DIC | 2213.3 (2192.1 - 2227.0) | 2253.3 (2186.5 - 2308.3) | 2251.6 (2185.5 - 2297.6) | n/a |
| TA | 2309.5 (2297.5 - 2321.3) | 2329.5 (2298.0 - 2351.3) | 2344.1 (2306.7 - 2373.0) | n/a |
| [CO32–] | 78.9 (75.7 - 84.3) | 70.2 (53.6 - 88.4) | 78.3 (70.2 - 93.8) | n/a |
| Ωarag | 0.99 (0.95 - 1.05) [71.9%] | 0.88 (0.67 - 1.11) [79.1%] | 0.98 (0.88 - 1.18) [62.2%] | n/a |
| Ωcalc | 1.55 (1.48 - 1.65) | 1.38 (1.05 - 1.74) | 1.54 (1.38 - 1.85) | n/a |
| pH | 7.87 (7.84 - 7.90) | 7.79 (7.67 - 7.90) | 7.83 (7.77 - 7.91) | n/a |
| 50°S to30°S | T | 3.22 (1.91 - 4.70) | 4.56 (2.98 - 5.57) | 4.46 (2.29 - 6.15) | n/a |
| S | 34.39 (34.28 - 34.58) | 34.36 (34.30 - 34.49) | 34.46 (34.39 - 34.61) | n/a |
| DIC | 2206.7 (2187.4 - 2237.5) | 2196.5 (2178.4 - 2246.0) | 2202.3 (2179.5 - 2242.9) | n/a |
| TA | 2311.0 (2295.7 - 2336.4) | 2300.7 (2290.8 - 2318.9) | 2313.4 (2301.0 - 2340.3) | n/a |
| [CO32–] | 82.8 (79.4 - 86.4) | 83.2 (67.5 - 89.9) | 87.2 (79.3 - 95.5) | n/a |
| Ωarag | 1.03 (0.99 - 1.08) [9.0%] | 1.04 (0.84 - 1.13) [23.7%] | 1.09 (0.98 - 1.20) [2.7%] | n/a |
| Ωcalc | 1.62 (1.55 - 1.69) | 1.63 (1.32 - 1.76) | 1.71 (1.55 - 1.88) | n/a |
| pH | 7.90 (7.88 - 7.92) | 7.88 (7.78 - 7.91) | 7.90 (7.87 - 7.92) | n/a |
| Southernmost to 50°S | T | 0.94 (–0.40 - 2.74) | 2.23 (–0.18 - 4.18) | 1.74 (0.30 - 3.81) | n/a |
| S | 34.66 (34.44 - 34.73) | 34.58 (34.35 - 34.83) | 34.67 (34.47 - 34.76) | n/a |
| DIC | 2250.0 (2224.7 - 2261.0) | 2239.0 (2202.7 - 2274.2) | 2245.6 (2212.7 - 2261.6) | n/a |
| TA | 2350.2 (2323.5 - 2362.4) | 2335.6 (2304.3 - 2371.4) | 2346.2 (2314.4 - 2363.5) | n/a |
| [CO32–] | 80.2 (79.0 - 81.4) | 78.8 (76.1 - 83.7) | 80.7 (78.9 - 83.6) | n/a |
| Ωarag | 0.99 (0.98 - 1.01) [93.5%] | 0.98 (0.95 - 1.05) [87.8%] | 1.00 (0.98 - 1.04) [60.4%] | n/a |
| Ωcalc | 1.56 (1.53 - 1.58) | 1.54 (1.49 - 1.64) | 1.57 (1.54 - 1.63) | n/a |
| pH | 7.92 (7.89 - 7.94) | 7.89 (7.87 - 7.93) | 7.91 (7.88 - 7.93) | n/a |

**Table S7.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 2000 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | –0.35 (–1.01 - 1.28) | n/a | n/a | –0.15 (–1.01 - 1.01) |
| S | 34.90 (34.79 - 35.18) | n/a | n/a | 34.95 (34.81 - 35.28) |
| DIC | 2161.2 (2153.9 - 2175.8) | n/a | n/a | 2178.6 (2117.9 - 2253.3) |
| TA | 2298.7 (2287.5 - 2322.6) | n/a | n/a | 2312.2 (2275.9 - 2348.1) |
| [CO32–] | 97.8 (89.8 - 106.3) | n/a | n/a | 96.3 (78.8 - 107.4) |
| Ωarag | 0.99 (0.91 - 1.08) [65.7%] | n/a | n/a | 0.97 (0.80 - 1.09) [66.2%] |
| Ωcalc | 1.53 (1.42 - 1.67) | n/a | n/a | 1.51 (1.24 - 1.69) |
| pH | 8.01 (7.93 - 8.03) | n/a | n/a | 7.99 (7.86 - 8.09) |
| 50°N to 70°N | T | 2.27 (–0.50 - 3.90) | 1.64 (0.91 - 1.90) | n/a | n/a |
| S | 34.92 (34.80 - 35.20) | 34.63 (34.59 - 34.73) | n/a | n/a |
| DIC | 2158.2 (2152.9 - 2175.7) | 2360.5 (2294.7 - 2386.1) | n/a | n/a |
| TA | 2303.7 (2293.9 - 2329.3) | 2403.0 (2369.9 - 2416.7) | n/a | n/a |
| [CO32–] | 103.0 (90.6 - 112.1) | 55.2 (49.8 - 70.2) | n/a | n/a |
| Ωarag | 1.06 (0.92 - 1.16) [8.2%] | 0.56 (0.51 - 0.71) [100%] | n/a | n/a |
| Ωcalc | 1.63 (1.43 - 1.79) | 0.88 (0.79 - 1.11) [91.8%] | n/a | n/a |
| pH | 7.99 (7.93 - 8.03) | 7.68 (7.63 - 7.79) | n/a | n/a |
| 30°N to 50°N | T | 3.73 (3.14 - 5.48) | 1.98 (1.81 - 2.36) | n/a | n/a |
| S | 35.00 (34.88 - 35.57) | 34.60 (34.58 - 34.67) | n/a | n/a |
| DIC | 2164.8 (2153.4 - 2203.7) | 2377.7 (2346.2 - 2393.7) | n/a | n/a |
| TA | 2315.6 (2301.9 - 2363.8) | 2415.5 (2402.2 - 2424.6) | n/a | n/a |
| [CO32–] | 106.5 (96.8 - 120.9) | 52.6 (48.6 - 62.7) | n/a | n/a |
| Ωarag | 1.10 (1.00 - 1.27) | 0.54 (0.50 - 0.65) [100%] | n/a | n/a |
| Ωcalc | 1.70 (1.55 - 1.95) | 0.84 (0.77 - 1.00) [100.0%] | n/a | n/a |
| pH | 7.98 (7.92 - 7.99) | 7.66 (7.63 - 7.72) | n/a | n/a |

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| 10°N to 30°N | T | 3.78 (3.45 - 5.17) | 2.17 (1.95 - 3.11) | 3.21 (2.66 - 4.68) | n/a |
| S | 35.01 (34.91 - 35.45) | 34.63 (34.59 - 34.81) | 34.91 (34.73 - 35.45) | n/a |
| DIC | 2173.7 (2161.7 - 2208.7) | 2353.2 (2266.6 - 2376.6) | 2336.9 (2321.0 - 2346.4) | n/a |
| TA | 2326.0 (2315.6 - 2360.0) | 2413.7 (2371.8 - 2422.9) | 2424.1 (2413.3 - 2452.0) | n/a |
| [CO32–] | 107.4 (96.7 - 117.3) | 61.9 (53.9 - 84.0) | 75.0 (71.1 - 89.9) | n/a |
| Ωarag | 1.11 (1.00 - 1.22) [0.1%] | 0.64 (0.55 - 0.87) [100%] | 0.78 (0.73 - 0.94) [100%] | n/a |
| Ωcalc | 1.72 (1.55 - 1.89) | 0.99 (0.86 - 1.35) [66.1%] | 1.20 (1.13 - 1.45) | n/a |
| pH | 7.98 (7.92 - 7.99) | 7.73 (7.67 - 7.85) | 7.79 (7.78 - 7.81) | n/a |
| 10°S to 10°N | T | 3.57 (3.32 - 4.47) | 2.31 (2.15 - 3.17) | 2.68 (2.39 - 3.47) | n/a |
| S | 34.99 (34.92 - 35.30) | 34.65 (34.63 - 34.83) | 34.77 (34.69 - 34.98) | n/a |
| DIC | 2174.3 (2166.3 - 2192.8) | 2334.2 (2253.3 - 2362.8) | 2312.1 (2273.2 - 2332.0) | n/a |
| TA | 2326.3 (2319.5 - 2352.6) | 2408.4 (2365.6 - 2422.2) | 2405.0 (2381.8 - 2417.1) | n/a |
| [CO32–] | 107.3 (102.7 - 113.7) | 68.1 (61.2 - 87.5) | 76.6 (72.1 - 84.2) | n/a |
| Ωarag | 1.11 (1.06 - 1.18) | 0.70 (0.63 - 0.91) [100%] | 0.79 (0.74 - 0.87) [100%] | n/a |
| Ωcalc | 1.72 (1.65 - 1.83) | 1.08 (0.97 - 1.40) [5.4%] | 1.22 (1.15 - 1.34) | n/a |
| pH | 7.98 (7.96 - 7.99) | 7.77 (7.73 - 7.87) | 7.82 (7.79 - 7.87) | n/a |
| 30°S to 10°S | T | 3.14 (2.80 - 3.61) | 2.23 (2.08 - 2.63) | 2.47 (2.37 - 2.78) | n/a |
| S | 34.89 (34.80 - 35.03) | 34.64 (34.62 - 34.72) | 34.72 (34.69 - 34.78) | n/a |
| DIC | 2188.0 (2170.9 - 2217.3) | 2307.3 (2276.1 - 2331.9) | 2283.8 (2234.2 - 2312.0) | n/a |
| TA | 2328.5 (2321.4 - 2341.1) | 2391.9 (2370.4 - 2404.3) | 2383.9 (2348.5 - 2402.3) | n/a |
| [CO32–] | 100.5 (91.2 - 106.2) | 72.3 (66.8 - 77.6) | 79.7 (75.0 - 86.6) | n/a |
| Ωarag | 1.04 (0.94 - 1.09) [26.7%] | 0.74 (0.69 - 0.80) [100%] | 0.82 (0.77 - 0.89) [100%] | n/a |
| Ωcalc | 1.61 (1.46 - 1.69) | 1.15 (1.07 - 1.24) | 1.27 (1.19 - 1.38) | n/a |
| pH | 7.96 (7.91 - 7.98) | 7.81 (7.77 - 7.83) | 7.85 (7.82 - 7.89) | n/a |
| 50°S to30°S | T | 2.51 (1.45 - 3.17) | 2.30 (2.01 - 2.60) | 2.33 (1.62 - 2.79) | n/a |
| S | 34.77 (34.71 - 34.84) | 34.65 (34.62 - 34.71) | 34.72 (34.68 - 34.78) | n/a |
| DIC | 2223.0 (2198.2 - 2251.3) | 2279.1 (2251.1 - 2299.7) | 2249.0 (2222.9 - 2276.5) | n/a |
| TA | 2339.5 (2327.0 - 2354.7) | 2369.6 (2351.7 - 2387.6) | 2354.5 (2340.9 - 2375.0) | n/a |
| [CO32–] | 87.4 (80.7 - 95.0) | 74.7 (71.4 - 79.2) | 82.0 (77.5 - 88.3) | n/a |
| Ωarag | 0.90 (0.83 - 0.98) [100%] | 0.77 (0.73 - 0.81) [100%] | 0.84 (0.80 - 0.91) [100%] | n/a |
| Ωcalc | 1.39 (1.28 - 1.52) | 1.19 (1.14 - 1.26) | 1.30 (1.23 - 1.41) | n/a |
| pH | 7.90 (7.87 - 7.93) | 7.83 (7.80 - 7.86) | 7.87 (7.84 - 7.91) | n/a |
| Southernmost to 50°S | T | 0.62 (–0.30 - 1.97) | 1.34 (–0.25 - 2.26) | 1.00 (–0.12 - 2.09) | n/a |
| S | 34.69 (34.66 - 34.73) | 34.70 (34.66 - 34.72) | 34.71 (34.66 - 34.74) | n/a |
| DIC | 2250.0 (2237.9 - 2258.7) | 2258.0 (2250.6 - 2269.0) | 2251.6 (2239.1 - 2261.2) | n/a |
| TA | 2353.6 (2346.8 - 2358.3) | 2356.3 (2351.7 - 2360.3) | 2356.1 (2351.7 - 2361.3) | n/a |
| [CO32–] | 80.2 (77.5 - 84.9) | 77.8 (74.2 - 80.6) | 80.7 (77.9 - 86.2) | n/a |
| Ωarag | 0.81 (0.78 - 0.87) [100%] | 0.79 (0.76 - 0.82) [100%] | 0.82 (0.79 - 0.88) [100%] | n/a |
| Ωcalc | 1.26 (1.22 - 1.34) | 1.23 (1.18 - 1.28) | 1.27 (1.22 - 1.37) | n/a |
| pH | 7.89 (7.87 - 7.90) | 7.86 (7.83 - 7.89) | 7.89 (7.86 - 7.91) | n/a |

**Table S8.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 3000 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | –0.41 (–1.05 - 1.04) | n/a | n/a | –0.13 (–1.05 - 0.51) |
| S | 34.91 (34.86 - 35.11) | n/a | n/a | 34.93 (34.82 - 35.13) |
| DIC | 2157.7 (2147.3 - 2174.1) | n/a | n/a | 2184.2 (2140.2 - 2251.2) |
| TA | 2299.6 (2288.5 - 2321.1) | n/a | n/a | 2319.1 (2286.3 - 2356.1) |
| [CO32–] | 97.5 (95.8 - 101.2) | n/a | n/a | 94.6 (80.7 - 102.1) |
| Ωarag | 0.81 (0.79 - 0.85) [100%] | n/a | n/a | 0.79 (0.67 - 0.84) [100%] |
| Ωcalc | 1.25 (1.22 - 1.30) | n/a | n/a | 1.21 (1.03 - 1.30) |
| pH | 7.98 (7.96 - 7.99) | n/a | n/a | 7.95 (7.85 - 8.01) |
| 50°N to 70°N | T | 1.67 (–0.53 - 2.84) | 1.38 (0.84 - 1.61) | n/a | n/a |
| S | 34.93 (34.86 - 35.11) | 34.69 (34.66 - 34.76) | n/a | n/a |
| DIC | 2162.6 (2152.4 - 2187.7) | 2336.3 (2287.5 - 2355.4) | n/a | n/a |
| TA | 2309.3 (2295.7 - 2343.6) | 2409.4 (2379.3 - 2422.8) | n/a | n/a |
| [CO32–] | 101.1 (97.0 - 107.5) | 65.9 (62.3 - 74.7) | n/a | n/a |
| Ωarag | 0.86 (0.81 - 0.92) [100%] | 0.56 (0.53 - 0.63) [100%] | n/a | n/a |
| Ωcalc | 1.31 (1.24 - 1.41) | 0.85 (0.81 - 0.96) [100%] | n/a | n/a |
| pH | 7.96 (7.94 - 7.98) | 7.74 (7.71 - 7.80) | n/a | n/a |
| 30°N to 50°N | T | 2.88 (2.61 - 3.60) | 1.58 (1.50 - 1.82) | n/a | n/a |
| S | 34.95 (34.88 - 35.24) | 34.66 (34.65 - 34.70) | n/a | n/a |
| DIC | 2174.5 (2157.7 - 2206.7) | 2349.8 (2331.9 - 2362.7) | n/a | n/a |
| TA | 2326.1 (2307.6 - 2362.8) | 2422.3 (2411.4 - 2432.3) | n/a | n/a |
| [CO32–] | 104.5 (96.9 - 111.8) | 65.4 (62.3 - 70.9) | n/a | n/a |
| Ωarag | 0.89 (0.83 - 0.97) [100%] | 0.55 (0.53 - 0.60) [100%] | n/a | n/a |
| Ωcalc | 1.37 (1.27 - 1.47) | 0.85 (0.81 - 0.92) [100%] | n/a | n/a |
| pH | 7.95 (7.91 - 7.96) | 7.73 (7.71 - 7.77) | n/a | n/a |

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| 10°N to 30°N | T | 2.82 (2.61 - 3.40) | 1.66 (1.54 - 2.53) | 2.04 (1.78 - 2.84) | n/a |
| S | 34.94 (34.88 - 35.16) | 34.68 (34.66 - 34.82) | 34.81 (34.71 - 35.10) | n/a |
| DIC | 2183.9 (2169.1 - 2211.7) | 2341.3 (2263.1 - 2357.3) | 2336.0 (2317.7 - 2348.1) | n/a |
| TA | 2336.3 (2323.5 - 2361.3) | 2422.9 (2379.7 - 2435.5) | 2438.4 (2425.5 - 2458.6) | n/a |
| [CO32–] | 105.1 (96.5 - 109.7) | 69.6 (66.3 - 87.3) | 80.1 (76.5 - 88.3) | n/a |
| Ωarag | 0.90 (0.83 - 0.95) [100%] | 0.59 (0.56 - 0.75) [100%] | 0.68 (0.65 - 0.76) [100%] | n/a |
| Ωcalc | 1.38 (1.26 - 1.45) | 0.90 (0.86 - 1.14) [96.9%] | 1.05 (1.00 - 1.16) [0.9%] | n/a |
| pH | 7.95 (7.91 - 7.96) | 7.76 (7.74 - 7.85) | 7.81 (7.80 - 7.83) | n/a |
| 10°S to 10°N | T | 2.74 (2.64 - 3.23) | 1.75 (1.63 - 2.59) | 1.76 (1.64 - 2.21) | n/a |
| S | 34.94 (34.89 - 35.12) | 34.69 (34.67 - 34.83) | 34.73 (34.70 - 34.85) | n/a |
| DIC | 2189.2 (2179.4 - 2206.2) | 2329.5 (2251.7 - 2355.3) | 2309.5 (2281.4 - 2329.4) | n/a |
| TA | 2340.1 (2334.1 - 2359.4) | 2419.8 (2374.5 - 2435.4) | 2415.9 (2395.7 - 2431.2) | n/a |
| [CO32–] | 104.5 (101.7 - 106.8) | 73.8 (69.0 - 90.3) | 81.3 (77.4 - 85.3) | n/a |
| Ωarag | 0.90 (0.87 - 0.92) [100%] | 0.63 (0.58 - 0.77) [100%] | 0.69 (0.66 - 0.73) [100%] | n/a |
| Ωcalc | 1.37 (1.34 - 1.41) | 0.96 (0.90 - 1.18) [88.1%] | 1.06 (1.01 - 1.11) | n/a |
| pH | 7.95 (7.93 - 7.96) | 7.79 (7.76 - 7.87) | 7.83 (7.81 - 7.86) | n/a |
| 30°S to 10°S | T | 2.61 (2.37 - 2.75) | 1.76 (1.66 - 2.11) | 1.71 (1.57 - 2.21) | n/a |
| S | 34.90 (34.85 - 34.97) | 34.68 (34.67 - 34.75) | 34.74 (34.70 - 34.81) | n/a |
| DIC | 2191.6 (2181.6 - 2215.2) | 2311.1 (2274.3 - 2331.9) | 2283.3 (2227.8 - 2306.4) | n/a |
| TA | 2338.4 (2330.7 - 2352.3) | 2405.3 (2383.5 - 2422.2) | 2393.7 (2356.5 - 2409.1) | n/a |
| [CO32–] | 101.8 (96.2 - 104.7) | 75.2 (73.2 - 84.0) | 82.9 (78.9 - 92.1) | n/a |
| Ωarag | 0.87 (0.82 - 0.90) [100%] | 0.64 (0.62 - 0.72) [100%] | 0.70 (0.67 - 0.78) [100%] | n/a |
| Ωcalc | 1.33 (1.26 - 1.37) | 0.98 (0.95 - 1.10) [83.9%] | 1.08 (1.03 - 1.20) | n/a |
| pH | 7.94 (7.91 - 7.96) | 7.80 (7.79 - 7.84) | 7.85 (7.82 - 7.90) | n/a |
| 50°S to30°S | T | 1.91 (0.88 - 2.63) | 1.69 (1.21 - 2.05) | 1.53 (0.91 - 2.26) | n/a |
| S | 34.80 (34.72 - 34.90) | 34.70 (34.67 - 34.74) | 34.74 (34.71 - 34.83) | n/a |
| DIC | 2221.3 (2185.8 - 2259.0) | 2284.6 (2258.0 - 2308.8) | 2252.8 (2214.7 - 2273.3) | n/a |
| TA | 2348.4 (2331.4 - 2367.4) | 2381.6 (2363.7 - 2399.8) | 2366.2 (2348.9 - 2383.0) | n/a |
| [CO32–] | 91.1 (80.5 - 101.5) | 76.1 (73.1 - 82.8) | 83.9 (79.3 - 94.8) | n/a |
| Ωarag | 0.77 (0.68 - 0.87) [100%] | 0.65 (0.62 - 0.71) [100%] | 0.71 (0.67 - 0.81) [100%] | n/a |
| Ωcalc | 1.19 (1.04 - 1.33) | 0.99 (0.95 - 1.08) [64.3%] | 1.09 (1.03 - 1.24) | n/a |
| pH | 7.90 (7.85 - 7.94) | 7.81 (7.79 - 7.84) | 7.86 (7.84 - 7.91) | n/a |
| Southernmost to 50°S | T | 0.22 (–0.46 - 1.27) | 0.80 (–0.33 - 1.51) | 0.42 (–0.30 - 1.28) | n/a |
| S | 34.68 (34.64 - 34.72) | 34.70 (34.67 - 34.72) | 34.69 (34.65 - 34.73) | n/a |
| DIC | 2252.3 (2241.5 - 2259.0) | 2261.4 (2255.0 - 2274.8) | 2255.4 (2242.4 - 2259.5) | n/a |
| TA | 2356.7 (2353.2 - 2366.1) | 2361.4 (2354.1 - 2371.2) | 2359.0 (2354.4 - 2364.2) | n/a |
| [CO32–] | 78.5 (76.7 - 84.1) | 76.7 (75.0 - 79.7) | 78.3 (75.5 - 84.9) | n/a |
| Ωarag | 0.66 (0.64 - 0.71) [100%] | 0.65 (0.62 - 0.67) [100%] | 0.65 (0.63 - 0.71) [100%] | n/a |
| Ωcalc | 1.01 (0.98 - 1.08) [61.9%] | 0.99 (0.96 - 1.03) [78.2%] | 1.00 (0.96 - 1.09) [56.4%] | n/a |
| pH | 7.86 (7.85 - 7.88) | 7.83 (7.81 - 7.85) | 7.85 (7.84 - 7.88) | n/a |

**Table S9.** Temperature (T, unit: °C), salinity (S), dissolved inorganic carbon (DIC, unit: μmol kg–1), total alkalinity (TA, unit: μmol kg–1), aragonite saturation state (Ωarag), calcite saturation state (Ωcalc), carbonate ion ([CO32–], unit: μmol kg–1), and pH with Total Scale at a depth of 4000 meters within the designated latitudinal bands of major world ocean basins. Format: area-averaged mean value (min value - max value) [percentage of gridded points with undersaturated Ωarag or Ωcalc]. The mean, min, and max values are based on triangulation based linear interpolation.

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| **Latitude** | **Var.** | **Atlantic Ocean** | **Pacific Ocean** | **Indian Ocean** | **Arctic Ocean** |
| 70°N to 90°N | T | n/a | n/a | n/a | 0.12 (–0.69 - 0.70) |
| S | n/a | n/a | n/a | 34.92 (34.80 - 35.13) |
| DIC | n/a | n/a | n/a | 2195.8 (2156.4 - 2249.5) |
| TA | n/a | n/a | n/a | 2327.1 (2296.2 - 2361.3) |
| [CO32–] | n/a | n/a | n/a | 90.8 (81.5 - 98.8) |
| Ωarag | n/a | n/a | n/a | 0.63 (0.57 - 0.70) [100%] |
| Ωcalc | n/a | n/a | n/a | 0.96 (0.87 - 1.05) [88.8%] |
| pH | n/a | n/a | n/a | 7.90 (7.83 - 7.94) |
| 50°N to 70°N | T | 1.67 (0.80 - 2.57) | 1.32 (0.93 - 1.49) | n/a | n/a |
| S | 34.92 (34.85 - 35.05) | 34.71 (34.68 - 34.76) | n/a | n/a |
| DIC | 2175.9 (2165.1 - 2202.4) | 2317.3 (2281.0 - 2336.3) | n/a | n/a |
| TA | 2323.2 (2310.7 - 2356.6) | 2409.3 (2382.8 - 2425.2) | n/a | n/a |
| [CO32–] | 99.6 (93.0 - 104.4) | 72.6 (70.3 - 77.2) | n/a | n/a |
| Ωarag | 0.70 (0.65 - 0.74) [100%] | 0.51 (0.50 - 0.54) [100%] | n/a | n/a |
| Ωcalc | 1.06 (0.99 - 1.12) [1.3%] | 0.78 (0.75 - 0.82) [100%] | n/a | n/a |
| pH | 7.92 (7.90 - 7.93) | 7.76 (7.74 - 7.80) | n/a | n/a |
| 30°N to 50°N | T | 2.40 (2.02 - 2.95) | 1.49 (1.41 - 1.69) | n/a | n/a |
| S | 34.91 (34.86 - 35.07) | 34.68 (34.68 - 34.72) | n/a | n/a |
| DIC | 2183.9 (2165.1 - 2210.1) | 2333.0 (2314.4 - 2345.7) | n/a | n/a |
| TA | 2334.3 (2313.2 - 2366.0) | 2422.8 (2408.7 - 2434.3) | n/a | n/a |
| [CO32–] | 101.7 (96.5 - 106.0) | 71.6 (70.2 - 76.3) | n/a | n/a |
| Ωarag | 0.72 (0.68 - 0.76) [100%] | 0.51 (0.50 - 0.54) [100%] | n/a | n/a |
| Ωcalc | 1.09 (1.04 - 1.15) | 0.76 (0.75 - 0.82) [100%] | n/a | n/a |
| pH | 7.91 (7.89 - 7.93) | 7.75 (7.74 - 7.77) | n/a | n/a |

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| 10°N to 30°N | T | 2.42 (2.20 - 2.81) | 1.55 (1.41 - 2.47) | 1.93 (1.64 - 2.52) | n/a |
| S | 34.90 (34.86 - 35.01) | 34.70 (34.68 - 34.83) | 34.82 (34.72 - 35.04) | n/a |
| DIC | 2189.5 (2175.1 - 2208.4) | 2321.4 (2246.0 - 2340.9) | 2318.4 (2303.1 - 2323.7) | n/a |
| TA | 2341.0 (2328.1 - 2362.7) | 2417.1 (2372.5 - 2431.1) | 2430.4 (2418.9 - 2435.1) | n/a |
| [CO32–] | 102.4 (96.5 - 104.6) | 74.4 (71.2 - 90.1) | 83.1 (79.4 - 89.8) | n/a |
| Ωarag | 0.73 (0.68 - 0.75) [100%] | 0.53 (0.50 - 0.64) [100%] | 0.59 (0.56 - 0.65) [100%] | n/a |
| Ωcalc | 1.10 (1.04 - 1.13) | 0.80 (0.76 - 0.97) [100%] | 0.90 (0.85 - 0.98) [100%] | n/a |
| pH | 7.92 (7.88 - 7.93) | 7.76 (7.75 - 7.84) | 7.80 (7.79 - 7.81) | n/a |
| 10°S to 10°N | T | 2.22 (1.73 - 2.61) | 1.59 (1.35 - 2.48) | 1.46 (1.23 - 1.91) | n/a |
| S | 34.88 (34.81 - 34.97) | 34.71 (34.69 - 34.83) | 34.73 (34.70 - 34.82) | n/a |
| DIC | 2200.3 (2185.0 - 2217.2) | 2310.6 (2240.0 - 2327.6) | 2300.5 (2271.8 - 2319.7) | n/a |
| TA | 2347.5 (2337.4 - 2360.6) | 2412.4 (2369.2 - 2425.6) | 2413.4 (2389.2 - 2429.8) | n/a |
| [CO32–] | 100.1 (94.7 - 103.0) | 77.4 (73.4 - 91.4) | 82.5 (79.9 - 84.9) | n/a |
| Ωarag | 0.71 (0.67 - 0.73) [100%] | 0.55 (0.52 - 0.65) [100%] | 0.58 (0.57 - 0.60) [100%] | n/a |
| Ωcalc | 1.07 (1.01 - 1.11) | 0.83 (0.79 - 0.99) [100%] | 0.88 (0.86 - 0.91) [100%] | n/a |
| pH | 7.91 (7.89 - 7.92) | 7.78 (7.76 - 7.85) | 7.82 (7.80 - 7.83) | n/a |
| 30°S to 10°S | T | 1.82 (1.09 - 2.36) | 1.52 (1.31 - 1.89) | 1.29 (1.13 - 1.56) | n/a |
| S | 34.82 (34.72 - 34.90) | 34.70 (34.68 - 34.73) | 34.72 (34.70 - 34.76) | n/a |
| DIC | 2220.3 (2207.1 - 2259.9) | 2297.8 (2270.5 - 2326.0) | 2280.8 (2249.4 - 2295.9) | n/a |
| TA | 2356.0 (2349.8 - 2373.2) | 2397.0 (2371.5 - 2421.7) | 2394.5 (2369.2 - 2409.6) | n/a |
| [CO32–] | 93.7 (81.9 - 99.5) | 75.6 (73.3 - 79.9) | 82.5 (80.5 - 85.2) | n/a |
| Ωarag | 0.66 (0.58 - 0.71) [100%] | 0.53 (0.52 - 0.57) [100%] | 0.58 (0.57 - 0.60) [100%] | n/a |
| Ωcalc | 1.00 (0.87 - 1.07) [40.9%] | 0.81 (0.79 - 0.86) [100%] | 0.88 (0.86 - 0.91) [100%] | n/a |
| pH | 7.88 (7.83 - 7.90) | 7.78 (7.76 - 7.80) | 7.82 (7.81 - 7.84) | n/a |
| 50°S to30°S | T | 0.98 (0.24 - 1.90) | 1.24 (0.73 - 1.61) | 0.87 (0.24 - 1.41) | n/a |
| S | 34.73 (34.67 - 34.82) | 34.71 (34.69 - 34.72) | 34.71 (34.68 - 34.76) | n/a |
| DIC | 2246.7 (2220.4 - 2271.9) | 2277.1 (2262.1 - 2305.8) | 2260.8 (2242.0 - 2275.3) | n/a |
| TA | 2361.7 (2352.3 - 2378.2) | 2378.7 (2365.8 - 2402.1) | 2372.1 (2361.3 - 2388.5) | n/a |
| [CO32–] | 82.6 (77.1 - 92.5) | 76.2 (74.1 - 79.3) | 80.7 (77.4 - 86.4) | n/a |
| Ωarag | 0.58 (0.53 - 0.66) [100%] | 0.54 (0.52 - 0.55) [100%] | 0.56 (0.54 - 0.61) [100%] | n/a |
| Ωcalc | 0.88 (0.81 - 1.00) [100%] | 0.81 (0.79 - 0.84) [100%] | 0.85 (0.81 - 0.92) [100%] | n/a |
| pH | 7.83 (7.81 - 7.87) | 7.79 (7.77 - 7.81) | 7.82 (7.81 - 7.85) | n/a |
| Southernmost to 50°S | T | –0.06 (–0.46 - 0.65) | 0.55 (–0.17 - 1.05) | 0.04 (–0.39 - 0.83) | n/a |
| S | 34.66 (34.65 - 34.69) | 34.70 (34.67 - 34.71) | 34.67 (34.65 - 34.71) | n/a |
| DIC | 2250.9 (2246.1 - 2266.1) | 2261.7 (2253.2 - 2272.6) | 2254.5 (2249.4 - 2263.4) | n/a |
| TA | 2356.8 (2351.3 - 2371.7) | 2363.5 (2352.9 - 2375.5) | 2358.8 (2352.4 - 2369.2) | n/a |
| [CO32–] | 77.2 (75.8 - 79.7) | 75.6 (73.5 - 78.1) | 76.6 (74.2 - 80.4) | n/a |
| Ωarag | 0.53 (0.52 - 0.55) [100%] | 0.53 (0.51 - 0.54) [100%] | 0.53 (0.51 - 0.56) [100%] | n/a |
| Ωcalc | 0.81 (0.79 - 0.84) [100%] | 0.80 (0.77 - 0.82) [100%] | 0.80 (0.78 - 0.84) [100%] | n/a |
| pH | 7.82 (7.81 - 7.83) | 7.80 (7.79 - 7.82) | 7.82 (7.81 - 7.83) | n/a |