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*Supplement of*

# Homogenized century-long surface incident solar radiation over Japan

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Table S1. The information of 156 stations over Japan, including the WMO-ID number, station name, latitude (°), longitude (°) and altitude (m).

| ID | Name | WMO-ID | Lat | Lon | Alt | ID | Name | WMO-ID | Lat | Lon | Alt |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | WAKKANAI | 47401 | 45.42 | 141.68 | 12 | 79 | TATEYAMA | 47672 | 34.99 | 139.87 | 7 |
| 2 | KITAMIESASHI | 47402 | 44.94 | 142.59 | 8 | 80 | KATSUURA | 47674 | 35.15 | 140.31 | 13 |
| 3 | HABORO | 47404 | 44.36 | 141.7 | 39 | 81 | OSHIMA | 47675 | 34.75 | 139.36 | 79 |
| 4 | OMU | 47405 | 44.58 | 142.96 | 15 | 82 | MIYAKEJIMA | 47677 | 34.12 | 139.52 | 37 |
| 5 | RUMOI | 47406 | 43.95 | 141.63 | 28 | 83 | HACHIJOJIMA | 47678 | 33.12 | 139.78 | 156 |
| 6 | ASAHIKAWA | 47407 | 43.76 | 142.37 | 116 | 84 | CHIBA | 47682 | 35.6 | 140.1 | 19 |
| 7 | ABASHIRI | 47409 | 44.02 | 144.28 | 43 | 85 | YOKKAICHI | 47684 | 34.94 | 136.58 | 56 |
| 8 | OTARU | 47411 | 43.18 | 141.02 | 26 | 86 | NIKKO | 47690 | 36.74 | 139.5 | 1294 |
| 9 | SAPPORO | 47412 | 43.06 | 141.33 | 26 | 87 | SAIGO | 47740 | 36.2 | 133.33 | 31 |
| 10 | IWAMIZAWA | 47413 | 43.21 | 141.79 | 51 | 88 | MATSUE | 47741 | 35.46 | 133.07 | 23 |
| 11 | OBIHIRO | 47417 | 42.92 | 143.21 | 43 | 89 | SAKAI | 47742 | 35.54 | 133.24 | 3 |
| 12 | KUSHIRO | 47418 | 42.99 | 144.38 | 16 | 90 | YONAGO | 47744 | 35.43 | 133.34 | 9 |
| 13 | NEMURO | 47420 | 43.33 | 145.59 | 39 | 91 | TOTTORI | 47746 | 35.49 | 134.24 | 16 |
| 14 | SUTTSU | 47421 | 42.8 | 140.22 | 38 | 92 | TOYOOKA | 47747 | 35.54 | 134.82 | 4 |
| 15 | MURORAN | 47423 | 42.31 | 140.98 | 49 | 93 | MAIZURU | 47750 | 35.45 | 135.32 | 22 |
| 16 | TOMAKOMAI | 47424 | 42.62 | 141.55 | 11 | 94 | HAGI | 47754 | 34.41 | 131.41 | 7 |
| 17 | URAKAWA | 47426 | 42.16 | 142.78 | 37 | 95 | HAMADA | 47755 | 34.9 | 132.07 | 20 |
| 18 | ESASHI | 47428 | 41.87 | 140.12 | 12 | 96 | TSUYAMA | 47756 | 35.06 | 134.01 | 147 |
| 19 | HAKODATE | 47430 | 41.82 | 140.75 | 44 | 97 | KYOTO | 47759 | 35.01 | 135.73 | 46 |
| 20 | KUTCHAN | 47433 | 42.9 | 140.76 | 188 | 98 | HIKONE | 47761 | 35.28 | 136.24 | 89 |
| 21 | MOMBETSU | 47435 | 44.35 | 143.36 | 16 | 99 | SHIMONOSEKI | 47762 | 33.95 | 130.93 | 19 |
| 22 | HIROO | 47440 | 42.29 | 143.32 | 33 | 100 | HIROSHIMA | 47765 | 34.4 | 132.46 | 53 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | OFUNATO | 47512 | 39.06 | 141.71 | 41 | 101 | KURE | 47766 | 34.24 | 132.55 | 5 |
| 24 | SHINJO | 47520 | 38.76 | 140.31 | 102 | 102 | FUKUYAMA | 47767 | 34.45 | 133.25 | 3 |
| 25 | WAKAMATSU | 47570 | 37.49 | 139.91 | 213 | 103 | OKAYAMA | 47768 | 34.66 | 133.92 | 18 |
| 26 | FUKAURA | 47574 | 40.65 | 139.93 | 67 | 104 | HIMEJI | 47769 | 34.84 | 134.67 | 40 |
| 27 | AOMORI | 47575 | 40.82 | 140.77 | 4 | 105 | KOBE | 47770 | 34.7 | 135.21 | 30 |
| 28 | MUTSU | 47576 | 41.28 | 141.21 | 5 | 106 | OSAKA | 47772 | 34.68 | 135.52 | 83 |
| 29 | HACHINOHE | 47581 | 40.53 | 141.52 | 28 | 107 | SUMOTO | 47776 | 34.34 | 134.91 | 112 |
| 30 | AKITA | 47582 | 39.72 | 140.1 | 22 | 108 | WAKAYAMA | 47777 | 34.23 | 135.16 | 18 |
| 31 | MORIOKA | 47584 | 39.7 | 141.17 | 155 | 109 | SHIONOMISAKI | 47778 | 33.45 | 135.76 | 69 |
| 32 | MIYAKO | 47585 | 39.65 | 141.97 | 46 | 110 | NARA | 47780 | 34.69 | 135.83 | 106 |
| 33 | SAKATA | 47587 | 38.91 | 139.84 | 4 | 111 | YAMAGUCHI | 47784 | 34.16 | 131.46 | 18 |
| 34 | YAMAGATA | 47588 | 38.26 | 140.35 | 154 | 112 | IZUHARA | 47800 | 34.2 | 129.29 | 19 |
| 35 | SENDAI | 47590 | 38.26 | 140.9 | 44 | 113 | HIRADO | 47805 | 33.36 | 129.55 | 59 |
| 36 | ISHINOMAKI | 47592 | 38.43 | 141.3 | 43 | 114 | FUKUOKA | 47807 | 33.58 | 130.38 | 15 |
| 37 | FUKUSHIMA | 47595 | 37.76 | 140.47 | 69 | 115 | IIZUKA | 47809 | 33.65 | 130.69 | 38 |
| 38 | SHIRAKAWA | 47597 | 37.13 | 140.22 | 357 | 116 | SASEBO | 47812 | 33.16 | 129.73 | 6 |
| 39 | ONAHAMA | 47598 | 36.95 | 140.9 | 5 | 117 | SAGA | 47813 | 33.27 | 130.31 | 32 |
| 40 | WAJIMA | 47600 | 37.39 | 136.9 | 7 | 118 | HITA | 47814 | 33.32 | 130.93 | 84 |
| 41 | AIKAWA | 47602 | 38.03 | 138.24 | 7 | 119 | OITA | 47815 | 33.24 | 131.62 | 13 |
| 42 | NIIGATA | 47604 | 37.89 | 139.02 | 6 | 120 | NAGASAKI | 47817 | 32.73 | 129.87 | 35 |
| 43 | KANAZAWA | 47605 | 36.59 | 136.63 | 34 | 121 | UNZENDAKE | 47818 | 32.74 | 130.26 | 679 |
| 44 | FUSHIKI | 47606 | 36.79 | 137.06 | 13 | 122 | KUMAMOTO | 47819 | 32.81 | 130.71 | 39 |
| 45 | TOYAMA | 47607 | 36.71 | 137.2 | 17 | 123 | ASOSAN | 47821 | 32.88 | 131.07 | 1144 |
| 46 | NAGANO | 47610 | 36.66 | 138.19 | 420 | 124 | NOBEOKA | 47822 | 32.58 | 131.66 | 21 |
| 47 | TAKADA | 47612 | 37.11 | 138.25 | 18 | 125 | AKUNE | 47823 | 32.03 | 130.2 | 45 |
| 48 | UTSUNOMIYA | 47615 | 36.55 | 139.87 | 140 | 126 | HITOYOSHI | 47824 | 32.22 | 130.76 | 147 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | FUKUI | 47616 | 36.06 | 136.22 | 17 | 127 | KAGOSHIMA | 47827 | 31.56 | 130.55 | 32 |
| 50 | TAKAYAMA | 47617 | 36.16 | 137.25 | 561 | 128 | MIYAKONOJO | 47829 | 31.73 | 131.08 | 156 |
| 51 | MATSUMOTO | 47618 | 36.25 | 137.97 | 611 | 129 | MIYAZAKI | 47830 | 31.94 | 131.41 | 15 |
| 52 | SUWA | 47620 | 36.05 | 138.11 | 762 | 130 | MAKURAZAKI | 47831 | 31.27 | 130.29 | 31 |
| 53 | KARUIZAWA | 47622 | 36.34 | 138.55 | 1004 | 131 | ABURATSU | 47835 | 31.58 | 131.41 | 15 |
| 54 | MAEBASHI | 47624 | 36.41 | 139.06 | 113 | 132 | YAKUSHIMA | 47836 | 30.39 | 130.66 | 38 |
| 55 | KUMAGAYA | 47626 | 36.15 | 139.38 | 32 | 133 | TANEGASHIMA | 47837 | 30.72 | 130.98 | 18 |
| 56 | MITO | 47629 | 36.38 | 140.47 | 31 | 134 | USHIBUKA | 47838 | 32.2 | 130.03 | 14 |
| 57 | TSURUGA | 47631 | 35.65 | 136.06 | 12 | 135 | FUKUE | 47843 | 32.69 | 128.83 | 26 |
| 58 | GIFU | 47632 | 35.4 | 136.76 | 17 | 136 | MATSUYAMA | 47887 | 33.84 | 132.78 | 34 |
| 59 | NAGOYA | 47636 | 35.17 | 136.97 | 56 | 137 | TADOTSU | 47890 | 34.28 | 133.75 | 5 |
| 60 | IIDA | 47637 | 35.52 | 137.82 | 529 | 138 | TAKAMATSU | 47891 | 34.32 | 134.05 | 10 |
| 61 | KOFU | 47638 | 35.67 | 138.55 | 282 | 139 | UWAJIMA | 47892 | 33.23 | 132.55 | 14 |
| 62 | FUJISAN | 47639 | 35.36 | 138.73 | 3773 | 140 | KOCHI | 47893 | 33.57 | 133.55 | 5 |
| 63 | KAWAGUCHIKO | 47640 | 35.5 | 138.76 | 861 | 141 | TOKUSHIMA | 47895 | 34.07 | 134.57 | 6 |
| 64 | CHICHIBU | 47641 | 35.99 | 139.07 | 234 | 142 | SUKUMO | 47897 | 32.92 | 132.7 | 11 |
| 65 | TATENO | 47646 | 36.06 | 140.13 | 31 | 143 | SHIMIZU | 47898 | 32.72 | 133.01 | 33 |
| 66 | CHOSHI | 47648 | 35.74 | 140.86 | 28 | 144 | MUROTOMISAKI | 47899 | 33.25 | 134.18 | 186 |
| 67 | UENO | 47649 | 34.76 | 136.14 | 161 | 145 | NAZE | 47909 | 28.38 | 129.5 | 8 |
| 68 | TSU | 47651 | 34.73 | 136.52 | 18 | 146 | YONAGUNIJIMA | 47912 | 24.47 | 123.01 | 36 |
| 69 | IRAKO | 47653 | 34.63 | 137.09 | 8 | 147 | IRIOMOTEJIMA | 47917 | 24.43 | 123.77 | 11 |
| 70 | HAMAMATSU | 47654 | 34.71 | 137.72 | 33 | 148 | ISHIGAKIJIMA | 47918 | 24.34 | 124.16 | 6 |
| 71 | OMAEZAKI | 47655 | 34.6 | 138.21 | 47 | 149 | MIYAKOJIMA | 47927 | 24.79 | 125.28 | 41 |
| 72 | SHIZUOKA | 47656 | 34.98 | 138.4 | 16 | 150 | KUMEJIMA | 47929 | 26.34 | 126.8 | 5 |
| 73 | MISHIMA | 47657 | 35.11 | 138.93 | 22 | 151 | NAHA | 47936 | 26.21 | 127.69 | 50 |
| 74 | TOKYO | 47662 | 35.69 | 139.76 | 36 | 152 | NAGO | 47940 | 26.59 | 127.97 | 7 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 75 | OWASE | 47663 | 34.07 | 136.19 | 27 | 153 | OKINOERABU | 47942 | 27.43 | 128.71 | 29 |
| 76 | IROZAKI | 47666 | 34.6 | 138.84 | 56 | 154 | MINAMIDAITOJIMA | 47945 | 25.83 | 131.23 | 20 |
| 77 | AJIRO | 47668 | 35.05 | 139.09 | 68 | 155 | CHICHIJIMA | 47971 | 27.09 | 142.19 | 8 |
| 78 | YOKOHAMA | 47670 | 35.44 | 139.65 | 43 | 156 | MINAMITORISHIMA | 47991 | 24.29 | 153.98 | 8 |

IDs marked with red color indicate the 41 stations on which the data were improved a lot after homogenization.

Table S2. The information of date when data inhomogeneity occurred due to changes in instrument, observational methods and/or site relocation for sunshine duration (SunDu) data, surface incident solar radiation ($R_s$) data and cloud amount (CA) data at each station.

| ID | SunDu | | | Rs | Cloud | ID | SunDu | | | Rs | Cloud |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | site relocation | measurement method | site relocation | change of instruments | measurement method | | site relocation | measurement method | site relocation | change of instruments | measurement method |
| **47401** | | 198601 | | 197207 | | **47672** | | 198601 | | nodata | |
| **47402** | | 198801 | | | 199504 | **47674** | | 198901 | | nodata | |
| **47404** | | 198801 | | nodata | 198104 | **47675** | | 198601 | 199112 | 197208 | |
| **47405** | | 198901 | | nodata | 198104 | **47677** | | 198701 | | nodata | |
| **47406** | | 198601 | | 197305 | | **47678** | | 198601 | 200308 | 197105 | |
| **47407** | | 198601 | 200405 | 197207 | | **47682** | | 198701 | | nodata | |
| **47409** | | 198601 | | 197301 | | **47684** | | 198901 | 200003 | nodata | 199204 |
| **47411** | | 198601 | | nodata | 199204 | **47690** | | 198901 | | nodata | 199104 |
| **47412** | | 198601 | | 197104 | | **47740** | | 198701 | | 197501 | |
| **47413** | | 198701 | | nodata | | **47741** | | 198701 | | 197501 | |
| **47417** | | 198601 | | 197405 | | **47742** | | 199001 | | nodata | 199404 |
| **47418** | 191001 | 198701 | 200010 | nodata | | **47744** | | 198601 | | 197205 | |
| **47420** | | 198601 | | 197104 | | **47746** | | 198701 | | 197501 | |

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|---|---|---|---|---|---|---|---|---|---|---|
| **47421** | | 198601 | 197305 | | **47747** | | 198701 | | nodata | |
| **47423** | | 198601 | 197305 | | **47750** | 197407 | 198601 | | 197408 | |
| **47424** | | 198701 | nodata | | **47754** | | 198701 | 200603 | 197501 | 198104 |
| **47426** | | 198601 | 197305 | | **47755** | | 198601 | | 197305 | |
| **47428** | | 198701 | nodata | | **47756** | | 198701 | | nodata | 199404 |
| **47430** | | 198601 | 197206 | | **47759** | | 198701 | | 197501 | |
| **47433** | | 198701 | 197501 | | **47761** | | 198601 | | 197305 | |
| **47435** | | 198701 | nodata | | **47762** | | 198601 | | 197305 | |
| **47440** | | 198901 | nodata | 199204 | **47765** | | 198601 | 198801 | 197205 | |
| **47512** | | 198701 | 197501 | | **47766** | | 198901 | | nodata | 198104 |
| **47520** | | 198511 | nodata | 199204 | **47767** | | 198801 | | nodata | 199404 |
| **47570** | | 198701 | 197501 | | **47768** | 198201 | 198701 | | 197501 | |
| **47574** | | 198701 | nodata | | **47769** | | 198701 | | nodata | 199404 |
| **47575** | | 198601 | 197207 | | **47770** | | 198601 | 200703 | 197501 | |
| **47576** | | 198801 | nodata | 198104 | **47772** | | 198601 | | 197102 | |
| **47581** | | 198601 | 197307 | | **47776** | | 198701 | | nodata | 199404 |
| **47582** | | 198601 | 197106 | | **47777** | | 198701 | | 197501 | |
| **47584** | | 198601 | 197208 | | **47778** | | 198601 | 201111 | 197103 | |
| **47585** | | 198601 | 197204 | | **47780** | | 198601 | | 197305 | |
| **47587** | 197003 | 198601 | 197307 | | **47784** | | 198701 | 201210 | 197501 | |
| **47588** | | 198601 | 197307 | | **47800** | | 198601 | 199109 | 197207 | |
| **47590** | | 198601 | 197207 | | **47805** | | 198801 | | 197501 | 198104 |
| **47592** | | 198701 | nodata | 199504 | **47807** | | 198601 | | 197107 | |
| **47595** | | 198601 | 197306 | | **47809** | | 198901 | | 197501 | 198104 |
| **47597** | | 198701 | nodata | 199204 | **47812** | | 198601 | 200203 | 197501 | 199304 |
| **47598** | | 198601 | 197205 | | **47813** | | 198601 | 199510 | 197306 | |

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|---|---|---|---|---|---|---|---|---|---|---|
| **47600** | | 198601 | | 197104 | | **47814** | | 198601 | | 197501 | 199304 |
| **47602** | | 198701 | | nodata | | **47815** | | 198601 | | 197308 | |
| **47604** | | 198601 | 200806 | 197204 | | **47817** | | 198601 | | 197107 | |
| **47605** | | 198701 | 199110 | nodata | | **47818** | 197701 | 199001 | | | |
| **47606** | | 198901 | | nodata | 198104 | **47819** | | 198601 | | 197207 | |
| **47607** | | 198601 | | 197305 | | **47821** | | 199001 | | 197501 | |
| **47610** | | 198701 | | 196701 | | **47822** | | 198701 | 201807 | 197501 | 199504 |
| **47612** | | 198601 | | 197309 | | **47823** | | 198801 | | 197501 | 198104 |
| **47615** | | 198601 | | 197305 | | **47824** | | 198601 | | 197501 | 199304 |
| **47616** | | 198601 | | 197305 | | **47827** | | 198601 | | 197107 | |
| **47617** | | 198701 | | 197501 | | **47829** | | 198901 | | 197501 | 198104 |
| **47618** | | 198601 | | 197206 | | **47830** | | 198601 | 200005 | 197207 | |
| **47620** | | 198601 | | 197501 | 198104 | **47831** | | 198601 | | 197501 | 199504 |
| **47622** | | 198901 | 201411 | nodata | 200804 | **47835** | | 198601 | | 197204 | 199504 |
| **47624** | | 198601 | | 197107 | | **47836** | 197504 | 198601 | | 197501 | |
| **47626** | | 198701 | | 197501 | | **47837** | | 198701 | 200412 | 197501 | |
| **47629** | | 198701 | | 197501 | | **47838** | | 198601 | | 197304 | 199304 |
| **47631** | | 198701 | | nodata | | **47843** | | 198601 | | 197501 | |
| **47632** | | 198701 | | nodata | | **47887** | | 198601 | | 197205 | |
| **47636** | | 198601 | | 197207 | | **47890** | | 198901 | | nodata | 198104 |
| **47637** | | 198701 | 200205 | 197501 | | **47891** | | 198601 | | 197205 | |
| **47638** | | 198601 | | 197309 | | **47892** | | 198901 | 199302 | nodata | |
| **47639** | | | | 200408 | nodata | **47893** | | 198701 | | 197307 | |
| **47640** | | 198801 | | nodata | 199104 | **47895** | | 198701 | | 197501 | |
| **47641** | | 198801 | | nodata | 199104 | **47897** | | 198901 | | nodata | 198104 |
| **47646** | | 199001 | | | 199004 | **47898** | | 198601 | | 197105 | |

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| **47648** | | 198601 | | 197204 | | **47899** | | 198701 | | 197312 | |
| **47649** | | 198601 | | nodata | 199104 | **47909** | | 198601 | | 197107 | |
| **47651** | | 198701 | | nodata | | **47912** | | 198601 | | nodata | |
| **47653** | | 198901 | | nodata | 198104 | **47917** | | 199001 | 200303 | nodata | |
| **47654** | | 198701 | 201211 | nodata | | **47918** | | 198601 | | 197308 | |
| **47655** | | 198601 | | 197205 | | **47927** | | 198601 | | 198103 | |
| **47656** | | 198601 | | 197309 | | **47929** | | 198601 | | nodata | 199504 |
| **47657** | | 198901 | | nodata | 199204 | **47936** | 192705 | 198601 | | 197201 | |
| **47662** | | 198701 | 200711 | 197204 | | **47940** | | 198701 | 199001 | nodata | |
| **47663** | | 198701 | | nodata | | **47942** | | 198601 | | nodata | |
| **47666** | | 198701 | | nodata | 199104 | **47945** | | 198601 | | 197306 | 201604 |
| **47668** | | 198901 | | nodata | 199504 | **47971** | | 198601 | | 197404 | |
| **47670** | | 198701 | | 197501 | | **47991** | | 198701 | | 197404 | |