

# Annexes



# Annex I: Observational Products

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## AI.1 Introduction

The purpose of this annex is to document observational datasets used by Working Group I in the Sixth Assessment Report. This includes details of the types and versions of datasets, the time period they cover, the chapters in which they appear, and citations and (where available) web links to the data.

This list includes those observational datasets that contribute to values reported in the text or in figures, unless they are citing a specific result from a paper (as opposed to an ongoing dataset for which that paper is a reference).

Reanalyses are within the scope of this annex, but historical climate model simulations are not. Proxy datasets are also outside the scope of this annex.

Datasets which are updated regularly on an operational basis are shown as ending in 2020, even if no 2020 data have yet been published at the time of writing.

Datasets are sorted alphabetically according to the dataset name or, if there is no formal name, the name of the responsible institution or lead author.

Table AI.1 | Observational products used by Working Group I in the Sixth Assessment Report.

| Name                                                                                                                | Version   | Type                | Resolution (Time and Space)             | Section(s)                       | Time Period | Citation, Link and DOI (Where Available)                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------|-----------|---------------------|-----------------------------------------|----------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOAA-CIRES 20th Century Reanalysis (20CR)                                                                           | 2c        | Reanalysis          | 3-hourly<br>2° × 2°, 24 vertical levels | 2.4.1                            | 1851–2014   | Compo et al. (2011)<br><a href="http://www.esrl.noaa.gov/psd/data/20thC_Rean/">www.esrl.noaa.gov/psd/data/20thC_Rean/</a>                                                 |
| NOAA-CIRES 20th Century Reanalysis (20CR)                                                                           | 3         | Reanalysis          | 3-hourly<br>0.5° × 0.5°                 | 2.3.1<br>3.3.3<br>3.7.1          | 1851–2020   | Slivinski et al. (2019)<br><a href="http://www.esrl.noaa.gov/psd/data/20thC_Rean/">www.esrl.noaa.gov/psd/data/20thC_Rean/</a>                                             |
| Finland Climate (Aalto)                                                                                             |           | In situ             | Daily<br>0.1° × 0.1°                    | 10.2.1                           | 1961–2010   | Aalto et al. (2016)<br><a href="http://www.csc.fi/~paituli">www.csc.fi/~paituli</a>                                                                                       |
| ACORN-SAT Australian temperature data                                                                               | 2.1       | In situ             | Daily<br>Point-based                    | Atlas 6.2                        | 1910–2020   | Trewin et al. (2020)<br><a href="http://www.bom.gov.au/climate/data/acorn-sat/">www.bom.gov.au/climate/data/acorn-sat/</a>                                                |
| AERONET AOD Level 2.0                                                                                               | 3         | Remote sensing      | Monthly<br>Point-based                  | 2.2.6                            | 1995–2020   | Giles et al. (2019)<br><a href="https://aeronet.gsfc.nasa.gov/data_push/AOT_Level2_Monthly.tar.gz">https://aeronet.gsfc.nasa.gov/data_push/AOT_Level2_Monthly.tar.gz</a>  |
| Advanced Global Atmospheric Gases Experiment (AGAGE)                                                                |           | In situ             | Up to 36 times per day<br>Point-based   | 2.2.3<br>2.2.4<br>5.2.2<br>5.2.3 | 1978–2020   | Prinn et al. (2018)<br><a href="http://agage.mit.edu/data">http://agage.mit.edu/data</a>                                                                                  |
| Australian Gridded Climate Data (AGCD)                                                                              |           | In situ             | Daily<br>0.05° × 0.05°                  | Atlas 6.2                        | 1900–2020   | Jones et al. (2009); Evans et al. (2020)<br><a href="http://www.bom.gov.au/climate/maps/rainfall">www.bom.gov.au/climate/maps/rainfall</a>                                |
| AIRS specific humidity                                                                                              | RetStd-v5 | Remote sensing      | Monthly<br>1° × 1°                      | 3.3.2                            | 2003–2010   | Susskind et al. (2006); Tian et al. (2013)<br><a href="https://esgf-node.llnl.gov/search/obs4mips/">https://esgf-node.llnl.gov/search/obs4mips/</a>                       |
| AIRS-6 climate data products                                                                                        |           | Remote sensing      | Various                                 | 2.3.1                            | 2002–2020   | Susskind et al. (2014)<br><a href="http://disc.sci.gsfc.nasa.gov/AIRS/data-holdings">http://disc.sci.gsfc.nasa.gov/AIRS/data-holdings</a>                                 |
| Energy balance reconstruction (Allan)                                                                               |           | Remote sensing      | Monthly<br>10° × 10°                    | 7.2.2                            | 1985–2012   | Allan et al. (2014)<br><a href="http://met.reading.ac.uk/~sgs02rpa/research/DEEP-C/GRL/">http://met.reading.ac.uk/~sgs02rpa/research/DEEP-C/GRL/</a>                      |
| AMOC dataset                                                                                                        |           | In situ, reanalysis | Monthly<br>Regional time series         | 3.5.4                            | 2004–2017   | Smeed et al. (2018)                                                                                                                                                       |
| Advanced Microwave Scanning Radiometer 2 (AMSR2)                                                                    |           | Remote sensing      | 3-hourly                                | 8.3.1                            | 2012–2019   | Kummerow et al. (2015)<br><a href="https://lance.nsstc.nasa.gov/amr2-science/data/level2/rainocean/">https://lance.nsstc.nasa.gov/amr2-science/data/level2/rainocean/</a> |
| Aqua's Advanced Microwave Scanning Radiometer for Earth Observing System (AMSR-E)                                   |           | Remote sensing      | 5.4–56 km                               | 8.3.1                            | 2002–2011   | Kawanishi et al. (2003)                                                                                                                                                   |
| Arctic sea ice thickness from submarine transects                                                                   |           | In situ             | Intermittent<br>Track-based             | 2.3.2                            | 1975–2000   | Rothrock et al. (2008)                                                                                                                                                    |
| Asian Precipitation – Highly-Resolved Observational Data Integration Towards Evaluation (APHRODITE's) Precipitation |           | In situ             | Daily<br>0.05° × 0.05°                  | 8.3.2<br>10.2.1<br>10.6.3        | 1900–2020   | Kamiguchi et al. (2010); Yatagai et al. (2012)                                                                                                                            |

| Name                                                                                                            | Version | Type                    | Resolution (Time and Space)                           | Section(s)                                                                                                                             | Time Period    | Citation, Link and DOI (Where Available)                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------|---------|-------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Asian Precipitation – Highly-Resolved Observational Data Integration Towards Evaluation Monsoon Asia (APHRO-MA) | V1808   | In situ                 | Daily<br>0.5°                                         | Cross-Chapter Box (CCB) 10.4                                                                                                           | 1961–2014      | Yasutomi et al. (2011)<br><a href="http://aphrodite.st.hirosaki-u.ac.jp/products.html">http://aphrodite.st.hirosaki-u.ac.jp/products.html</a>                                                                             |
| Asian Precipitation – Highly-Resolved Observational Data Integration Towards Evaluation Monsoon Asia (APHRO-MA) | V1101   | In situ                 | Daily<br>0.5°                                         | 10.6.3                                                                                                                                 | 1956–2005      | Yatagai et al. (2012)<br><a href="http://aphrodite.st.hirosaki-u.ac.jp/products.html">http://aphrodite.st.hirosaki-u.ac.jp/products.html</a>                                                                              |
| Advanced Scatterometer (ASCAT)                                                                                  |         | Remote sensing          | Daily<br>25 km                                        | 8.3.1                                                                                                                                  | 2006–2016      | Wagner et al. (1999)                                                                                                                                                                                                      |
| Cross-calibrated multi-platform wind dataset (Atlas)                                                            |         | Remote sensing, in situ | 6-hourly<br>25 km                                     | 2.3.1                                                                                                                                  | 1987–2020      | Atlas et al. (2011)<br><a href="http://www.remss.com/measurements/ccmp/">www.remss.com/measurements/ccmp/</a>                                                                                                             |
| Australian vineyard data                                                                                        |         | In situ                 | Annual<br>Point-based                                 | 2.3.4                                                                                                                                  | Varies by site | Webb et al. (2011)                                                                                                                                                                                                        |
| AVISO sea level observations                                                                                    |         | Remote sensing          | Monthly<br>0.25°                                      | 9.2.4                                                                                                                                  | 1995–2020      | Legeais et al. (2018)<br><a href="http://www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level.html">www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level.html</a> |
| Beaune grape harvest dates                                                                                      |         | In situ                 | Annual<br>Point-based                                 | 2.3.4                                                                                                                                  | 1354–2018      | Labbé et al. (2019)<br><a href="http://www.euroclimhist.unibe.ch/en/">www.euroclimhist.unibe.ch/en/</a>                                                                                                                   |
| Berkeley Earth surface air temperature                                                                          |         | In situ                 | Monthly<br>1° × 1°<br>(or equivalent equal-area grid) | 1.3.6<br>1.4.1<br>1.4.2<br>1.6.1<br>FAQ 1.2<br>2.3.1<br>CCB 2.3<br>3.3.1<br>3.7.3<br>10.3.3<br>10.6.4<br>Box 10.3<br>CCB 10.4<br>Atlas | 1750–2020      | Rohde and Hausfather (2020)<br><a href="http://www.berkeleyearth.org">www.berkeleyearth.org</a>                                                                                                                           |
| Berlin City Measurement Network                                                                                 |         | In situ                 | 1-minute                                              | Box 10.3                                                                                                                               | Ongoing        | <a href="http://www.geo.fu-berlin.de/en/met/service/stadtmessnetz/index.html">www.geo.fu-berlin.de/en/met/service/stadtmessnetz/index.html</a>                                                                            |
| Bermuda Atlantic Time-series Study Data                                                                         |         | In situ                 | Point-based                                           | 2.3.3                                                                                                                                  | 1988–2016      | Bates et al. (2014); Bates and Johnson (2020)<br><a href="http://bats.bios.edu/bats-data/">http://bats.bios.edu/bats-data/</a>                                                                                            |
| Czech Republic precipitation (Bližňák)                                                                          |         | In situ                 | 10 min<br>0.01° × 0.01°                               | 10.2.1                                                                                                                                 | 2002–2011      | Bližňák et al. (2018)                                                                                                                                                                                                     |
| Boulder stratospheric water vapour                                                                              |         | In situ                 | Profiles approx.<br>monthly<br>Point-based            | 2.2.5                                                                                                                                  | 1980–2010      | Hurst et al. (2011)                                                                                                                                                                                                       |
| BUCL (Birmingham)                                                                                               |         | In situ                 | Hourly                                                | Box 10.3                                                                                                                               | 2013–2020      | Chapman et al. (2015)                                                                                                                                                                                                     |
| Global temperature data (Callendar)                                                                             |         | In situ                 | Annual<br>Global time series                          | 1.3.3                                                                                                                                  | 1880–1935      | Callendar (1938); Hawkins and Jones (2013)                                                                                                                                                                                |
| Cyprus precipitation (Camera)                                                                                   |         | In situ                 | Daily<br>0.01° × 0.01°                                | 10.2.1                                                                                                                                 | 1980–2010      | Camera et al. (2014)                                                                                                                                                                                                      |
| CAMS atmospheric composition reanalysis                                                                         |         | Reanalysis              | 3-hourly<br>1° × 1°                                   | 7.3.3                                                                                                                                  | 2003–2018      | Inness et al. (2019)<br><a href="http://atmosphere.copernicus.eu">http://atmosphere.copernicus.eu</a>                                                                                                                     |
| Data of CARIACO ocean time-series program in the Cariaco Basin                                                  |         | In situ                 | Point-based                                           | 5.3.2                                                                                                                                  | 1996–2017      | Bates et al. (2014)<br><a href="http://imars.marine.usf.edu/cariaco">http://imars.marine.usf.edu/cariaco</a>                                                                                                              |
| CCU 'IKI-Monitoring' satellite data archive                                                                     |         | Remote sensing          | Daily<br>Resolution varies                            | Atlas                                                                                                                                  | 1984–2020      | Loupian et al. (2015)                                                                                                                                                                                                     |



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|----------------------------------------------------------------|---------|-------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Climate Prediction Centre (CPC) Precipitation                  |         | In situ                 | Hourly<br>2.0° × 2.5°<br>Daily<br>0.25° × 0.25° | 10.2.1                                                                                                       | 1948–2006                        | Higgins et al. (2000); Xie et al. (2007b); Chen et al. (2008)                                                                                                                                                                                            |
| CPC teleconnection indices (AAO, AO, NAO, PNA)                 |         | In situ                 | Daily<br>Regional means                         | 2.4.1                                                                                                        | 1950–2020<br>(1979–2019 for AAO) | <a href="http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml">www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml</a>                                                                 |
| CPC Unified Gauge-Based Analysis of Global Daily Precipitation |         | In situ, remote sensing | Daily<br>0.5° × 0.5°                            | 8.3.1                                                                                                        | 1979–2019                        | Xie et al. (2010)<br><a href="https://psl.noaa.gov/data/gridded/data.cpc.globalprecip.html">https://psl.noaa.gov/data/gridded/data.cpc.globalprecip.html</a>                                                                                             |
| CloudSat Cloud Profiling Radar (CPR)                           |         | Remote sensing          | 1.5 km horizontal,<br>0.5 km vertical           | 8.3.1                                                                                                        | 2006–2019                        | Tanelli et al. (2008)                                                                                                                                                                                                                                    |
| CRU TS                                                         | 4.02    | In situ                 | Monthly<br>0.5° × 0.5°                          | 3.3.2<br>3.3.3<br>3.7.3<br>5.2.1                                                                             | 1901–2017                        | Harris et al. (2014)<br><a href="https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.02/">https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.02/</a>                                                                                                            |
| CRU TS                                                         | 4.03    | In situ                 | Monthly<br>0.5° × 0.5°                          | 10.6.2                                                                                                       | 1901–2017                        | Harris et al. (2014)<br><a href="https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.03/">https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.03/</a>                                                                                                            |
| CRU TS                                                         | 4.04    | In situ                 | Monthly<br>0.5° × 0.5°                          | 2.3.1<br>8.3.2<br>Box 8.1<br>10.3.3<br>10.3.4<br>10.4.2<br>10.6.3<br>10.6.4<br>Box 10.3<br>CCB 10.4<br>Atlas | 1901–2020                        | Harris et al. (2020)<br><a href="https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.04/">https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.04/</a>                                                                                                            |
| CRUTEM                                                         | 4       | In situ                 | Monthly<br>5° × 5°                              | 10.6.4<br>Atlas                                                                                              | 1850–2020                        | Jones et al. (2012)<br><a href="https://crudata.uea.ac.uk/cru/data/temperature/">https://crudata.uea.ac.uk/cru/data/temperature/</a>                                                                                                                     |
| CRUTEM                                                         | 5       | In situ                 | Monthly<br>5° × 5°                              | Atlas                                                                                                        | 1850–2020                        | Osborn et al. (2021)<br><a href="https://crudata.uea.ac.uk/cru/data/temperature/">https://crudata.uea.ac.uk/cru/data/temperature/</a>                                                                                                                    |
| Cryosat Arctic sea ice thickness data                          |         | Remote sensing          | Monthly<br>25 × 25 km                           | 2.3.2<br>9.4.1                                                                                               | 2011–2020                        | Kwok and Cunningham (2015); Bamber et al. (2018)<br><a href="http://nsidc.org/cryosphere/sotc/sea_ice.html">http://nsidc.org/cryosphere/sotc/sea_ice.html</a><br><a href="https://science-pds.cryosat.esa.int/">https://science-pds.cryosat.esa.int/</a> |
| CSIR-ML6 air-sea CO <sub>2</sub> fluxes                        | 2019    | In situ                 | Monthly<br>1° × 1°                              | 5.2.1                                                                                                        | 1982–2015                        | Gregor (2019)<br><a href="https://doi.org/10.6084/m9.figshare.7894976">https://doi.org/10.6084/m9.figshare.7894976</a>                                                                                                                                   |
| CSIRO atmospheric gas measurements                             |         | In situ                 | Monthly<br>Point-based                          | 2.2.3<br>5.2.3                                                                                               | 1976–2019                        | Langenfelds et al. (2002); Francey et al. (2003); Kirschke et al. (2013)                                                                                                                                                                                 |
| CSIRO global mean sea level                                    |         | Remote sensing          | Monthly<br>1° × 1°                              | 2.3.3                                                                                                        | 1993–2020                        | Church and White (2011)                                                                                                                                                                                                                                  |
| CSIRO ocean heat content                                       |         | In situ                 | Annual<br>Global                                | 2.3.3                                                                                                        | 1950–2020                        | Domingues et al. (2008); Wijffels et al. (2016)                                                                                                                                                                                                          |
| Mexican climate (Cuervo-Robayo)                                |         | In situ                 | Monthly<br>30 arcsec                            | 10.2.1                                                                                                       | 1910–2009                        | Cuervo-Robayo et al. (2014)                                                                                                                                                                                                                              |
| 3D-VAR regional reanalysis (Dahlgren)                          |         | Reanalysis              | 6-hourly<br>0.2° × 0.2°                         | 10.2.1                                                                                                       | 1989–2010                        | Dahlgren et al. (2016)                                                                                                                                                                                                                                   |
| Global sea level reconstruction (Dangendorf)                   |         | In situ, remote sensing | Monthly<br>Regional means                       | 1.2.1<br>2.3.3                                                                                               | 1900–2015                        | Dangendorf et al. (2017, 2019)                                                                                                                                                                                                                           |
| DCNet (Washington)                                             |         | In situ                 | Hourly                                          | Box 10.3                                                                                                     | Ongoing                          | Hicks et al. (2012)                                                                                                                                                                                                                                      |
| Ethiopian precipitation (Dinku)                                |         | In situ                 | Sub-monthly<br>0.1° × 0.1°                      | 10.2.1                                                                                                       | 1983–2013                        | Dinku et al. (2014)                                                                                                                                                                                                                                      |
| Data of DYFAMED station in the Ligurian Sea                    |         | In situ                 | Point-based                                     | 5.3.2                                                                                                        | 1991–2016                        | Merlivat et al. (2018)<br><a href="http://dyfbase.obs-vlfr.fr/">http://dyfbase.obs-vlfr.fr/</a>                                                                                                                                                          |

| Name                                                                 | Version                       | Type           | Resolution (Time and Space)                                         | Section(s)                                                                                                     | Time Period | Citation, Link and DOI (Where Available)                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------|-------------------------------|----------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eastern China spring phenology index                                 |                               | In situ        | Annual<br>Point-based                                               | 2.3.4                                                                                                          | 1834–2009   | Ge et al. (2014)                                                                                                                                                                                                                                                         |
| European Climate Assessment & Dataset (ECA&D)                        |                               | In situ        | Daily<br>Point-based                                                | 10.6.4                                                                                                         | 1775–2020   | Klein Tank et al. (2002)<br><a href="http://www.ecad.eu/">www.ecad.eu/</a>                                                                                                                                                                                               |
| EDGARv4.3.2                                                          | 2019                          | In situ        | Monthly<br>0.1° × 0.1°                                              | 6.7.1                                                                                                          | 1970–2012   | Janssens-Maenhout et al. (2019)<br><a href="http://edgar.jrc.ec.europa.eu/overview.php?v=432_GHG&amp;SECURE=123">http://edgar.jrc.ec.europa.eu/overview.php?v=432_GHG&amp;SECURE=123</a>                                                                                 |
| EN4 ocean subsurface profiles                                        |                               | In situ        | Monthly<br>Point-based                                              | 2.3.3                                                                                                          | 1900–2020   | Good et al. (2013)<br><a href="http://www.metoffice.gov.uk/hadobs/">www.metoffice.gov.uk/hadobs/</a>                                                                                                                                                                     |
| E-OBS                                                                | V19.0                         | In situ        | Daily<br>0.1° and 0.25°                                             | 10.3.3<br>10.6.4<br>Atlas 8.2                                                                                  | 1950–2020   | Cornes et al. (2018)<br><a href="http://www.ecad.eu/">www.ecad.eu/</a>                                                                                                                                                                                                   |
| ERA 20th Century (ERA-20C) reanalysis                                |                               | Reanalysis     | 3-hourly<br>Approx. 125 km,<br>128 vertical levels                  | 2.3.1<br>3.3.3<br>3.7.1                                                                                        | 1900–2010   | Hersbach et al. (2015); Poli et al. (2016)<br><a href="http://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era-20c">www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era-20c</a>                                                                       |
| ERA-5                                                                |                               | Reanalysis     | Hourly<br>30 km, 137 vertical levels                                | 1.4.1<br>2.3.1<br>3.3.1<br>3.3.2<br>3.3.3<br>3.7.1<br>3.8.2<br>CCB 3.1<br>8.3.2<br>11.4.3<br>Box 11.4<br>Atlas | 1979–2020   | Hersbach et al. (2020)<br><a href="http://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5">www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5</a>                                                                                                 |
| ECMWF ERA-Interim reanalysis                                         |                               | Reanalysis     | 6-hourly<br>T255 spectral<br>(approx. 80 km),<br>60 vertical levels | 2.3.1<br>3.3.3<br>3.7.1<br>8.3.2<br>10.3.3                                                                     | 1979–2019   | Dee et al. (2011)<br><a href="http://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era-interim">www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era-interim</a>                                                                                        |
| ECMWF ERA-Interim reanalysis – Land                                  |                               | Reanalysis     | 6-hourly<br>T255 spectral<br>(approx. 80 km),<br>60 vertical levels | 10.2.1                                                                                                         | 1979–2010   | Balsamo et al. (2015)                                                                                                                                                                                                                                                    |
| NOAA ERSST sea surface temperature                                   | 5                             | In situ        | Monthly<br>2° × 2°                                                  | 2.4.2<br>2.4.3<br>2.4.5<br>3.7.3<br>3.7.6<br>3.7.7<br>9.2.1<br>CCB 9.2<br>Atlas                                | 1880–2020   | Huang et al. (2017)<br><a href="http://www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst-v5">www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst-v5</a>                |
| ESA CCI sea surface temperature                                      | L4-GHRSST-SSTdepth-OSTIA-GLOB | Remote sensing | Monthly<br>0.05° × 0.05°                                            | 3.8.2                                                                                                          | 1992–2010   | Merchant et al. (2014a, b)<br><a href="ftp://anon-ftp.ceda.ac.uk/neodc/esacci/sst/data/">ftp://anon-ftp.ceda.ac.uk/neodc/esacci/sst/data/</a>                                                                                                                            |
| ESA CCI Soil Moisture                                                | L3S-SSMV-COMBINED-v4.2        | Remote sensing | Monthly,<br>0.25° × 0.25°<br>Daily, global images                   | 3.8.2<br>8.3.1                                                                                                 | 1979–2016   | Y.Y. Liu et al. (2012); Dorigo et al. (2017); Gruber et al. (2017)<br><a href="ftp://anon-ftp.ceda.ac.uk/neodc/esacci/soil_moisture/data/">ftp://anon-ftp.ceda.ac.uk/neodc/esacci/soil_moisture/data/</a>                                                                |
| European Station for Time series in the Ocean Canary Islands (ESTOC) |                               | In situ        | Point-based                                                         | 5.3.2                                                                                                          | 1995–2018   | González-Dávila et al. (2010)<br><a href="http://data.plocan.eu/thredds/catalog/aggregate/public/ESTOCInSitu/EMSOservices/Biogeochemistry/catalog.html">http://data.plocan.eu/thredds/catalog/aggregate/public/ESTOCInSitu/EMSOservices/Biogeochemistry/catalog.html</a> |
| Alpine precipitation grid dataset (EURO4M-APGD)                      | 1.0                           | In situ        | Daily<br>0.04° × 0.04°                                              | 10.2.2                                                                                                         | 1971–2008   | Isotta et al. (2014)                                                                                                                                                                                                                                                     |
| FLO1K flow metrics dataset                                           |                               | In situ        | Annual<br>1 km                                                      | 2.3.1                                                                                                          | 1960–2015   | Barbarossa et al. (2018)                                                                                                                                                                                                                                                 |



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|----------------------------------------------------------------|---------|----------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fogt SAM reconstruction                                        |         | In situ        | Monthly index                | 2.4.1                                                                                                                    | 1865–2005   | Fogt et al. (2009)<br><a href="http://polarmet.osu.edu/ACD/sam/sam_recon.html">http://polarmet.osu.edu/ACD/sam/sam_recon.html</a>                                                                                        |
| Global mean sea level reconstruction (Frederikse)              | 2018    | In situ        | Annual<br>Global time series | 2.3.3                                                                                                                    | 1958–2014   | Frederikse et al. (2018)                                                                                                                                                                                                 |
| Global mean sea level reconstruction (Frederikse)              | 2020    | In situ        | Annual<br>Global time series | 2.3.3                                                                                                                    | 1900–2018   | Frederikse et al. (2020)                                                                                                                                                                                                 |
| GHCN precipitation                                             | 2       | In situ        | Monthly<br>5° × 5°           | 3.3.2<br>3.8.1<br>3.8.2                                                                                                  | 1900–2014   | Jones and Moberg (2003)<br><a href="http://www.esrl.noaa.gov/psd/data/gridded/data.ghcngripp2.html">www.esrl.noaa.gov/psd/data/gridded/data.ghcngripp2.html</a>                                                          |
| Global Historical Climatology Network (GHCN) – Monthly         | 4       | In situ        | Monthly<br>Point-based       | 2.3.1<br>3.8.2<br>10.3.3                                                                                                 | 1880–2020   | Menne et al. (2018)<br><a href="http://www.ncdc.noaa.gov/ghcnm/">www.ncdc.noaa.gov/ghcnm/</a>                                                                                                                            |
| GHCNDEX                                                        |         | In situ        | Monthly<br>2.5° × 2.5°       | 2.3.1                                                                                                                    | 1951–2020   | Donat et al. (2013b)<br><a href="http://www.climdex.org">www.climdex.org</a>                                                                                                                                             |
| Global albedo change (Ghimire)                                 |         | In situ        | Monthly<br>1° × 1°           | 2.2.7                                                                                                                    | 1700–2005   | Ghimire et al. (2014)                                                                                                                                                                                                    |
| GISTEMP                                                        | 4       | In situ        | Monthly<br>2° × 2°           | 1.3.6<br>2.3.1<br>3.7.3<br>CCB 3.1<br>10.6.4<br>Box 10.3                                                                 | 1880–2020   | Lenssen et al. (2019)<br><a href="https://data.giss.nasa.gov/gistemp/">https://data.giss.nasa.gov/gistemp/</a>                                                                                                           |
| Glacier Thickness Database (GlaThiDa)                          | 3.0.1   | In situ        | Annual<br>Point-based        | 9.5.1                                                                                                                    | 1935–2018   | GlaThiDa Consortium (2019)<br><a href="http://www.gtn-g.ch/data_catalogue_glathida/">www.gtn-g.ch/data_catalogue_glathida/</a><br>doi:10.5904/wqms-glathida-2019-03                                                      |
| GLDAS                                                          |         | Reanalysis     | Monthly<br>1° × 1°           | 3.4.2<br>8.3.1                                                                                                           | 1951–2010   | Rodell et al. (2004)<br><a href="https://hydro1.gesdisc.eosdis.nasa.gov/data/GLDAS/GLDAS_NOAH10_M.2.0/">https://hydro1.gesdisc.eosdis.nasa.gov/data/GLDAS/GLDAS_NOAH10_M.2.0/</a>                                        |
| Global Carbon Project                                          |         | In situ        | Global<br>Spatial average    | 5.2.1<br>5.2.2                                                                                                           | 1959–2020   | Friedlingstein et al. (2020); Saunio et al. (2020)<br><a href="http://www.globalcarbonproject.org/">www.globalcarbonproject.org/</a>                                                                                     |
| Global Ocean Data Analysis Project (GLODAP)                    | 2       | In situ        | Point-based                  | 5.2.1                                                                                                                    | 1972–2020   | Olsen et al. (2019)<br><a href="http://www.glodap.info/">www.glodap.info/</a>                                                                                                                                            |
| Global Space-based Stratospheric Aerosol Climatology (GloSSAC) | 1.0     | Remote sensing | Monthly<br>5° zonal means    | 2.2.2<br>7.3.2                                                                                                           | 1979–2016   | Thomason et al. (2018)<br><a href="https://eosweb.larc.nasa.gov">https://eosweb.larc.nasa.gov</a>                                                                                                                        |
| Ghana Meteorological Agency (GMet) precipitation               | 1.0     | In situ        | Monthly<br>0.5° × 0.5°       | 10.2.1                                                                                                                   | 1990–2012   | Aryee et al. (2018)                                                                                                                                                                                                      |
| GOME global total ozone (GTO) dataset                          |         | Remote sensing | Monthly<br>1° × 1°           | 2.2.5                                                                                                                    | 1996–2020   | Coldewey-Egbers et al. (2015)<br><a href="http://www.esa-ozone-cci.org/?q=node/163">www.esa-ozone-cci.org/?q=node/163</a>                                                                                                |
| GOME GSG ozone dataset                                         |         | Remote sensing | Monthly<br>5° zonal means    | 2.2.5                                                                                                                    | 1995–2020   | Weber et al. (2018a)<br><a href="http://www.iup.uni-bremen.de/gome/wfdoas/merged/">www.iup.uni-bremen.de/gome/wfdoas/merged/</a>                                                                                         |
| GOSAT                                                          | 2019    | Remote sensing | Hourly–monthly               | 5.2.1                                                                                                                    | 2009–2017   | Yoshida et al. (2013)<br><a href="http://www.gosat.nies.go.jp/en/recent-global-ch4.html">www.gosat.nies.go.jp/en/recent-global-ch4.html</a>                                                                              |
| Global Precipitation Climatology Centre (GPCP)                 | 8       | In situ        | Monthly<br>0.25° × 0.25°     | 1.2.1<br>2.3.1<br>3.3.3<br>3.7.3<br>8.3.1<br>8.3.2<br>Box 8.1<br>10.3.3<br>10.4.2<br>10.6.3<br>10.6.4<br>11.6.2<br>Atlas | 1981–2020   | Becker et al. (2013); Schneider et al. (2017)<br><a href="ftp://ftp.dwd.de/pub/data/gpcp/html/fulldata-monthly_v2018_doi_download.html">ftp://ftp.dwd.de/pub/data/gpcp/html/fulldata-monthly_v2018_doi_download.html</a> |



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|------------------------------------------------------------------------------------------|--------------|----------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Global Precipitation Climatology Project (GPCP)                                          | 2.3          | Remote sensing, in situ    | Monthly<br>2.5° × 2.5°                     | 2.3.1<br>3.3.2<br>3.3.3<br>3.7.3<br>3.8.2<br>8.2.3<br>8.3.1<br>9.2.1<br>10.4.2<br>Atlas                | 1979–2020   | Adler et al. (2018)<br><a href="http://www.esrl.noaa.gov/psd/data/gridded/data.gpcp.html">www.esrl.noaa.gov/psd/data/gridded/data.gpcp.html</a>                    |
| Gravity Recovery and Climate Experiment (GRACE)                                          |              | Remote sensing             | 3 days<br>400 m                            | 2.3.2<br>8.3.1                                                                                         | 2002–2017   | Tapley et al. (2004); Wouters et al. (2019)<br><a href="https://gracefo.jpl.nasa.gov/data/grace-fo-data/">https://gracefo.jpl.nasa.gov/data/grace-fo-data/</a>     |
| GRID-Sat                                                                                 |              | Remote sensing             | 15-minute<br>4 km                          | 8.3.1                                                                                                  | 1994–2016   | Inamdar and Knapp (2015)                                                                                                                                           |
| The Oceanic sink for anthropogenic CO <sub>2</sub> from 1994 to 2007 – the data (Gruber) |              | In situ                    | 1° × 1°                                    | 5.2.1                                                                                                  |             | Gruber et al. (2019)<br><a href="http://www.nodc.noaa.gov/archive/arc0132/0186034/1.1/data/0-data/">www.nodc.noaa.gov/archive/arc0132/0186034/1.1/data/0-data/</a> |
| Global Streamflow Indices and Metadata Archive (GSIM)                                    |              | In situ                    | Daily<br>Point-based                       | 2.3.1                                                                                                  | 1806–2016   | Do et al. (2018)                                                                                                                                                   |
| GSMaP                                                                                    |              | Remote sensing             | Hourly<br>0.1°                             | 10.3.3                                                                                                 | 2007–2020   | Kubota et al. (2020)                                                                                                                                               |
| GEWEX Water Vapour Assessment (G-VAP)                                                    |              | Reanalysis, remote sensing | Monthly<br>2° × 2°                         | 2.3.1                                                                                                  | 1988–2009   | Schröder et al. (2018)<br><a href="http://qewex-vap.org/">http://qewex-vap.org/</a>                                                                                |
| HadAT                                                                                    | 2            | In situ                    | Monthly<br>5° latitude by<br>10° longitude | Atlas                                                                                                  | 1958–2012   | Thorne et al. (2005)<br><a href="http://www.metoffice.gov.uk/hadobs/hadat/">www.metoffice.gov.uk/hadobs/hadat/</a>                                                 |
| HadCRUT                                                                                  | 5            | In situ                    | Monthly<br>5° × 5°                         | 1.2.1<br>1.3.6<br>1.4.1<br>1.6.1<br>2.3.1<br>CCB 2.3<br>3.3.1<br>3.6.1<br>3.8.1<br>CCB 3.1<br>Box 10.3 | 1850–2020   | Morice et al. (2021)<br><a href="http://www.metoffice.gov.uk/hadobs/">www.metoffice.gov.uk/hadobs/</a>                                                             |
| HadCRUT                                                                                  | 4            | In situ                    | Monthly<br>5° × 5°                         | 3.3.1<br>FAQ 3.1<br>8.2.3<br>10.3.3<br>10.6.4                                                          | 1850–2020   | Morice et al. (2012)<br><a href="http://www.metoffice.gov.uk/hadobs/hadcrut4/">www.metoffice.gov.uk/hadobs/hadcrut4/</a>                                           |
| HadEX                                                                                    | 2            | In situ                    | Monthly<br>3.75° × 2.5°                    | 2.3.1                                                                                                  | 1901–2010   | Donat et al. (2013a)<br><a href="http://www.climdex.org">www.climdex.org</a>                                                                                       |
| HadEX                                                                                    | 3            | In situ                    | Monthly<br>1.875° × 1.25°                  | CCB 3.2<br>11.1.4<br>11.3.2<br>11.4.3<br>11.6.2                                                        | 1901–2020   | Dunn et al. (2020)<br><a href="http://www.metoffice.gov.uk/hadobs/hadex3/">www.metoffice.gov.uk/hadobs/hadex3/</a>                                                 |
| HadGHCND                                                                                 |              | In situ                    | Daily<br>3.75° × 2.5°                      | Atlas                                                                                                  | 1950–2014   | Caesar et al. (2006)<br><a href="http://www.metoffice.gov.uk/hadobs/hadghcnd/">www.metoffice.gov.uk/hadobs/hadghcnd/</a>                                           |
| HadISD                                                                                   | 2.0.2. 2017f | In situ                    | Sub-daily<br>Point-based                   | 2.3.1                                                                                                  | 1973–2020   | Dunn et al. (2012, 2016)<br><a href="http://www.metoffice.gov.uk/hadobs/hadis/">www.metoffice.gov.uk/hadobs/hadis/</a>                                             |
| HadISDH                                                                                  | 1.0.0. 2019f | In situ                    | Monthly<br>5° × 5°                         | 2.3.1                                                                                                  | 1973–2020   | Willett et al. (2014, 2020)<br><a href="http://www.metoffice.gov.uk/hadobs/hadisdh/">www.metoffice.gov.uk/hadobs/hadisdh/</a>                                      |

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|------------------------------------------------------------------------------------|---------|-------------------------|------------------------------------------------------|-------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hadley Centre Sea Ice and Sea Surface Temperature dataset (HadISST)                | 1       | In situ, remote sensing | Monthly<br>1° × 1°                                   | 2.4.3<br>2.4.5<br>3.5.1<br>3.7.3<br>3.7.6<br>3.7.7<br>3.8.1<br>7.4.4<br>9.2.1 | 1871–2020   | Rayner et al. (2003)<br><a href="http://www.metoffice.gov.uk/hadobs/hadisst/">www.metoffice.gov.uk/hadobs/hadisst/</a>                                                                                                        |
| Hadley Centre HadNMAT2 night marine air temperature                                | 2       | In situ                 | Monthly<br>5° × 5°                                   | CCB 2.3                                                                       | 1880–2010   | Kent et al. (2013)<br><a href="http://www.metoffice.gov.uk/hadobs/hadnmat2/">www.metoffice.gov.uk/hadobs/hadnmat2/</a>                                                                                                        |
| Hadley Centre Sea Level Pressure (HadSLP)                                          | 2r      | In situ, reanalysis     | Monthly<br>5° × 5°                                   | 3.3.3                                                                         | 1850–2020   | Allan and Ansell (2006)<br><a href="http://www.metoffice.gov.uk/hadobs/hadslp2/">www.metoffice.gov.uk/hadobs/hadslp2/</a>                                                                                                     |
| Hadley Centre HadSST sea surface temperature                                       | 4       | In situ                 | Monthly<br>5° × 5°                                   | 9.2.1<br>Atlas                                                                | 1850–2020   | Kennedy et al. (2019)<br><a href="http://www.metoffice.gov.uk/hadobs/">www.metoffice.gov.uk/hadobs/</a>                                                                                                                       |
| HadUK-Grid                                                                         | 1.0     | In situ                 | Daily<br>0.009° × 0.009°                             | 10.2.1                                                                        | 1862–2019   | <a href="http://www.metoffice.gov.uk/climate/uk/data/haduk-grid/haduk-grid">www.metoffice.gov.uk/climate/uk/data/haduk-grid/haduk-grid</a>                                                                                    |
| Hawaii Ocean Time-series Data                                                      |         | In situ                 | Point-based                                          | 2.3.3                                                                         | 1988–2018   | Dore et al. (2009)<br><a href="http://hahana.soest.hawaii.edu/hot/hot-dogs/interface.html">http://hahana.soest.hawaii.edu/hot/hot-dogs/interface.html</a>                                                                     |
| Global mean sea level reconstruction (Hay)                                         |         | In situ                 | Annual<br>Global mean                                | 2.3.3                                                                         | 1901–2010   | Hay et al. (2015)                                                                                                                                                                                                             |
| Boulder stratospheric water vapor (Hegglin)                                        |         | In situ                 |                                                      | 2.2.5                                                                         | 1980–2010   | Hegglin et al. (2014)                                                                                                                                                                                                         |
| Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite data record (HOAPS4) |         | Remote sensing          | 6-hourly<br>0.5° × 0.5°                              | 2.3.1                                                                         | 1987–2014   | Andersson et al. (2010, 2017)<br><a href="https://wui.cmsaf.eu/safira/action/viewDoiDetails?acronym=HOAPS_V002">https://wui.cmsaf.eu/safira/action/viewDoiDetails?acronym=HOAPS_V002</a><br>doi:10.5676/EUM_SAF_CM/HOAPS/V002 |
| Glacier and ice sheet dataset (Hugonnet)                                           |         | Remote sensing          | Annual<br>Point-based                                | 2.3.2                                                                         | 2000–2019   | Hugonnet et al. (2021)                                                                                                                                                                                                        |
| Central European high-resolution gridded daily datasets (HYRAS)                    | 1.0     | In situ                 | Daily<br>0.5° × 0.5°,<br>0.25° × 0.25°               | 10.2.1                                                                        | 1951–2006   | Frick et al. (2014)                                                                                                                                                                                                           |
| IAGOS airborne ozone data                                                          |         | In situ                 | Intermittent                                         | 2.2.5<br>6.3.2                                                                | 1994–2020   | Cohen et al. (2018); Cooper et al. (2020); Gaudel et al. (2020)<br><a href="http://www.iagos-data.fr/">www.iagos-data.fr/</a><br>doi:10.25326/20                                                                              |
| ICESat sea ice thickness data                                                      |         | Remote sensing          | Intermittent<br>25 × 25 km                           | 2.3.1                                                                         | 2003–2008   | Kwok et al. (2009)<br><a href="http://nsidc.org/cryosphere/sotc/sea_ice.html">http://nsidc.org/cryosphere/sotc/sea_ice.html</a>                                                                                               |
| International Comprehensive Ocean–Atmosphere Data Set (ICOADS)                     | 3.0     | In situ                 | Frequency varies,<br>point-based<br>Monthly, 1° × 1° | 2.3.1                                                                         | 1662–2019   | Freeman et al. (2017)<br><a href="https://icoads.noaa.gov/">https://icoads.noaa.gov/</a>                                                                                                                                      |
| IFREMER4                                                                           | 4       | Remote sensing          | Daily<br>0.25° × 0.25°                               | 9.2.1                                                                         | 1992–2017   | de Boyer Montégut et al. (2004); Bentamy et al. (2017)                                                                                                                                                                        |
| Integrated Global Radiosonde Archive (IGRA)                                        |         | In situ                 | Point-based                                          | 8.3.1                                                                         | 1900–2019   | Durre et al. (2006)<br><a href="https://data.noaa.gov/dataset/dataset/integrated-global-radiosonde-archive-igra-version-2">https://data.noaa.gov/dataset/dataset/integrated-global-radiosonde-archive-igra-version-2</a>      |
| IMBIE Greenland and Antarctic ice sheet mass                                       |         | Remote sensing          | Regional aggregate                                   | 2.3.2<br>9.4.1<br>9.4.2                                                       | 1992–2017   | The IMBIE Team (2018, 2019, 2021)                                                                                                                                                                                             |
| Indian Monsoon Data Assimilation and Analysis (IMDAA)                              |         | Reanalysis              | Sub-daily<br>0.11° × 0.11°                           | 10.2.1                                                                        | 1979–2016   | Mahmood et al. (2018)                                                                                                                                                                                                         |
| Indian Institute of Tropical Meteorology (IITM) all-India rainfall                 |         | In situ                 | Monthly<br>Time series                               | 10.6.3                                                                        | 1871–1993   | Parthasarathy et al. (1994)                                                                                                                                                                                                   |
| IPRC subsurface temperature data                                                   |         | In situ                 | Monthly<br>1° × 1°                                   | 2.3.3                                                                         | 2005–2020   | <a href="http://apdrc.soest.hawaii.edu/projects/Argo/data/gridded/On_standard_levels/index-1.html">http://apdrc.soest.hawaii.edu/projects/Argo/data/gridded/On_standard_levels/index-1.html</a>                               |

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|---------------------------------------------------------------------------------|---------|----------------|-------------------------------------------------------------|-----------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISAS-15 temperature and salinity gridded fields                                 |         | In situ        | Monthly<br>1° × 1°                                          | 2.3.3                                                           | 2002–2015   | Gaillard et al. (2016); Kolodziejczyk et al. (2017)<br><a href="http://www.seanoe.org/data/00412/52367/">www.seanoe.org/data/00412/52367/</a>                                                                |
| Ocean heat content (Ishii)                                                      |         | In situ        | Annual<br>Time series                                       | 2.3.3<br>9.2.2                                                  | 1955–2020   | Ishii et al. (2017)                                                                                                                                                                                          |
| JAMSTEC Database for time series stations K2 and S1                             |         | In situ        | Point-based                                                 | 5.3.2                                                           | 1997–2018   | Wakita et al. (2017)<br><a href="http://www.godac.jamstec.go.jp/catalog/data_catalog/metadataDisp/JAMSTEC_K2_S1?lang=en">www.godac.jamstec.go.jp/catalog/data_catalog/metadataDisp/JAMSTEC_K2_S1?lang=en</a> |
| Jena-MLS air–sea CO <sub>2</sub> fluxes                                         | 2018    | In situ        | Daily<br>4° × 5°                                            | 5.2.1                                                           | 1982–2017   | Rödenbeck et al. (2013, 2014)<br><a href="http://www.bgc-jena.mpg.de/CarboScope/?ID=oc">www.bgc-jena.mpg.de/CarboScope/?ID=oc</a>                                                                            |
| Global mean sea level reconstruction (Jevrejeva)                                |         | In situ        | Annual<br>Global time series                                | 2.3.3                                                           | 1807–2009   | Jevrejeva et al. (2014)                                                                                                                                                                                      |
| JMA-TRANSCOM                                                                    |         | Reanalysis     | Monthly<br>1° × 1°                                          | 3.6.1<br>3.8.2                                                  | 1985–2008   | Gurney et al. (2003)                                                                                                                                                                                         |
| Japanese Ocean Flux Data Sets with Use of Remote Sensing Observations (JOFURO3) | 3       | Remote sensing | Daily<br>0.25° × 0.25°                                      | 8.3.1                                                           | 1988–2013   | Tomita et al. (2017)                                                                                                                                                                                         |
| Belgium precipitation (Journée)                                                 |         | In situ        | Daily<br>4 km <sup>2</sup>                                  | 10.2.1                                                          | 1981–2010   | Journée et al. (2015)                                                                                                                                                                                        |
| Japan Meteorological Agency JRA-55 reanalysis                                   |         | Reanalysis     | 3-hourly<br>TL319<br>(approx. 55 km),<br>60 vertical levels | 2.3.1<br>3.3.3<br>3.7.1<br>3.8.2<br>8.3.2<br>10.3.3<br>CCB 10.4 | 1958–2020   | Kobayashi et al. (2015); Harada et al. (2016)<br><a href="https://jra.kishou.go.jp/JRA-55/index_en.html">https://jra.kishou.go.jp/JRA-55/index_en.html</a>                                                   |
| JRA-25                                                                          |         | Reanalysis     | 6-hourly<br>T106<br>(approx. 120km)                         | 10.3.3                                                          | 1979–2004   | Onogi et al. (2007)<br><a href="https://jra.kishou.go.jp/JRA-25/index_en.html">https://jra.kishou.go.jp/JRA-25/index_en.html</a>                                                                             |
| Kadow global temperature dataset                                                |         | In situ        | Monthly<br>5° × 5°                                          | 1.4.1<br>1.6.1<br>2.3.1<br>CCB 2.3<br>3.3.1<br>CCB 3.1          | 1850–2020   | Kadow et al. (2020)                                                                                                                                                                                          |
| Kaplan Extended SST dataset                                                     | 2       | In situ        | Monthly<br>5° × 5°                                          | 2.4.3<br>2.4.5<br>Atlas                                         | 1856–2019   | Kaplan et al. (1998)<br><a href="http://www.esrl.noaa.gov/psd/data/gridded/data.kaplan_sst.html">www.esrl.noaa.gov/psd/data/gridded/data.kaplan_sst.html</a>                                                 |
| Greenland Ice Sheet discharge (King)                                            |         | Remote sensing | Annual<br>Regional time series                              | 9.4.1                                                           | 1985–2018   | King et al. (2020)<br><a href="https://datadryad.org/stash/dataset/doi:10.5061/dryad.qrfj6q5cb">https://datadryad.org/stash/dataset/doi:10.5061/dryad.qrfj6q5cb</a><br>doi:10.5061/dryad.qrfj6q5cb           |
| Kyoto cherry blossom data                                                       |         | In situ        | Annual<br>Point-based                                       | 2.3.4                                                           | 801–2020    | Aono and Saito (2010)<br><a href="http://atmenv.envi.osakafu-u.ac.jp/aono/kyophenotemp4/">http://atmenv.envi.osakafu-u.ac.jp/aono/kyophenotemp4/</a>                                                         |
| LAI3g                                                                           |         | Remote sensing | Monthly<br>0.5° × 0.5°                                      | 3.6.1<br>3.8.2                                                  | 1982–2011   | Zhu et al. (2013)                                                                                                                                                                                            |
| LandFlux-EVAL                                                                   |         | In situ        | Monthly                                                     | 3.8.2<br>8.3.1                                                  | 2000–2004   | Mueller et al. (2013)<br><a href="http://www.iac.ethz.ch/groups/seneviratne/research/LandFlux-EVAL">www.iac.ethz.ch/groups/seneviratne/research/LandFlux-EVAL</a>                                            |
| Landsat Global Land Survey (GLS) database                                       |         | Remote sensing | Daily<br>Global images                                      | 8.3.1                                                           | 1972–2019   | Gutman et al. (2013)                                                                                                                                                                                         |
| LAQN (London)                                                                   |         | In situ        | 15-minute                                                   | Box 10.3                                                        | 1993–2019   | <a href="http://www.londonair.org.uk">www.londonair.org.uk</a>                                                                                                                                               |
| LDEO Global Ocean Surface Water Partial Pressure of CO <sub>2</sub> Database    |         | In situ        | Point-based                                                 | 5.3.2                                                           | 1957–2018   | Takahashi et al. (2014)<br><a href="http://www.nodc.noaa.gov/ocads/oceans/LDEO_Underway_Database/NDP-088_V2018.pdf">www.nodc.noaa.gov/ocads/oceans/LDEO_Underway_Database/NDP-088_V2018.pdf</a>              |
| LEGOS sea level budget                                                          |         | Remote sensing | Monthly<br>Global time series                               | 2.3.3                                                           | 1993–2020   | Blazquez et al. (2018)                                                                                                                                                                                       |

| Name                                                                         | Version     | Type                                | Resolution (Time and Space)                     | Section(s)              | Time Period | Citation, Link and DOI (Where Available)                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------|-------------|-------------------------------------|-------------------------------------------------|-------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Combined satellite and station data (Maidment)                               |             | Remote sensing, in situ             | 10-day<br>0.0375° × 0.0375°                     | 10.2.1                  | 1983–2012   | Maidment et al. (2014)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Marshall SAM index                                                           |             | In situ                             | Monthly<br>Regional means                       | 2.4.1                   | 1957–2020   | Marshall (2003)<br><a href="http://www.nerc-bas.ac.uk/icd/gjma/sam.html">www.nerc-bas.ac.uk/icd/gjma/sam.html</a>                                                                                                                                                                                                                                                                                                                                                                                            |
| Princeton MEaSUREs                                                           |             | Reanalysis, remote sensing, in situ | Monthly<br>0.5° × 0.5°                          | 8.3.1                   | 1950–2019   | Pan et al. (2012)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Multivariate ENSO Index (MEI)                                                |             | In situ                             | Monthly                                         | 5.2.3                   | 1977–2017   | Wolter and Timlin (1998)<br><a href="http://www.esrl.noaa.gov/psd/enso/mei/">www.esrl.noaa.gov/psd/enso/mei/</a>                                                                                                                                                                                                                                                                                                                                                                                             |
| Historical greenhouse gas concentrations for climate modelling (Meinshausen) |             | In situ                             | Monthly<br>15° zonal means                      | 2.2.3                   | 1850–2014   | Meinshausen et al. (2017)<br><a href="http://www.climatecollege.unimelb.edu.au/cmip6">www.climatecollege.unimelb.edu.au/cmip6</a>                                                                                                                                                                                                                                                                                                                                                                            |
| MERRA Reanalysis                                                             | 1           | Reanalysis                          | 3-hourly<br>0.5° × 0.66°                        | 8.3.2                   | 1979–2016   | Rienecker et al. (2011)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| MERRA-2 reanalysis                                                           | 2           | Reanalysis                          | Hourly<br>0.5 × 0.66°,<br>72 vertical levels    | 2.3.1<br>3.3.3<br>8.3.2 | 1980–2020   | Gelaro et al. (2017)<br><a href="https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/">https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/</a>                                                                                                                                                                                                                                                                                                                                                                          |
| MERRA-2 reanalysis – Land                                                    | 2           | Reanalysis                          | 6-hourly<br>0.5° × 0.66°,<br>72 vertical levels | 8.3.1                   | 1980–2020   | Reichle (2012)<br><a href="http://gmao.gsfc.nasa.gov/pubs/office_notes">http://gmao.gsfc.nasa.gov/pubs/office_notes</a>                                                                                                                                                                                                                                                                                                                                                                                      |
| METROS (Tokyo)                                                               |             | In situ                             | 15-minute                                       | Box 10.3                | 2000–2005   | Takahashi et al. (2011)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| MIROC4-ACTM emission flux data                                               | 2018        | Reanalysis                          | Monthly<br>1° × 1°                              | 5.2.2                   | 1996–2016   | Patra et al. (2016, 2018); Saeki and Patra (2017)<br><a href="https://ebcrpa.jamstec.go.jp/~prabir/data/co2l2r84/s042_FaChOt_srcdf1/">https://ebcrpa.jamstec.go.jp/~prabir/data/co2l2r84/s042_FaChOt_srcdf1/</a><br><a href="https://ebcrpa.jamstec.go.jp/~prabir/data/ch4l2r53/gcp2019/">https://ebcrpa.jamstec.go.jp/~prabir/data/ch4l2r53/gcp2019/</a><br><a href="https://ebcrpa.jamstec.go.jp/~prabir/data/n2ol2r84/s037_edqman1/">https://ebcrpa.jamstec.go.jp/~prabir/data/n2ol2r84/s037_edqman1/</a> |
| MISR Component Global Aerosol Product                                        | V4, Level 3 | Remote sensing                      | Yearly<br>0.5° × 0.5° grid                      | 2.2.6                   | 2000–2020   | Garay et al. (2017)<br><a href="https://cmr.earthdata.nasa.gov/search/concepts/C43677715-LARC.html">https://cmr.earthdata.nasa.gov/search/concepts/C43677715-LARC.html</a>                                                                                                                                                                                                                                                                                                                                   |
| MOCCA (Ghent)                                                                |             | In situ                             | 15-minute                                       | Box 10.3                | 2016–2020   | Vandemeulebroucke et al. (2019); Caluwaerts et al. (2020)                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NASA Merged Ozone Data (MOD)                                                 | 8.6         | Remote sensing                      | Monthly<br>5° zonal means                       | 2.2.6                   | 1970–2020   | Frith et al. (2017)<br><a href="https://acd-ext.gsfc.nasa.gov/Data_services/merged/index.html">https://acd-ext.gsfc.nasa.gov/Data_services/merged/index.html</a>                                                                                                                                                                                                                                                                                                                                             |
| MODIS Aerosol Optical Depth 550nm                                            | MYD08_M3    | Remote sensing                      | Monthly<br>1° × 1°                              | 2.2.6                   | 2003–2011   | Platnick et al. (2003)<br><a href="https://adsweb.modaps.eosdis.nasa.gov/search/order">https://adsweb.modaps.eosdis.nasa.gov/search/order</a>                                                                                                                                                                                                                                                                                                                                                                |
| MODIS NDVI/EVI vegetation greenness index                                    | 6           | Remote sensing                      | 16-day<br>1 km                                  | 5.2.1                   | 2000–2018   | Myneni et al. (2015)<br>doi:10.5067/MODIS/MCD15A2H.006                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Moderate Resolution Imaging Spectro-radiometer (MODIS)                       | MCD12Q1     | Remote sensing                      | Annual<br>500 m                                 | 8.3.1                   | 2001–2019   | Loveland and Belward (1997)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| MPI-SOMFFN air–sea CO <sub>2</sub> fluxes                                    | 2016        | In situ                             | Monthly<br>1° × 1°                              | 3.8.2<br>5.2.1          | 1982–2015   | Landschützer et al. (2016)<br><a href="http://www.nodc.noaa.gov/ocads/oceans/SPCO2_1982_2015_ETH_SOM_FFNN.html">www.nodc.noaa.gov/ocads/oceans/SPCO2_1982_2015_ETH_SOM_FFNN.html</a>                                                                                                                                                                                                                                                                                                                         |
| Ozone Multi-sensor Reanalysis (MSR)                                          | 2           | Reanalysis                          | 6-hourly<br>1° × 1°                             | 2.2.5                   | 1970–2019   | Braesicke et al. (2018); Chipperfield et al. (2018); Weber et al. (2018b, 2020)<br><a href="http://www.temis.nl/protocols/O3global.php">www.temis.nl/protocols/O3global.php</a>                                                                                                                                                                                                                                                                                                                              |
| Multi-Source Weighted-Ensemble Precipitation dataset (MSWEP)                 |             | Reanalysis, remote sensing, in situ | 3-hourly<br>0.25° × 0.25°                       | 8.3.1                   | 1979–2015   | Beck et al. (2017)<br><a href="https://wald.anu.edu.au/data_services/data/mswep-multi-source-weighted-ensem%2%ADble-pre%2%ADcip%2%ADi%2%ADta%2%ADtion/">https://wald.anu.edu.au/data_services/data/mswep-multi-source-weighted-ensem%2%ADble-pre%2%ADcip%2%ADi%2%ADta%2%ADtion/</a>                                                                                                                                                                                                                          |
| MTE Gross Primary Productivity                                               | May12       | Reanalysis                          | Monthly<br>0.5° × 0.5°                          | 3.8.2                   | 1982–2011   | Jung et al. (2011)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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| Northern Hemisphere Blended Snow Cover Extent and Snow Mass Time Series (Mudryk)                |         | Remote sensing, in situ | Monthly Time series                        | 2.3.2<br>3.4.2<br>9.5.3                                     | 1980–2018               | Mudryk et al. (2020)<br><a href="http://data.ec.gc.ca/data/climate/scientificknowledge/climate-research-publication-based-data/northern-hemisphere-blended-snow-extent-and-snow-mass-time-series/">http://data.ec.gc.ca/data/climate/scientificknowledge/climate-research-publication-based-data/northern-hemisphere-blended-snow-extent-and-snow-mass-time-series/</a> |
| NASA global mean sea level                                                                      | 4.2     | Remote sensing          | 10-day Global time series                  | 2.3.3                                                       | 1993–2020               | Beckley et al. (2016)                                                                                                                                                                                                                                                                                                                                                   |
| NASA Team Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data | 1       | Remote sensing          | Monthly 25 km                              | 3.4.1                                                       | 1979–2019               | Cavalieri et al. (1996)<br><a href="https://nsidc.org/data/nsidc-0051">https://nsidc.org/data/nsidc-0051</a>                                                                                                                                                                                                                                                            |
| NCEI Ocean Heat Content                                                                         |         | In situ                 | Annual 1° × 1°                             | 2.3.3<br>9.2.2<br>9.3.2                                     | 1955–2020               | Levitus et al. (2012)<br><a href="http://www.ncei.noaa.gov/access/global-ocean-heat-content/">www.ncei.noaa.gov/access/global-ocean-heat-content/</a>                                                                                                                                                                                                                   |
| NCEP-NCAR Reanalysis                                                                            |         | Reanalysis              | Daily and monthly 2.5° × 2.5°              | 3.7.1<br>3.8.2<br>10.3.3                                    | 1980–2020               | Kalnay et al. (1996)<br><a href="http://www.esrl.noaa.gov/psd/data/gridded/data.ncep_reanalysis.html">www.esrl.noaa.gov/psd/data/gridded/data.ncep_reanalysis.html</a>                                                                                                                                                                                                  |
| New Zealand temperature and rainfall datasets                                                   |         | In situ                 | Daily Point-based                          | Atlas 6.2                                                   | 1870–2020               | NIWA (2020)                                                                                                                                                                                                                                                                                                                                                             |
| NIWA d <sup>13</sup> C-CO <sub>2</sub>                                                          | 2019    | In situ                 | Monthly                                    | 5.2.1                                                       | 1957–2015               | Turnbull et al. (2017)                                                                                                                                                                                                                                                                                                                                                  |
| NOAA atmospheric gas measurements                                                               |         | In situ                 | Time resolution depends on gas Point-based | 2.2.3<br>2.2.4<br>3.6.1<br>5.1.2<br>5.2.1<br>5.2.2<br>5.2.3 | Varies depending on gas | Masarie and Tans (2004); Montzka et al. (2009, 2015); Hall et al. (2011); Dlugokencky and Tans (2019)<br><a href="http://www.esrl.noaa.gov/gmd/ccgg/">www.esrl.noaa.gov/gmd/ccgg/</a>                                                                                                                                                                                   |
| NOAA ESRL MLO Carbon dioxide                                                                    |         | In situ                 | Monthly Point-based                        | 3.6.1                                                       | 1980–2014               | Zeng et al. (2014)<br><a href="http://www.esrl.noaa.gov/gmd/ccgg/trends/data.html">www.esrl.noaa.gov/gmd/ccgg/trends/data.html</a>                                                                                                                                                                                                                                      |
| NOAA Global Temp                                                                                | 5       | In situ                 | Monthly 5° × 5°                            | 1.3.6<br>10.6.4                                             | 1880–2020               | Huang et al. (2020)<br><a href="http://www.ncdc.noaa.gov/data-access/marineocean-data/noaa-global-surface-temperature-noaaglobaltemp">www.ncdc.noaa.gov/data-access/marineocean-data/noaa-global-surface-temperature-noaaglobaltemp</a>                                                                                                                                 |
| NOAA Global Temp – Interim                                                                      |         | In situ                 | Monthly 5° × 5°                            | 1.4.1<br>1.6.1<br>2.3.1<br>3.3.1<br>CCB 2.3<br>CCB 3.1      | 1850–2020               | Vose et al. (2021)                                                                                                                                                                                                                                                                                                                                                      |
| NOAA Merge ozone data (SBUV)                                                                    | 8.6     | Remote sensing          | Daily 5° zonal means                       | 2.2.5                                                       | 1978–2020               | Wild et al. (2016)<br><a href="ftp://ftp.cpc.ncep.noaa.gov/SBUV_CDR/">ftp://ftp.cpc.ncep.noaa.gov/SBUV_CDR/</a>                                                                                                                                                                                                                                                         |
| NOAA reconstructed snow cover dataset                                                           |         | Remote sensing, in situ | Monthly Hemispheric time series            | 3.4.2<br>9.5.3                                              | 1915–1997               | Brown (2002); Brown and Robinson (2011)<br><a href="https://nsidc.org/data/q02131">https://nsidc.org/data/q02131</a>                                                                                                                                                                                                                                                    |
| NOAA Climate Data Record of Sea Ice Concentration                                               | 3.0     | Remote sensing          | Monthly 25 km                              | 2.3.2                                                       | 1979–2020               | Peng et al. (2013)<br><a href="https://nsidc.org/data/q02202">https://nsidc.org/data/q02202</a>                                                                                                                                                                                                                                                                         |
| NOAA STAR satellite temperature                                                                 | 3.0     | Remote sensing          | Monthly 2.5° × 2.5°, 3 vertical layers     | 2.3.1                                                       | 1979–2020               | Zou and Wang (2011)<br><a href="http://www.star.nesdis.noaa.gov/smcd/emb/mscat/">www.star.nesdis.noaa.gov/smcd/emb/mscat/</a>                                                                                                                                                                                                                                           |
| National Oceanography Centre (NOC) surface flux and meteorological dataset                      | 2.0     | In situ                 | Monthly 1° × 1°                            | 2.3.1                                                       | 1973–2014               | Berry and Kent (2011)<br><a href="http://badc.nerc.ac.uk/data/nocs_flux/">http://badc.nerc.ac.uk/data/nocs_flux/</a>                                                                                                                                                                                                                                                    |
| African Rainfall Climatology (Novella and Thiaw)                                                | 2.0     | Remote sensing          | Daily 0.1° × 0.1°                          | 10.2.1                                                      | 1983–2010               | Novella and Thiaw (2013)                                                                                                                                                                                                                                                                                                                                                |
| National Sea and Ice Data Center (NSIDC) sea ice index                                          | 3       | Remote sensing          | Daily 25 km                                | 2.3.2                                                       | 1978–2020               | Fetterer et al. (2017)<br><a href="https://nsidc.org/data/G02135/versions/3">https://nsidc.org/data/G02135/versions/3</a>                                                                                                                                                                                                                                               |

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| NASA Water Vapor Project MEaSUREs (NVAP-M)                                          |         | Remote sensing          | Daily<br>1°                                                                             | 2.3.1          | 1988–2008   | Vonder Haar et al. (2012)<br><a href="https://public.satproj.klima.dwd.de/data/GVAP_data_archive/v1.0/TCWV/long/">https://public.satproj.klima.dwd.de/data/GVAP_data_archive/v1.0/TCWV/long/</a>                  |
| NYCMET-NET (New York)                                                               | 2.0.0   | In situ                 | 15-minute                                                                               | Box 10.3       | Ongoing     | <a href="http://nycmetnet.cuny.cuny.edu">http://nycmetnet.cuny.cuny.edu</a>                                                                                                                                       |
| OAFflux                                                                             |         | Remote sensing          | Daily<br>0.25° × 0.25°                                                                  | 2.3.1<br>9.2.1 | 1987–2019   | Yu et al. (2008)<br><a href="http://oafux.whoii.edu/">http://oafux.whoii.edu/</a>                                                                                                                                 |
| Ocean Colour Climate Change Initiative (OC-CCI)                                     | 4.2     | Remote sensing          | Daily<br>4 km                                                                           | 2.3.4          | 1997–2019   | Sathyendranath et al. (2019)<br><a href="https://climate.esa.int/en/projects/ocean-colour/">https://climate.esa.int/en/projects/ocean-colour/</a>                                                                 |
| Ocean Satellite Oceanographic Datasets for Acidification (OCEAN SODA-ETHZ)          |         | Remote sensing          | Monthly<br>1°                                                                           | 2.3.3          | 1985–2018   | Gregor and Gruber (2021)<br>doi:10.25921/m5wx-ja34                                                                                                                                                                |
| NOAA Optimum Interpolation SST (OISST)                                              | 2       | In situ, remote sensing | Daily<br>0.25° × 0.25°                                                                  | 2.4.3          | 1981–2020   | Reynolds et al. (2002); Banzon et al. (2016)<br><a href="http://www.ncdc.noaa.gov/oisst">www.ncdc.noaa.gov/oisst</a>                                                                                              |
| OSISAF/ CCI sea ice concentration                                                   | 450     | Remote sensing          | Monthly<br>25 km                                                                        | 2.3.2<br>3.4.1 | 1979–2015   | Lavergne et al. (2019)<br><a href="http://osisaf.met.no/p/ice/">http://osisaf.met.no/p/ice/</a>                                                                                                                   |
| USA temperature (Oyler)                                                             |         | In situ                 | Daily<br>30-arcsec                                                                      | 10.2.1         | 1948–2012   | Oyler et al. (2015)                                                                                                                                                                                               |
| Swiss Alps (Panziera)                                                               |         | Remote sensing          | Sub-daily<br>0.01° × 0.01°                                                              | 10.2.1         | 2005–2017   | Panziera et al. (2018)                                                                                                                                                                                            |
| Gridded dataset of hourly precipitation in Germany (Paulat)                         |         | In situ                 | Hourly<br>0.06° × 0.06°                                                                 | 10.2.1         | 2001–2004   | Paulat et al. (2008)                                                                                                                                                                                              |
| Portland State University (PDX) CH <sub>4</sub> , d <sup>13</sup> C-CH <sub>4</sub> | 2017    | In situ                 | Daily–monthly                                                                           | 5.2.2          | 1977–2010   | Rice et al. (2016)                                                                                                                                                                                                |
| PERSIANN-CDR                                                                        |         | Remote sensing          | Daily<br>0.25° × 0.25°                                                                  | 10.2.1         | 1982–2020   | Ashouri et al. (2015)<br><a href="http://www.ncdc.noaa.gov/cdr/atmospheric/precipitation-persiann-cdr">www.ncdc.noaa.gov/cdr/atmospheric/precipitation-persiann-cdr</a>                                           |
| Philadelphia plant data                                                             |         | In situ                 | Annual<br>Point-based                                                                   | 2.3.4          | 1840–2010   | Panchen et al. (2012)                                                                                                                                                                                             |
| PIOMAS Arctic sea ice reanalysis                                                    | 2.1     | Reanalysis              | Monthly<br>4°–5°                                                                        | 7.2.2          | 1979–2020   | Zhang and Rothrock (2003); Schweiger et al. (2011)<br><a href="http://psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/">http://psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/</a> |
| PMEL ocean heat content                                                             |         | In situ                 | Annual<br>Global time series                                                            | 2.3.3          | 1950–2011   | Lyman and Johnson (2014)                                                                                                                                                                                          |
| PROMICE Greenland Ice Sheet discharge                                               |         | Remote sensing          | Annual<br>Regional time series                                                          | 9.4.1          | 1986–2018   | Mankoff et al. (2019)<br><a href="http://promice.org/PromiceDataPortal">http://promice.org/PromiceDataPortal</a>                                                                                                  |
| PROMICE ice sheet mass balance                                                      |         | Remote sensing          | Annual<br>Regional time series                                                          | 9.4.1          | 1995–2019   | Colgan et al. (2019)<br><a href="http://promice.org/PromiceDataPortal">http://promice.org/PromiceDataPortal</a>                                                                                                   |
| Purkey and Johnson ocean heat content                                               |         | In situ                 | Annual<br>Global mean                                                                   | 2.3.3          | 1981–2010   | Purkey and Johnson (2010)                                                                                                                                                                                         |
| High Resolution Gridded Data for India (Rajeevan)                                   | 1.0     | In situ                 | Daily<br>1° × 1°                                                                        | 10.6.3         | 1951–2003   | Rajeevan et al. (2006)                                                                                                                                                                                            |
| Randolph Glacier Inventory                                                          | 6       | Remote sensing          | Decametric shape files of glacier outlines, global 0.5° global grid of glacierized area | 2.3.2<br>9.5.1 | 1955–2014   | Scherler et al. (2018)<br><a href="http://www.glims.org/RGI/rgi60_dl.html">www.glims.org/RGI/rgi60_dl.html</a>                                                                                                    |
| RAOB-CORE radiosonde dataset                                                        | 1.7     | In situ                 | Monthly<br>10° × 5°, 12 vertical levels                                                 | 2.3.1<br>3.3.1 | 1958–2020   | Haimberger et al. (2012)<br><a href="http://www.univie.ac.at/theoret-met/research/raobcore/">www.univie.ac.at/theoret-met/research/raobcore/</a>                                                                  |
| Global mean sea level reconstruction (Ray and Douglas)                              |         | In situ                 | Annual<br>Global time series                                                            | 2.3.3          | 1900–2010   | Ray and Douglas (2011)                                                                                                                                                                                            |

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|--------------------------------------------------------------------------------------------|---------|----------------|-----------------------------------------------------------|-------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REGEN global precipitation                                                                 | 1       | In situ        | Daily<br>1° × 1°                                          | 10.3.2                  | 1950–2016   | Contractor et al. (2020)<br><a href="https://researchdata.andcs.org.au/rainfall-estimates-gridded-v1-2019/1408744">https://researchdata.andcs.org.au/rainfall-estimates-gridded-v1-2019/1408744</a><br>doi:10.25914/5ca4c380b0d44 |
| RICH radiosonde dataset                                                                    | 1.7     | In situ        | Monthly<br>10° × 5°, 12 vertical levels                   | 2.3.1<br>3.3.1          | 1958–2020   | Haimberger et al. (2012)<br><a href="http://www.univie.ac.at/theoret-met/research/raobcore/">www.univie.ac.at/theoret-met/research/raobcore/</a>                                                                                  |
| Antarctic ice mass balance (Rignot)                                                        |         | Remote sensing | Annual<br>Regional average                                | 2.3.2                   | 1979–2017   | Rignot et al. (2019)                                                                                                                                                                                                              |
| ROCADA daily dataset Romania                                                               | 1.0     | In situ        | Daily<br>0.1° × 0.1°                                      | 10.2.1                  | 1961–2013   | Dumitrescu et al. (2016)                                                                                                                                                                                                          |
| MSG-based gridded datasets of clouds, precipitation and radiation (Roebeling and Holleman) |         | Remote sensing | Daily<br>0.27° × 0.27°                                    | 10.2.1                  | 2005–2019   | Roebeling and Holleman (2009)                                                                                                                                                                                                     |
| ROM SAF radio occultation climate data record                                              |         | Remote sensing | Monthly<br>5° latitude bins,<br>200 m vertical resolution | 2.3.1                   | 2001–2020   | Gleisner et al. (2020)<br><a href="http://www.romsaf.org">www.romsaf.org</a>                                                                                                                                                      |
| Arctic permafrost layer temperature (Romanovsky)                                           |         | In situ        | Annual<br>Site-based                                      | 2.3.2                   | 1977–2020   | Romanovsky et al. (2020)                                                                                                                                                                                                          |
| Israel precipitation (Rostkier-Edelstein)                                                  |         | Reanalysis     | Seasonal<br>0.02° × 0.02°                                 | 10.2.1                  | 1991–2009   | Rostkier-Edelstein et al. (2014)                                                                                                                                                                                                  |
| Remote Sensing Systems (RSS) precipitation and water vapour                                | 7       | Remote sensing | 2 per day<br>0.25° × 0.25°                                | 2.3.1<br>3.3.2          | 1987–2020   | Wentz (2013)<br><a href="http://www.remss.com/measurements/rain-rate/">www.remss.com/measurements/rain-rate/</a>                                                                                                                  |
| Remote Sensing Systems RSS satellite temperature                                           | 4.0     | Remote sensing | Monthly<br>2.5° × 2.5°,<br>5 vertical layers              | 2.3.1                   | 1979–2020   | Mears and Wentz (2017)<br><a href="http://www.remss.com/measurements/upper-air-temperature/">www.remss.com/measurements/upper-air-temperature/</a>                                                                                |
| Rutgers University/NOAA snow cover extent dataset                                          | V01r01  | Remote sensing | Weekly<br>100–200 km                                      | 2.3.2<br>9.5.3          | 1966–2020   | Estilow et al. (2015)<br><a href="https://climate.rutgers.edu/snowcover/">https://climate.rutgers.edu/snowcover/</a>                                                                                                              |
| SAFRAN temperature and precipitation for France                                            |         | Reanalysis     | Hourly<br>8 km <sup>2</sup>                               | 10.2.1                  | 1958–2008   | Vidal et al. (2010)                                                                                                                                                                                                               |
| SAT1 NASA satellite ozone data                                                             |         | Remote sensing | Daily<br>1° × 1°                                          | 2.2.5                   | 2004–2020   | Ziemke et al. (2019)<br><a href="https://acd-ext.gsfc.nasa.gov/Data_services/cloud_slice/new_data.html">https://acd-ext.gsfc.nasa.gov/Data_services/cloud_slice/new_data.html</a>                                                 |
| SAT2 NASA satellite ozone data                                                             |         | Remote sensing | Daily<br>1° × 1°                                          | 2.2.5                   | 2004–2020   | Heue et al. (2016)                                                                                                                                                                                                                |
| SAT3 NASA satellite ozone data                                                             |         | Remote sensing | Daily<br>1° × 1°                                          | 2.2.5                   | 2004–2020   | Leventidou et al. (2018)                                                                                                                                                                                                          |
| Scripps atmospheric CO <sub>2</sub> data                                                   |         | In situ        | Weekly<br>Point-based                                     | 1.2.1<br>2.2.3<br>5.2.1 | 1958–2019   | Keeling et al. (2001, 2005)<br><a href="http://scrippsco2.ucsd.edu/data/atmospheric_co2/">http://scrippsco2.ucsd.edu/data/atmospheric_co2/</a>                                                                                    |
| SeaWiFS FAPAR Data                                                                         | V2010.0 | Remote sensing | Monthly<br>1 km                                           | 2.3.4                   | 1998–2017   | Gobron (2018)<br><a href="https://fapar.jrc.ec.europa.eu/Home.php">https://fapar.jrc.ec.europa.eu/Home.php</a>                                                                                                                    |
| Norwegian seNorge2 precipitation                                                           | 2.0     | In situ        | Daily<br>0.008° × 0.008°                                  | 10.2.1                  | 1957–2019   | Lussana et al. (2018)                                                                                                                                                                                                             |
| Merged Precipitation in China (Shen)                                                       |         | In situ        | Hourly<br>0.01° × 0.01°                                   | 10.2.1                  | 2015        | Shen et al. (2018)                                                                                                                                                                                                                |
| The Surface Ocean CO <sub>2</sub> Atlas (SOCAT)                                            | 6       | In situ        | Point-based                                               | 5.2.1                   | 1957–2020   | Bakker et al. (2016)<br><a href="http://www.socat.info/">www.socat.info/</a>                                                                                                                                                      |
| Southern Oscillation Index (SOI)                                                           |         | In situ        | Monthly<br>Regional time series                           | 2.4.2                   | 1876–2020   | Troup (1965)<br><a href="http://www.bom.gov.au/climate/current/soihtm1.shtml">www.bom.gov.au/climate/current/soihtm1.shtml</a>                                                                                                    |
| Spain02                                                                                    | 5.0     | In situ        | Daily<br>0.1° × 0.1°                                      | 10.2.1                  | 1948–2002   | Herrera et al. (2016)                                                                                                                                                                                                             |



| Name                                                                  | Version | Type                    | Resolution (Time and Space)                       | Section(s)     | Time Period | Citation, Link and DOI (Where Available)                                                                                                                                                  |
|-----------------------------------------------------------------------|---------|-------------------------|---------------------------------------------------|----------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Arosa stratospheric ozone data (Staehelin)                            |         | In situ                 | Time resolution varies<br>Point-based             | 2.2.5          | 1926–2020   | Staehelin et al. (2018)                                                                                                                                                                   |
| STAMMEX                                                               |         | In situ                 | Daily<br>0.1°, 0.25° and 0.5°                     | 8.3.1          | 1931–2000   | Zolina et al. (2014)                                                                                                                                                                      |
| State University of New York (SUNY) radiosonde dataset                |         | In situ                 | Monthly<br>10° × 10°                              | 2.3.1          | 1958–2020   | Zhou et al. (2021)                                                                                                                                                                        |
| Stratospheric Water and Ozone Satellite Homogenized (SWOOSH)          | 2.5     | Remote sensing          | Monthly<br>2.5° zonal mean,<br>12 vertical levels | 2.2.5          | 1984–2020   | Davis et al. (2016)<br><a href="https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.ncdc:C00958">https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.ncdc:C00958</a>                        |
| Tibetan plateau growing season                                        |         | In situ                 | Annual<br>Point-based                             | 2.3.4          | 1960–2014   | B. Yang et al. (2017)                                                                                                                                                                     |
| Merged TM4NO2A tropospheric NO <sub>2</sub> dataset                   |         | Remote sensing          | Monthly<br>0.25°                                  | 6.3.3          | 1996–2016   | Georgoulias et al. (2019)<br><a href="http://www.temis.nl/airpollution/no2.php">www.temis.nl/airpollution/no2.php</a>                                                                     |
| Tropospheric Ozone Assessment Report (TOAR) surface ozone database    |         | In situ                 | Hourly<br>Point-based                             | 6.3.2          | 1970–2020   | Schultz et al. (2017); Tarasick et al. (2019)<br><a href="http://www.igacproject.org/activities/TOAR">www.igacproject.org/activities/TOAR</a>                                             |
| Tohoku Univ. N <sub>2</sub> O, d <sup>15</sup> N, <sup>15</sup> Na    | 2018    | In situ                 | Irregular                                         | 5.2.3          | 1950–2000   | Ishijima et al. (2007)                                                                                                                                                                    |
| TOST composite ozonesonde product                                     |         | In situ                 | Monthly<br>5° × 5° × 1 km                         | 2.2.5<br>6.3.2 | 1965–2012   | Tarasick et al. (2010); Liu et al. (2013); Gaudel et al. (2018)                                                                                                                           |
| TRMM Precipitation Radar 3A25                                         | 7       | Remote sensing          | Monthly<br>0.5°                                   | 8.3.1          | 1997–2014   | Iguchi et al. (2000)                                                                                                                                                                      |
| TRMM GPOF                                                             | GPOF    | Remote sensing          | Daily<br>0.25° × 0.25°                            | 8.3.1          | 1997–2015   | Stocker et al. (2018)                                                                                                                                                                     |
| TRMM Microwave Imager (TRMM TMI)                                      | TMI     | Remote sensing          | 3 day<br>0.25° × 0.25°                            | 8.3.1          | 1997–2015   | Wentz et al. (2001)                                                                                                                                                                       |
| TRMM Multi-Satellite Precipitation Analysis                           | 7.0     | Remote sensing          | 3-hourly<br>0.25° × 0.25°                         | 10.2.1         | 1997–2018   | Huffman et al. (2007); TRMM (2011); Z. Liu et al. (2012)<br><a href="https://disc.gsfc.nasa.gov/datasets/TRMM_3B42_7/summary">https://disc.gsfc.nasa.gov/datasets/TRMM_3B42_7/summary</a> |
| Tropical Rainfall Measuring Mission Precipitation Radar (TRMM PR)     | PR      | Remote sensing          | Monthly<br>0.5° × 0.5°                            | 8.3.1          | 1997–2015   | Haddad et al. (1997)                                                                                                                                                                      |
| TWIN (Taipei)                                                         |         | In situ                 | Hourly                                            | Box 10.3       | 2004–2020   | Chang et al. (2010)                                                                                                                                                                       |
| University of Alabama at Huntsville (UAH) satellite temperature       | 6.0     | Remote sensing          | Monthly<br>3 vertical layers                      | 2.3.1          | 1979–2020   | Spencer et al. (2017)<br><a href="http://www.nsstc.uah.edu/climate/">www.nsstc.uah.edu/climate/</a>                                                                                       |
| UC Berkeley, N <sub>2</sub> O, d <sup>15</sup> N, <sup>15</sup> Na    | 2018    | In situ                 | Event                                             | 5.2.3          | 1900–1995   | Park et al. (2012)                                                                                                                                                                        |
| University of Colorado global mean sea level                          |         | Remote sensing          | Monthly<br>Global time series                     | 2.3.3          | 1993–2017   | Nerem et al. (2018)                                                                                                                                                                       |
| UCAR/ NOAA radio occultation data                                     |         | Remote sensing          | Monthly<br>5° latitude bands                      | 2.3.1          | 2002–2020   | Steiner et al. (2020)                                                                                                                                                                     |
| University of California at Irvine (UCI) atmospheric gas measurements |         | In situ                 | Several sampling periods per year<br>Point-based  | 2.2.3          | 1984–2020   | Simpson et al. (2012)<br><a href="http://cdiac.ornl.gov/tracegases.html">http://cdiac.ornl.gov/tracegases.html</a>                                                                        |
| UEA-SI air-sea CO <sub>2</sub> fluxes                                 | 2015    | In situ                 | Monthly<br>2.5° × 2.5°                            | 5.2.1          | 1985–2011   | Jones et al. (2015)<br>doi:10.1594/PANGAEA.849262                                                                                                                                         |
| UHH sea ice product                                                   |         | In situ, remote sensing | Monthly<br>Area average                           | 2.3.2          | 1850–2020   | Doerr et al. (2021)<br><a href="http://www.fdr.uni-hamburg.de/record/8559#.YEtN09xxXIU">www.fdr.uni-hamburg.de/record/8559#.YEtN09xxXIU</a><br>doi:10.25592/uhhfdm.8525                   |
| UrBAN (Helsinki)                                                      |         | In situ                 | Sub-hourly                                        | Box 10.3       | 2004–2020   | Wood et al. (2013)<br><a href="http://urban.fmi.fi">http://urban.fmi.fi</a>                                                                                                               |
| Global temperature dataset (Vaccaro)                                  |         | In situ                 | Monthly<br>5° × 5°                                | 2.3.1          | 1850–2020   | Vaccaro et al. (2021)                                                                                                                                                                     |

| Name                                                                                                                   | Version | Type                    | Resolution (Time and Space)            | Section(s) | Time Period | Citation, Link and DOI (Where Available)                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------|---------|-------------------------|----------------------------------------|------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| W5E5 bias-adjusted reanalysis                                                                                          | 1.0     | Reanalysis              | Daily<br>0.5° × 0.5°                   | Atlas      | 1979–2016   | Lange (2019)<br><a href="https://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:4855898">https://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:4855898</a><br>doi:10.5880/pik.2019.023                                  |
| Sea ice data (Walsh)                                                                                                   |         | Remote sensing, in situ | Monthly                                | 2.3.2      | 1850–2020   | Walsh et al. (2017)                                                                                                                                                                                                                          |
| WASWind marine wind data                                                                                               |         | In situ                 | Monthly<br>4° × 4°                     | 2.4.4      | 1950–2011   | Tokinaga and Xie (2011)<br><a href="https://climatedataguide.ucar.edu/climate-data/waswind-wave-and-anemometer-based-sea-surface-wind">https://climatedataguide.ucar.edu/climate-data/waswind-wave-and-anemometer-based-sea-surface-wind</a> |
| WCRP/Palmer global sea level                                                                                           |         | Remote sensing, in situ | Monthly<br>Global time series          | 2.3.3      | 1901–2018   | WCRP Global Sea Level Budget Group (2018); Palmer et al. (2021)                                                                                                                                                                              |
| Wegener Centre radio occultation dataset                                                                               |         | Remote sensing          | Monthly<br>0.1 km vertical resolution  | 2.3.1      | 2001–2020   | Angerer et al. (2017)                                                                                                                                                                                                                        |
| Global mean sea level reconstruction (Wenzel and Schröter)                                                             |         | In situ                 | Monthly<br>Global time series          | 2.3.3      | 1900–2009   | Wenzel and Schröter (2014)                                                                                                                                                                                                                   |
| WFDE5                                                                                                                  | 1.0     | Reanalysis              | Hourly<br>0.5°                         | 10.3.3     | 1979–2018   | Cucchi et al. (2020)                                                                                                                                                                                                                         |
| WMO Global Atmosphere Watch greenhouse gas measurements                                                                |         | In situ                 | Annual<br>Point-based and global means | 2.2.3      | 1984–2020   | Tsutsumi et al. (2009); WMO (2019)<br><a href="https://gaw.kishou.go.jp/publications/global_mean_mole_fractions">https://gaw.kishou.go.jp/publications/global_mean_mole_fractions</a>                                                        |
| World Ocean Atlas (WOA)                                                                                                | 2018    | In situ                 | Monthly<br>1° × 1°                     | 3.5.1      | 2009        | Levitus et al. (2012); Locarnini et al. (2019); Zweng et al. (2019)<br><a href="http://www.nodc.noaa.gov/OC5/woa18/woa18data.html">www.nodc.noaa.gov/OC5/woa18/woa18data.html</a>                                                            |
| World Ozone and UV Data Center (WOUDC) ozone dataset                                                                   |         | In situ                 | Monthly<br>Global and zonal means      | 2.2.5      | 1964–2020   | Fioletov et al. (2002)<br><a href="https://woudc.org/">https://woudc.org/</a>                                                                                                                                                                |
| Global Earth Observation for Integrated Water Resource Assessment (Earth2Observe) Water Resources Reanalysis v2 (WRR2) | 2       | Reanalysis              | Monthly<br>0.5° × 0.5°                 | 8.3.1      | 1979–2012   | Schellekens et al. (2017)                                                                                                                                                                                                                    |
| Brazil gridded met data 1980–2013 (Xavier)                                                                             |         | In situ                 | Daily<br>0.25° × 0.25°                 | 10.2.1     | 1980–2013   | Xavier et al. (2016)<br><a href="http://careyking.com/data-downloads/">http://careyking.com/data-downloads/</a>                                                                                                                              |
| Chile precipitation (Yang)                                                                                             |         | In situ                 | Daily<br>0.04° × 0.04°                 | 10.2.1     | 2009–2014   | Z. Yang et al. (2017)<br><a href="http://www.climatedatalibrary.cl/SOURCES/">www.climatedatalibrary.cl/SOURCES/</a>                                                                                                                          |
| Ocean heat content and thermocline sea level reconstruction (Zanna)                                                    |         | In situ                 | Annual<br>Global means                 | 2.3.3      | 1871–2017   | Zanna et al. (2019)                                                                                                                                                                                                                          |

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