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ISLSCP II Air-Sea Carbon Dioxide Gas Exchange

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Revision date: February 26, 2014

Summary:

This data set contains the calculated net ocean-air carbon dioxide (CO₂) flux and sea-air CO₂ partial pressure (pCO₂) difference. The estimates are based on approximately one million measurements made for the pCO₂ in surface waters of the global ocean since the International Geophysical Year, 1956-1959. Only the ocean water pCO₂ values measured using direct gas-seawater equilibration methods were used. The results represent the climatological distributions under non-El Nino conditions. Since the measurements were made in different years, during which the atmospheric pCO₂ was increasing, they were corrected to a single reference year (arbitrarily chosen to be 1995) on the basis of the following assumptions:

- Surface waters in subtropical gyres mix vertically at slow rates with subsurface waters due to the presence of strong stratification at the base of the mixed layer. This will allow a long contact time with the atmosphere to exchange CO₂. Therefore, their CO₂ chemistry tends to follow the atmospheric CO₂ increase. Accordingly, the pCO₂ measured in a given month and year is corrected to the same month of the reference year 1995 using changes in the atmospheric CO₂ concentration occurred during this period.
- Oceanic pCO₂ measurements made after the beginning of 1979 have been corrected to 1995 using the atmospheric CO₂ concentration data from the GLOBALVIEW-CO₂ database (2000), in which the zonal mean atmospheric concentrations (for each 0.05 in sine of latitude) within the planetary boundary layer are summarized for each month since 1979 to 2000.
- Pre-1979 oceanic pCO₂ data were corrected to 1979 using the annual mean trend for the global mean atmospheric CO₂ concentration constructed from the Mauna Loa data of Keeling and Whorf (2000), and then from 1979 to 1995 using the GLOBALVIEW-CO₂ database.
- Measurements for pCO₂ made in the following areas have been corrected for the time of observation; 45 degrees N, 50 degrees S, in the Atlantic Ocean, north of 50 degrees S in the Indian Ocean, 40 degrees N, 50 degrees S in the western Pacific west of the date line, and 40 degrees N, 60 degrees S, in the eastern Pacific east of the date line.

There are eight data files with this data set. This includes six compressed (.zip) and two comma-delimited (.csv) files.

Additional Documentation:

This data set is one of the products of the **International Satellite Land-Surface Climatology Project, Initiative II (ISLSCP II)** data collection which contains 50 global time series data sets for the ten-year period 1986 to 1995. A complete description of the data, its derivation, acknowledgements, and references provided by the ISLSCP II Data Management Staff is included with this data set as a companion file named [1_air_sea_gas_exchange_doc.pdf](#).

ISLSCP II is a consistent collection of data sets that were compiled from existing data sources and algorithms, and were designed to satisfy the needs of modelers and investigators of the global carbon, water and energy cycle. The data were acquired from a number of U.S. and international agencies, universities, and institutions. The data and documentation have undergone two peer reviews.

ISLSCP is one of several projects of Global Energy and Water Cycle Experiment (GEWEX) [<http://www.gewex.org/>] and has the lead role in addressing land-atmosphere interactions -- process modeling, data retrieval algorithms, field experiment design and execution, and the development of global data sets.

Data Citation:

Cite this data set as follows:

Takahashi, T., S.C. Sutherland, R.H. Wanninkhof, R.A. Feely, R.F. Weiss, D.W. Chipman, N. Bates, J. Olafsson, C. Sabine, A. Poisson, N. Metz, B. Tilbrook, Y. Nojiri, and C. Sweeney. 2014. ISLSCP II Air-Sea Carbon Dioxide Gas Exchange. In Hall, Forrest G., G. Collatz, B. Meeson, S. Los, E. Brown de Colstoun, and D. Landis (eds.). ISLSCP Initiative II Collection. Data set. Available on-line [<http://daac.ornl.gov/>] from Oak Ridge National Laboratory

File Information:

The archived data sets for ISLSCP II have been organized by categories. This data set is in the Carbon category.

Data Set Spatial Extent: Global

Westernmost Longitude: -180 W

Easternmost Longitude: 180 E

Northernmost Latitude: 90 N

Southernmost Latitude: -90 S

Projection: Geographic

Data Set Spatial Resolution: one degree and five degrees in both latitude and longitude

Data Set Temporal Extent: monthly

Data File Format

There are eight data files with this data set. All files with the .csv file extension were converted from space-separated format (.asc). The **map_1d** files are in standard arc/info grid ASCII format (.asc).

- **air_sea_d-pco2_5d_1995.csv:** Contains original data submitted by the Principal Investigator, and converted to comma-delimited format (.csv). The data are for monthly CO₂ partial pressure difference (delta-pco2) in seawater corrected to 1995 and interpolated onto a 5 degree longitude by 4 degree latitude Earth grid. The data are longitude (LON), latitude (LAT), month (MONTH), sea surface temperature (SST), salinity (SAL), barometric pressure (PBARO), (PCO₂_SW), (PCO₂_AIR), and CO₂ partial pressure difference (DELTA_PCO₂).
- **air_sea_d-pco2_5d_1995.zip:** A point shape file of the lat/lon data from the file above. This includes six files **air_sea_d-pco2_5d_1995.xxx** where **xxx** is .dbf, .prj, .sbn, .sbx, .shp, and .shx.
- **air_sea_d-pco2_5d_1995_12month.zip:** A polygon shape file of 12 months of data from the file **air_sea_d-pco2_5d_1995.csv**. This file includes seven files **air_sea_d-pco2_5d_1995_12month.xxx** where **xxx** is .dbf, .prj, .sbn, .sbx, .shx., .xml, and .shp.
Attributes include:
 - Id = the polygon id 0 – 3239 (from LL corner west to east) used to join the .csv file
 - Point_X = the longitudinal center of each polygon
 - Point_Y = the latitudinal center of each polygon
 - pco2_9501 – pco2_9512 = the measured attribute from the csv file for each month 1-12.
- **air_sea_co2flux_5d_1995.csv:** Contains original data submitted by the Principal Investigator, and converted to comma-delimited format (.csv). The data are for monthly ocean/air CO₂ flux, interpolated onto a 5 degree longitude by 4 degree latitude Earth grid. Data are included for longitude (LON), latitude (LAT), month (MONTH), CO₂ partial pressure difference (DELTA_PCO₂), wind speed (WIND_SPD), sea surface temperature (SST), and CO₂ flux (CO₂_FLUX).
- **air_sea_co2flux_5d_1995.zip:** A point shape file of the lat/lon data from the file above. This includes six files **air_sea_co2flux_5d_1995.xxx** where **xxx** is .dbf, .prj, .sbn, .sbx, .shx., and .shp.
- **air_sea_co2flux_5d_1995_12month.zip:** A polygon shape file of 12 months of data from the 12 files in **air_sea_co2flux_5d_1995.csv**. This includes seven files **air_sea_co2flux_5d_1995_12month.xxx** where **xxx** is .dbf, .prj, .sbn, .sbx, .shx., .shp., and .xml.
Attributes include:
 - Id = the polygon id 0 – 3239 (from LL corner west to east) used to join the .csv file
 - Point_X = the longitudinal center of each polygon
 - Point_Y = the latitudinal center of each polygon
 - co2_9501 – co2_9512 = the measured attribute from the csv file for each month 1-12.
- ***air_sea_co2fluxmaps_1d.zip:** Contains 12 files (.asc) of monthly average ocean/air CO₂ flux data for 1995, at 1 x 1-degree, created by the ISLSCP Staff, for CO₂ flux.
- ***air_sea_d-pco2_maps_1d.zip:** Contains 12 files (.asc) of monthly average seawater-air pCO₂ difference data for 1995, at 1 x 1-degree, created by the ISLSCP Staff, for d-pCO₂.

***A value of -999.9 indicates land cells and values of -888.8 indicate cells with sea ice.**

NOTE: The 5 x 4-degree files were processed again by: filling in blank pixels along the coastlines using averaging of all the surrounding pixels, then expanding each pixel in a line 5 times, then copying each line 4 times. This preserved the original missing values of -999.9. Additionally, the 1-degree land mask was overlaid on the files, inserting the land (listed as -99.9) at a finer scale than the original 5 x 4-degree data. Thus, there are missing land data listed as -99.9, then additional missing data listed as -999.9. Sea ice is indicated by -888.8.

WARNING: This 1 x 1-degree product is for browse use only. These data files are not interpolated between the original 5 x 4 pixels. Thus the values at specific pixels are not exact. Use this data with caution and always refer to the original tabular data files for specific information.

Please refer to [0_air_sea_gas_readme.txt](#) for additional information on the data file contents and naming conventions.

Data Access:

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) [<http://daac.ornl.gov>].

Data Archive Contact Information:

E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

References:

Gurney, K.R., R.M. Law, A.S. Denning, P.J. Rayner, D. Baker, P. Bousquet, L. Bruhwiler, Y.H., Chen, P. Ciais, S. Fan, I.Y. Fung, M. Gloor, M. Heimann, K.Higuchi, J. John, T. Maki, S.Maksyutov, K. Masarie, P. Peylin, M.Prather, B.C. Pak, J. Randerson, J. Sarmiento, S.Taguchi, T. Takahashi and C.-W. Yuen, 2001: Towards robust regional estimates of CO2 sources and sinks using atmospheric transport models. *Nature*, 415, 626-630, Feb. 2002.

Takahashi, T., Sutherland, S. C., Sweeney, C., Poisson, A., Metzl, N., Tillbrook, B., Bates, N., Wanninkhof, R., Feely, R. A., Sabine, C., Olafsson, J. and Nojiri, Y. (2002). Global sea-air CO2 flux based on climatological surface ocean pCO2, and seasonal biological and temperature effects, *Deep-Sea Res. II*, 49, 1601-1622.



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