ARC-Lake – Data Product Description

Version

v1.0	22nd September 2010	1st release
v1.1	22nd March 2011	2nd release
v1.1.1	31st March 2011	Update to some 2nd release data products

Release Notes

v1.0 First official release of ARC-Lake lake surface temperature (LSWT) and lake ice concentration (LIC) products.

Draft Data Product Description (22/09/2010)

v1.1 Second release of ARC-Lake lake surface water temperature (LSWT) and lake ice concentration (LIC) products.
1. Salinity dependent emissivity.
2. Modification of ice-detection algorithm to reduce classification of clouds as ice.
3. New methods of handling ice and periods of no observations in reconstructions.

v1.1.1 Update to v1.1.
1. Change in methodology for deriving averaged data products based on observations. Details of the new method are given in the Averaging Methods section.
2. Correction to NLSWT and NICE fields in global spatially-resolved averaged products.
3. Correction to LAKEID field in global lake-mean averaged products.

Documentation History

22/09/10	Document created
24/09/10	Correction to table of lakes (table 7)
22/03/11	Major revision to accommodate significant differences between v1.0 and v1.1 data products and additional v1.1 data products. Please see http://www.geos.ed.ac.uk/arclake/data.html for documentation for v1.0.
31/03/11	Averaging Methods section updated to describe v1.1.1 products Description of NICE data field updated.

Overview

This document describes the data products released through the ARC-Lake project, funded by the European Space Agency.

A number of different types of data product are available, from gridded observations on a lake-by-lake basis to global climatology. Data products derived from spatially complete reconstructions are available alongside those derived directly from the ARC-Lake observations. A summary of the possible variants is given in Table 1. Note that not all possible combinations of these variants are available:

	Variants			
Source	Observations		Reconstructions	
Coverage	Per-lake		Global	
Time	Day		Night	
Spatial Resolution	0.05° grid		Lake-mean	
Temporal Averaging Type	Climatology		Time-series	
Temporal Averaging Period	Seasonal	Monthly	Twice-monthly	Daily

Table 1. Overview of the types of data product available through ARC-Lake.

The structure and contents of these data products are described in detail in the following pages.

Contents

File Naming Convention

There are four possible file name formats, each of which shares a common naming convention across the first 16 characters. The four filename formats and the types of files to which they apply are given in Table 2.The meanings of the file name components are outlined in Table 3.

File Name Format	Product Types
AAAABBBB_CCDDDEF.nc	Unaveraged per-lake observations and reconstructions
AAAABBBB_CCDDDEF_GGGGHHII.nc	Unaveraged daily global observations
AAAABBBB_CCDDDEF_JJKKKLL.nc	All per-lake averaged products (e.g. climatology) and lake-mean global products
AAAABBBB_CCDDDEF_JJKKKLL_MMNN_OOPP.nc	Spatially resolved global climatology products

Table 2. ARC-Lake file name formats and summary of associated file types.

Component	Meaning	Possible Values	
AAAA	ARC-Lake ID	ALID	
BBBB	ARC-Lake ID value	0001-1820	Lake ID
		9999	All lakes
CC	Coverage	PL	Per-lake
		DG	Daily-global
		CG	Climatology-global
DD	Source	OBS	Observations
		REC	Reconstructions
E	ATSR ID	1	ATSR1
		2	ATSR2
		3	AATSR
		9	Merged ATSR
F	Time	D	Day
		N	Night
GGGG	Year	1991-2011	
HH	Month	01-12	
II	Day	01-31	
JJ	Temporal averaging type	CA	Climatology-annual
		TS	Time-series
KKK	Temporal averaging period	004	Seasonal
		012	Monthly
		024	Twice-monthly
		366	Daily
LL	Spatial resolution	SR	Spatially-resolved (0.05° grid)
		LM	Lake-mean
MM	Start day of annual climatology time period	01-31	
NN	Start month of annual climatology time period	01-12	
OO	End day of annual climatology time period	01-31	
PP	End month of annual climatology time period	01-12	

Table 3. Description of components of ARC-Lake product file names.

Summary of File Types

Averaging

Unaveraged
Data products containing observations or reconstructions on daily time-steps (i.e. no temporal or spatial averaging has been applied (beyond the initial spatial averaging to the 0.05° grid).

Averaged

Data products derived from the unaveraged files. Averaging is performed in time, creating time-series and climatology over various averaging intervals. Averaging is also performed spatially, to create lake-mean data products.

Source

Observations
Data products derived directly from ARC-Lake estimates of LSWT and LIC.

Reconstructions

Data products derived from spatially and temporally complete reconstructions of the ARC-Lake LSWT product. Spatially complete reconstructions are derived from observations using EOF-based techniques, using the software DINEOF (Data INterpolating Empirical Orthogonal Functions) described by Alvera-Azcárate *et al*, 2005. Details of the methodology used to derive these reconstructions are given in MacCallum and Merchant (2010).

Coverage

Per-lake
Lake specific data files. Data is stored on a fixed grid (for spatially resolved products) covering only the local area of the lake.

Global
Data files containing all lakes, globally. Spatially resolved data are stored on a fixed 0.05° grid, covering the full globe (stored in a compressed form for unaveraged global products). Lake-mean data are stored in a single array for all lakes, with associated lake ID.

Spatial Resolution

Spatially-Resolved
Data are stored on a 0.05° grid with associated longitude and latitude values.

Lake-Mean
Data are stored as a single value (spatially) for each lake with associated longitude and latitude values for the nominal lake centre.

Temporal Averaging Type

None
No temporal averaging applied.

Climatology
Averaging applied over a set time interval over all years to create an annual climatology (e.g. 12 monthly averages)

Time-series
Averaging applied over a set time interval to create a time-series of averaged data (e.g. 168 monthly averages covering the years 1996-2009).

Temporal Averaging Period

Seasonal
Averaging period covers three-month periods: January-February-March (JAS), April-May-June (AMJ), July-August-September (JAS), October-November-December (OND).

Monthly
Averaging period covers calendar months.

Twice-Monthly
Averaging performed over fixed half-month periods.

Daily
Daily lake-mean averages.

File Contents

Colour Key

Global attributes
Dimensions
Variables on grid points – Observations and reconstructions
Variables on grid points – Observation-based data only
Variables on grid points – Reconstruction-based data only
Ancillary variables – Observations and reconstructions
Ancillary variables - Observation-based data only
Ancillary variables - Reconstruction-based data only

Table 4. Colour scheme used to highlight which variables are shared across observation and reconstruction-based products and which variables are unique to one product type.

Unaveraged – Per-Lake – Observations & Reconstructions

File Names

Basic File Name Format	Example
AAAABBBB_CCDDDEF.nc	ALID0001_PLOBS3D.nc

Table 5. File naming convention for unaveraged per-lake data products.

Dimensions

Dimension Name	Description
LON	Longitude.
LAT	Latitude
TIME	Time
NV	For ancillary data describing global grid

Table 6. Dimensions in unaveraged per-lake data products.

Variables

Variable Name	Type	Description [units]	Contents / Array Dimensions
LON	FLOAT	Longitude at centre of grid cell. [degrees_east]	[LON]
LAT	FLOAT	Latitude at centre of grid cell. [degrees_north]	[LAT]
TIME	FLOAT	Reference time for data: day of observation [days since 00:00:00 01/01/1970]	[TIME]
LSWT	FLOAT	Lake surface water temperature [K]	[LON,LAT, TIME]
LAKEID	INT	Lake ID (>0 = valid lake ID)	[LON,LAT, TIME]
NCLOUD	INT	Number of cloudy pixels.	[LON,LAT, TIME]
NICE	INT	Number of ice pixels	[LON,LAT, TIME]
NLSWT	INT	Number of clear lake pixels. (i.e. Not cloud or ice covered)	[LON,LAT, TIME]

ERR_LSWT	FLOAT	Uncertainty estimate for lake surface temperature [K]	[LON,LAT, TIME]
CHI2	FLOAT	Chi-squared (goodness of fit measure for OE retrieval)	[LON,LAT, TIME]
OBSERVATION_TIME	LONG	Observation time in seconds since 00:00 GMT [s]	[LON,LAT, TIME]
VALID	INT	Flag to indicate if valid LSWT exists for cell (0=Valid, 1=Invalid)	[LON,LAT, TIME]
CHANNEL_SET	INT	Channel set used in retrieval: 1=Dual(3.7/11/12), 2=Dual(11/12), 3=Nadir(3.7/11/12), 4=Nadir(11/12)	[LON,LAT, TIME]
NDAYS	INT	Number of days with data	1
LONBOUNDS	FLOAT	Longitudes of lake area bounds on full global grid at 0.05° resolution [degrees_east]	[NV]
LATBOUNDS	FLOAT	Latitudes of lake area bounds on full global grid at 0.05° resolution [degrees_north]	[NV]
LONGRIDBOUNDS	INT	Indices of lake area longitude bounds on full global grid at 0.05° resolution - [xmin, xmax]	[NV]
LATGRIDBOUNDS	INT	Indices of lake area latitude bounds on full global grid at 0.05° resolution - [ymin, ymax]	[NV]
GLOBAL_LON_ZERO	FLOAT	Longitude at centre of westernmost cell of global grid (corresponding to lonindex=0) [degrees_east]	-179.95
GLOBAL_LAT_ZERO	FLOAT	Latitude at centre of northernmost cell of global grid (corresponding to latindex=0)	89.975
GLOBAL_RESOLUTION	FLOAT	Resolution of grid cells	0.05
LON_SCALE	FLOAT	Scaling factor for converting longitude index (gridindex MOD lon) to longitude value at centre of cell	0.05
LON_OFFSET	FLOAT	Offset for converting longitude index (gridindex MOD lon) to	-179.975

		longitude value at centre of cell	
LAT_SCALE	FLOAT	Scaling factor for converting latitude index (gridindex / lon) to latitude value at centre of cell	-0.05
LAT_OFFSET	FLOAT	Offset for converting latitude index (gridindex / lon) to latitude value at centre of cell	89.975
CROSS_ERR	FLOAT	Cross-validation error from DINEOF [Kelvin]	e.g. 0.75
NEV	INT	Number of EOFs used in the reconstruction	e.g. 8
FLAG_TIMESERIES	INT	Flag to indicate of LSWT reconstruction is based on time-series or climatology 0=Time-series, 1=Climatology, 2=Invalid reconstruction	e.g. 0
FLAG_SOURCE	INT	Flag to indicate source of LSWT reconstruction at each time step. 0=Observation 1=FLake 2=Excluded observation 4=Interpolated	[TIME]
TITLE	STRING	Data product type	ARCLake – Per-Lake
SOURCE	STRING	Source of data	ARCLake
VERSION	STRING	ARCLake version number	1.1
CREATION_DATE	STRING	Date of creation (YYYYMMDD)	20110318
ARCLAKE_NAME	STRING	Lake name	CASPIAN
ARCLAKE_ID	STRING	Lake ID	1
DAY_NIGHT	STRING	String to indicate day-time or night-time retrievals	Day
LONGITUDE_CONVERSION	STRING		Longitude=(LON*LON_SCALE)+LON_OFFSET
LATITUDE_CONVERSION	STRING		Latitude=(LAT*LAT_SCALE)+LAT_OFFSET

Table 7. Overview of variables and global attributes present in the unaveraged per-lake data products.

Unaveraged – Global – Observations Only

File Names

Basic File Name Format	Example
AAAABBBB_CCDDDEF_GGGGHHII.nc	ALID9999_PLOBS3D_20060101.nc

Table 8. File naming convention for unaveraged global data products.

Dimensions

Dimension Name	Description
LON	Longitude.
LAT	Latitude
TIME	Time
GRIDINDEX	Describes subset of cells on global grid, that contain observations

Table 9. Dimensions in unaveraged global data products.

Variables

Variable Name	Type	Description [units]	Contents / Array Dimensions
LON	FLOAT	Longitude at centre of grid cell. [degrees_east]	[LON]
LAT	FLOAT	Latitude at centre of grid cell. [degrees_north]	[LAT]
TIME	FLOAT	Reference time for data: day of observation [days since 00:00:00 01/01/1970]	[TIME]
GRIDINDEX	LONG	Subscripts of cells on global grid with observations	[GRIDINDEX]
LSWT	FLOAT	Lake surface water temperature [K]	[GRIDINDEX]
LAKEID	INT	Lake ID (>0 = valid lake ID)	[GRIDINDEX]
NCLOUD	INT	Number of cloudy pixels.	[GRIDINDEX]
NICE	INT	Number of ice pixels	[GRIDINDEX]
NLSWT	INT	Number of clear lake pixels. (i.e. Not cloud or ice covered)	[GRIDINDEX]
ERR_LSWT	FLOAT	Uncertainty estimate for lake surface temperature [K]	[GRIDINDEX]
CHI2	FLOAT	Chi-squared (goodness of fit measure for OE retrieval)	[GRIDINDEX]
OBSERVATION_TIME	LONG	Observation time in seconds since 00:00 GMT [s]	[GRIDINDEX]
VALID	INT	Flag to indicate if valid LSWT exists for cell (0=Valid, 1=Invalid)	[GRIDINDEX]
CHANNEL_SET	INT	Channel set used in retrieval: 1=Dual(3.7/11/12), 2=Dual(11/12), 3=Nadir(3.7/11/12),	[GRIDINDEX]

		4=Nadir(11/12)	
NCELLS	LONG	Number of cells	(e.g. 10000)
GLOBAL_LON_ZERO	FLOAT	Longitude at centre of westernmost cell of global grid (corresponding to lonindex=0) [degrees_east]	-179.95
GLOBAL_LAT_ZERO	FLOAT	Latitude at centre of northernmost cell of global grid (corresponding to latindex=0)	89.975
GLOBAL_RESOLUTION	FLOAT	Resolution of grid cells	0.05
LON_SCALE	FLOAT	Scaling factor for converting longitude index (gridindex MOD lon) to longitude value at centre of cell	0.05
LON_OFFSET	FLOAT	Offset for converting longitude index (gridindex MOD lon) to longitude value at centre of cell	-179.975
LAT_SCALE	FLOAT	Scaling factor for converting latitude index (gridindex / lon) to latitude value at centre of cell	-0.05
LAT_OFFSET	FLOAT	Offset for converting latitude index (gridindex / lon) to latitude value at centre of cell	89.975
TITLE	STRING	Data product type	ARCLake – Daily Global
SOURCE	STRING	Source of data	ARCLake
VERSION	STRING	ARCLake version number	1.1
CREATION_DATE	STRING	Date of creation (YYYYMMDD)	20110318
DATE	STRING	Date of observation (YYYYMMDD)	20060101
DAY_NIGHT	STRING	String to indicate day-time or night-time retrievals	Day
LONGITUDE_CONVERSION	STRING		Longitude=(LON*LON_SCALE)+LON_OFFSET
LATITUDE_CONVERSION	STRING		Latitude=(LAT*LAT_SCALE)+LAT_OFFSET
LONINDEX_CONVERSION	STRING		Lonindex = gridindex MOD lon
LATINDEX_CONVERSION	STRING		Latindex = gridindex / lon

Table 10. Overview of variables and global attributes present in the unaveraged global data products.

Averaged – Per-Lake

File Names

Basic File Name Format	Example
AAAABBBB_CCDDDEF_JJKKKLL.nc	ALID0001_PLOBS3D_CA012SR.nc

Table 11. File naming convention for averaged per-lake data products.

Dimensions

Dimension Name	Description
LON	Longitude.
LAT	Latitude
TIME	Time
NV	For ancillary data describing start and end times of averaging period and for ancillary data describing global grid.
ATSR	For ancillary data describing which ATSR instruments have been used.

Table 12. Dimensions in averaged per-lake data products.

Variables

Variable Name	Type	Description [units]	Contents / Array Dimensions
LON	FLOAT	Longitude at centre of grid cell. [degrees_east]	[LON]
LAT	FLOAT	Latitude at centre of grid cell. [degrees_north]	[LAT]
TIME	FLOAT	Reference time for data: day of observation [days since 00:00:00 01/01/1970]	[TIME]
ATSR	INT	ATSR instrument number. 1=ATSR1 2=ATSR2 3=AATSR	[ATSR]
LSWT	FLOAT	Lake surface water temperature [K]	[LON,LAT, TIME]
VAR_LSWT	FLOAT	Variance of LSWT over averaging period/area	[LON,LAT, TIME]
LAKEID	INT	Lake ID (>0 = valid lake ID)	[LON,LAT, TIME]
NCLOUD	INT	Number of cloudy pixels.	[LON,LAT, TIME]
NICE	INT	Number of ice pixels	[LON,LAT, TIME]
NLSWT	INT	Number of clear lake pixels. (i.e. Not cloud or ice covered)	[LON,LAT, TIME]
ERR_LSWT	FLOAT	Uncertainty estimate for lake surface temperature [K]	[LON,LAT, TIME]
CHI2	FLOAT	Chi-squared (goodness of fit measure for OE	[LON,LAT, TIME]

		retrieval)	
OBSERVATION_TIME	LONG	Observation time in seconds since 00:00 GMT [s]	[LON,LAT, TIME]
LONBOUNDS	FLOAT	Longitudes of lake area bounds on full global grid at 0.05° resolution [degrees_east]	[NV]
LATBOUNDS	FLOAT	Latitudes of lake area bounds on full global grid at 0.05° resolution [degrees_north]	[NV]
LONGRIDBOUNDS	INT	Indices of lake area longitude bounds on full global grid at 0.05° resolution - [xmin, xmax]	[NV]
LATGRIDBOUNDS	INT	Indices of lake area latitude bounds on full global grid at 0.05° resolution - [ymin, ymax]	[NV]
GLOBAL_LON_ZERO	FLOAT	Longitude at centre of westernmost cell of global grid (corresponding to lonindex=0) [degrees_east]	-179.95
GLOBAL_LAT_ZERO	FLOAT	Latitude at centre of northernmost cell of global grid (corresponding to latindex=0)	89.975
GLOBAL_RESOLUTION	FLOAT	Resolution of grid cells	0.05
LON_SCALE	FLOAT	Scaling factor for converting longitude index (gridindex MOD lon) to longitude value at centre of cell	0.05
LON_OFFSET	FLOAT	Offset for converting longitude index (gridindex MOD lon) to longitude value at centre of cell	-179.975
LAT_SCALE	FLOAT	Scaling factor for converting latitude index (gridindex / lon) to latitude value at centre of cell	-0.05
LAT_OFFSET	FLOAT	Offset for converting latitude index (gridindex / lon) to latitude value at centre of cell	89.975
CLIMATOLOGY_BOUNDS	FLOAT	Start and end times of averaging period.	[NV,TIME]
NDAYS_SAT	INT	Number of days with valid satellite	[TIME]

		observations in averaging period.	
FLAG_TIMESERIES	INT	Flag to indicate if reconstruction is based on time-series, climatology, or if reconstruction failed. 0=Time-series 1=Climatology 2=Failed	[ATSR]
NDAYS_FLAKE	INT	Number of days where FLake data is used in the reconstruction.	[TIME]
FLAG_SOURCE†	INT	Flag to indicate source of data in daily time-series reconstructions	[TIME]
TITLE	STRING	Data product type	e.g. ARCLake – Spatially-resolved Monthly Climatology from Day-time ATSR2/AATSR Observations
SOURCE	STRING	Source of data	ARCLake – CDO processing
VERSION	STRING	ARCLake version number	1.1
CREATION_DATE	STRING	Date of creation (YYYYMMDD)	20110318
ARCLAKE_NAME	STRING	Lake name	CASPIAN
ARCLAKE_ID	STRING	Lake ID	1
DAY_NIGHT	STRING	String to indicate day-time or night-time retrievals	Day
LONGITUDE_CONVERSION	STRING		Longitude=(LON*LON_SCALE)+LON_OFFSET
LATITUDE_CONVERSION	STRING		Latitude=(LAT*LAT_SCALE)+LAT_OFFSET

Table 13. Overview of variables and global attributes present in the averaged per-lake data products. †Only present in daily averaged lake-mean files, where NDAYS_SAT and NDAYS_FLAKE are not present.

Averaged – Global – Spatially-Resolved

File Names

Basic File Name Format	Example
AAAABBBB_CCDDDEF_ JJKKKLL_MMNN_OOPP.nc	ALID9999_PLOBS9D_ CA012SR_0101_3101.nc

Table 14. File naming convention for averaged global spatially-resolved data products.

Dimensions

Dimension Name	Description
LON	Longitude.
LAT	Latitude
TIME	Time
NV	For ancillary data describing start and end times of averaging period and for ancillary data describing global grid.

Table 15. Dimensions in averaged global spatially-resolved data products.

Variables

Variable Name	Type	Description [units]	Contents / Array Dimensions
LON	FLOAT	Longitude at centre of grid cell. [degrees_east]	[LON]
LAT	FLOAT	Latitude at centre of grid cell. [degrees_north]	[LAT]
TIME	FLOAT	Reference time for data: day of observation [days since 00:00:00 01/01/1970]	[TIME]
LSWT	FLOAT	Lake surface water temperature [K]	[LON,LAT, TIME]
VAR_LSWT	FLOAT	Variance of LSWT over averaging period/area	[LON,LAT, TIME]
FLAG_TIMESERIES	BYTE	Flag to indicate combination of ATSRs used and type of data used for each ATSR (time series, climatology, none).	[LON,LAT,TIME]
NCLOUD	BYTE	Number of cloudy pixels.	[LON,LAT, TIME]
NICE	BYTE	Number of ice pixels	[LON,LAT, TIME]
NLSWT	BYTE	Number of clear lake pixels. (i.e. Not cloud or ice covered)	[LON,LAT, TIME]
ERR_LSWT	FLOAT	Uncertainty estimate for lake surface temperature [K]	[LON,LAT, TIME]
CHI2	FLOAT	Chi-squared (goodness of fit measure for OE retrieval)	[LON,LAT, TIME]
OBSERVATION_TIME	LONG	Observation time in seconds since 00:00 GMT [s]	[LON,LAT, TIME]
CLIMATOLOGY_BOUNDS	FLOAT	Start and end times of averaging period.	[NV,TIME]
NDAYS_SAT	INT	Number of days with valid satellite	[TIME]

		observations in averaging period.	
NDAYS_FLAKE	INT	Number of days where FLake data is used in the reconstruction.	[TIME]
TITLE	STRING	Data product type	e.g. ARCLake – Spatially-resolved Monthly Climatology from Day-time ATSR2/AATSR Observations
SOURCE	STRING	Source of data	ARCLake
VERSION	STRING	ARCLake version number	1.1
CREATION_DATE	STRING	Date of creation (YYYYMMDD)	20110318
DAY_NIGHT	STRING	String to indicate day-time or night-time retrievals	Day

Table 16. Overview of variables and global attributes present in the averaged global spatially-resolved data products.

Averaged – Global – Lake-Mean

File Names

Basic File Name Format	Example
AAAABBBB_CCDDDEF_JJKKKLL.nc	ALID9999_PLOBS9D_CA012LM.nc

Table 17. File naming convention for averaged global lake-mean data products.

Dimensions

Dimension Name	Description
TIME	Time
LAKES	Lake IDs
NV	For ancillary data describing start and end times of averaging period.
ATSR	For ancillary data describing which ATSR instruments have been used.

Table 18. Dimensions in averaged global lake-mean data products.

Variables

Variable Name	Type	Description [units]	Contents / Array Dimensions
TIME	FLOAT	Reference time for data: day of observation [days since 00:00:00 01/01/1970]	[TIME]
LAKEID	INT	Lake ID	[LAKES]
ATSR	INT	ATSR instrument number. 1=ATSR1 2=ATSR2 3=AATSR	[ATSR]
LSWT	FLOAT	Lake surface water	[LAKES, TIME]

		temperature [K]	
VAR_LSWT	FLOAT	Variance of LSWT over averaging period/area	[LAKES, TIME]
NDAYS_SAT	INT	Number of days with valid satellite observations in averaging period.	[LAKES,TIME]
NCLOUD	INT	Number of cloudy pixels.	[LAKES, TIME]
NICE	INT	Number of ice pixels	[LAKES, TIME]
NLSWT	INT	Number of clear lake pixels. (i.e. Not cloud or ice covered)	[LAKES, TIME]
ERR_LSWT	FLOAT	Uncertainty estimate for lake surface temperature [K]	[LAKES, TIME]
CHI2	FLOAT	Chi-squared (goodness of fit measure for OE retrieval)	[LAKES, TIME]
OBSERVATION_TIME	LONG	Observation time in seconds since 00:00 GMT [s]	[LAKES, TIME]
NDAYS_FLAKE	INT	Number of days where FLake data is used in the reconstruction.	[LAKES,TIME]
CLIMATOLOGY_BOUNDS	FLOAT	Start and end times of averaging period.	[NV,TIME]
FLAG_TIMESERIES	BYTE	Flag to indicate combination of ATSRs used and type of data used for each ATSR (time series, climatology, none).	[ATSR,LAKES]
TITLE	STRING	Data product type	e.g. ARCLake – Lake-mean Monthly Climatology from Day-time ATSR2/AATSR Observations
SOURCE	STRING	Source of data	ARCLake
VERSION	STRING	ARCLake version number	1.1
CREATION_DATE	STRING	Date of creation (YYYYMMDD)	20110318
DAY_NIGHT	STRING	String to indicate day-time or night-time retrievals	Day

Table 19. Overview of variables and global attributes present in the averaged global lake-mean data products.

Detailed Data Description

Overview

The following section describes the contents of the data fields in more detail. These descriptions apply to all products.

LON

Spatially-Resolved

In the unaveraged global product, LON contains the longitude values of all cells on the 0.05° global grid that the compressed 1D data arrays are mapped onto when uncompressed. In the averaged global products, LON contains the longitude values of the cells on the 0.05° global grid on which the data is stored.

In the per-lake products, LON contains the longitude values on the 0.05° grid for the local area of the lake only.

In all products the longitude values in LON, represent the cell centre.

Lake-Mean

In all lake-mean products, LON contains the longitude values at the nominal centre of the lake. Note, it is possible for this value to be over land (for lakes with highly non-uniform shapes).

LAT

Spatially-Resolved

In the unaveraged global product, LAT contains the latitude values of all cells on the 0.05° global grid that the compressed 1D data arrays are mapped onto when uncompressed. In the averaged global products, LAT contains the latitude values of the cells on the 0.05° global grid on which the data is stored.

In the per-lake products, LAT contains the latitude values on the 0.05° grid for the local area of the lake only.

In all products the latitude values in LAT, represent the cell centre.

Lake-Mean

In all lake-mean products, LAT contains the latitude values at the nominal centre of the lake. Note, it is possible for this value to be over land (for lakes with highly non-uniform shapes).

TIME

TIME is the reference time of the data fields (e.g. LSWT). For unaveraged products, TIME represents the day of observation (or reconstruction). For averaged products, TIME represents the centre point of the averaging period. In all cases, TIME is defined as days since 00:00:00 on 1st January 1970.

ATSR

ATSR contains the reference numbers for the ATSR instruments: 1=ATSR1, 2=ATSR2, 3=AATSR. For use in referencing FLAG_TIMESERIES.

LAKEID

LAKEID in the lake-mean products contains the ARC-Lake ID for each lake in the data product.

LSWT

LSWT is the lake surface water temperature in Kelvin (K). For the unaveraged products this is the mean value over all observations in the cell at a single time of day. It is possible for the satellite instrument to make multiple observations of the cell at different times of the day. For such cases, LSWT contains the mean of all observations in the cell at the time of maximal clear-sky (i.e. where NLSWT is largest). LSWT is provided in this form to increase the usefulness of the associated time information (OBSERVATION_TIME).

A single LSWT is reported for each cell, using the most optimal retrieval algorithm available. The LSWT retrieval algorithm used is defined by the variable CHANNEL_SET (in unaveraged products only).

For averaged products, LSWT is the mean lake surface water temperature averaged over all observations in the averaging time period and over all lake grid cells (for the lake-mean products only).

VAR_LSWT

VAR_LSWT is the variance of the LSWT field over the temporal averaging period in the averaged products and the variance of the LSWT field over both the temporal averaging period and the spatial extent of the lake for lake-mean averaged products. VAR_LSWT is not present in unaveraged products.

LAKEID

LAKEID is an integer value that provides a unique identifier for each lake. The LAKEID values match those used in the Global Lakes and Wetlands Database (GLWD), described by Lehner and Doll [2004]. A list of associations between LAKEID and lake names is given in Table 28 in the Appendix.

See LAKEID for alternative usage in lake-mean products.

NCLOUD

NCLOUD is the number of pixels in the cell, flagged as cloudy by the ARC-Lake cloud detection scheme. This value contains only the number of cloudy pixels observed over lake surfaces. Observations over land surfaces within the cell are not considered.

For averaged products, NCLOUD is the mean of NCLOUD in the unaveraged products, over the temporal averaging period and across all lake cells (lake-mean products only).

NICE

NICE is the number of pixels in the cell, flagged as ice covered by the ARC-Lake ice detection scheme. This value contains only the number of ice covered pixels observed over lake surfaces. Observations over land surfaces within the cell are not considered.

For averaged products, NICE is the mean of NICE in the unaveraged products, over the temporal averaging period and across all lake cells (lake-mean products only).

An estimate of the fractional ice cover, under clear-sky conditions, can be obtained by combining the NICE and NLSWT data fields: ICE_FRACTION = NICE / (NICE+NLSWT).

NLSWT

NLSWT is the number of pixels in the cell, flagged as clear-sky (i.e. pixels that have passed ARC-Lake cloud and ice detection tests). This value contains only the number of clear-sky pixels observed over lake surfaces. Observations over land surfaces within the cell are not considered.

For averaged products, NLSWT is the mean of NLSWT in the unaveraged products, over the temporal averaging period and across all lake cells (lake-mean products only).

ERR_LSWT

ERR_LSWT is the estimated uncertainty in the lake surface temperature reported in the variable LSWT. Details of how this value is calculated are given in MacCallum and Merchant (2010).

For averaged products, ERR_LSWT is the mean of ERR_LSWT in the unaveraged products, over the temporal averaging period and across all lake cells (lake-mean products only).

CHI2

CHI2 is the χ^2 goodness of fit measure for the optimal estimation lake surface temperature retrieval. Details of how this value is calculated will be given in MacCallum and Merchant (2010).

For averaged products, CHI2 is the mean of CHI2 in the unaveraged products, over the temporal averaging period and across all lake cells (lake-mean products only).

OBSERVATION_TIME

OBSERVATION_TIME is the mean time of observations in the cell. It is recorded in seconds since midnight (UTC).

For averaged products, OBSERVATION_TIME is the mean of OBSERVATION_TIME in the unaveraged products, over the temporal averaging period and across all lake cells (lake-mean products only).

VALID

VALID is a flag to enable a simple filtering procedure for extracting only cells with valid LSWT retrievals. VALID=0 indicates a valid LSWT value exists for the cell. VALID=1 indicates that LSWT is not available for the cell.

VALID is not present in the averaged products. The variable attribute _FILL_VALUE can be used to filter missing data.

CHANNEL_SET

CHANNEL_SET defines the retrieval algorithm used to calculate the LSWT. The choice of retrieval algorithm is based on the relative performance of the algorithms and the channel brightness temperatures available. Details of the retrieval algorithms, ranked in order of preference, are given in Table 20.

CHANNEL_SET	Algorithm Name	Channels (μm)	View(s)
1	D3	3.7, 11, 12	Nadir/Forward
2	D2	11, 12	Nadir/Forward
3	N3	3.7, 11, 12	Nadir
4	N2	11, 12	Nadir
-9999	No retrieval	None	None

Table 20. Retrieval algorithms used, ranked in order of preference.

CHANNEL_SET is not present in the averaged products.

NCELLS

NCELLS is present in the unaveraged daily global (DG) product only. It contains the number of 0.05°x0.05° cells with lake observations for the given day. This is the total number of cells containing observations over lakes, and therefore includes cells where no LSWT retrievals are made due to cloud or ice cover. NCELLS determines the dimension of the 1-D data arrays in the DG files.

NDAYS

NDAYS is present in the unaveraged per-lake (PL) products only. It contains the number of days on which the satellite instrument observes the given lake in at least one 0.05°x0.05° grid cell. As for NCELLS, this includes cases where no LSWT retrievals are made due to cloud or ice cover. NDAYS determines the 3rd dimension of the 3-D data arrays in the PL files.

For the case of reconstruction-based PL files, NDAYS refers to the total number of days where the reconstruction is available. FLAG_SOURCE provides information on the source of the data used in the reconstruction for each day (i.e. whether reconstructions were performed using observations, FLake simulations of ice cover, or whether the reconstruction is based on temporal interpolation between observation days).

LONGRIDBOUNDS

LONGRIDBOUNDS is present in the PL products only. It contains the longitude indices that define the lake boundary on the 0.05° global grid.

GRIDBOUNDS Index	Index on Global Grid	Longitude/Latitude
0	Min. longitude index	Min. longitude
1	Max. longitude index	Max. longitude

Table 21. Contents of the LONGRIDBOUNDS variable.

LATGRIDBOUNDS

LATGRIDBOUNDS is present in the PL products only. It contains the latitude indices that define the lake boundary on the 0.05° global grid.

GRIDBOUNDS Index	Index on Global Grid	Longitude/Latitude
0	Min. latitude index	Max. latitude
1	Max. latitude index	Min. latitude

Table 22. Contents of the LATGRIDBOUNDS variable. Note that the minimum latitude index (LATGRIDBOUNDS[0]) corresponds to the maximum latitude value.

LONBOUNDS and LATBOUNDS

LONBOUNDS and LATBOUNDS are present in the PL products only. They contain the longitude and latitude boundaries of the lake on the 0.05° grid. They correspond to the grid indices in LONGRIDBOUNDS (Table 21) and LATGRIDBOUNDS (Table 22).

LON_SCALE and LON_OFFSET

These are the scaling factor and offset to be applied to convert the longitude indices of the 0.05° global grid to longitude values. Longitude indices of the global grid have range [0, 7199], representing longitudes with range [-179.975, 179.975]. The resulting longitude values correspond to the centre of the cell.

LAT_SCALE and LAT_OFFSET

These are the scaling factor and offset to be applied to convert the latitude indices of the 0.05° global grid to latitude values. Latitude indices of the global grid have range [0, 3599], representing latitudes with range [89.975, -89.975]. The resulting latitude values correspond to the centre of the cell.

GLOBAL_LON_ZERO

GLOBAL_LON_ZERO is the longitude value corresponding to a grid index of 0 on the 0.05° longitude grid. It represents the centre of the cell.

GLOBAL_LAT_ZERO

GLOBAL_LAT_ZERO is the latitude value corresponding to a grid index of 0 on the 0.05° latitude grid. It represents the centre of the cell.

GLOBAL_RESOLUTION

GLOBAL_RESOLUTION is the resolution in degrees of the grid cells on which data values are given.

CLIMATOLOGY_BOUNDS

CLIMATOLOGY_BOUNDS is present in all averaged data products and contains the start and end times of the averaging period. Times are given in the same format as those in TIME, days since 00:00:00 on 1st January 1970.

NDAYS_SAT

NDAYS_SAT is present in all averaged data products and contains the number of days of satellite observations within the averaging period.

For global lake-mean products NDAYS_SAT is a 2-dimensional array containing the number of days of satellite observations within the averaging period for each lake.

FLAG_TIMESERIES

FLAG_TIMESERIES provides information on the quality of the reconstruction and which ATSR instruments have contributed to the averaged products. Its form varies across the different types of data product.

FLAG_TIMESERIES in the unaveraged reconstructions is a single integer value used to indicate whether the reconstruction is based on the original time-series of observations (0), an annual climatology derived from the observations (1), or is deemed to be invalid by expert assessment (2).

FLAG_TIMESERIES in the averaged per-lake products is a three-element vector containing the information described above (in the same format) for each ATSR instrument. The relevant element of FLAG_TIMESERIES is set equal to 2 if no data is available for a particular ATSR. For averaged products based on observations, FLAG_TIMESERIES only describes which ATSRs are present (using the same numbering scheme).

FLAG_TIMESERIES in the averaged global lake-mean products contains the three-element vector (as described above) for each lake.

FLAG_TIMESERIES in the averaged global spatially resolved products combines the information contained in FLAG_TIMESERIES in the averaged PL products, into a byte array on the global grid. This is done by setting bit-values to indicate whether reconstructions are based on climatology and

whether reconstructions are valid (ATSR is present) for each ATSR. Details of this bit-setting method are given in Table 23. If the original time-series is used, then no bit-value is set for that ATSR.

Instrument	Climatology		Invalid	
	Bit	Value	Bit	Value
ATSR1	1	1	2	2
ATSR2	3	4	4	8
AATSR	5	16	6	32

Table 23. Details of bit-value settings for FLAG_TIMESERIES in the averaged global products.

FLAG_SOURCE

FLAG_SOURCE is present only in data products for unaveraged reconstructions and averaged daily lake-mean time-series from reconstructions. It provides information on the source of input data to DINEOF for each day of the reconstruction. The flag meanings for FLAG_SOURCE are outlined in Table 24. A value of zero indicates sufficient observations were present to use in DINEOF.

Bit	Value	Meaning
1	1	FLake data used
2	2	Too few observations for use in DINEOF
3	4	Interpolated in time

Table 24. Details of the bit-value settings for the FLAG_SOURCE variable.

NDAYS_FLAKE

NDAYS_FLAKE is present only in averaged data products derived from reconstructions. It contains the number of days where FLake simulations of ice cover have been used in the reconstruction , within the averaging period.

For global lake-mean products NDAYS_FLAKE is a 2-dimensional array containing the number of days of where FLake simulations of ice cover have been used in the reconstruction, within the averaging period, for each lake.

CROSS_ERR

CROSS_ERR is the cross-validation error (Kelvin) from the DINEOF reconstruction. It provides a measure the accuracy of the reconstruction, relative to the observations.

NEV

NEV is the number of eigenvectors used in the reconstruction. The optimal number of eigenvectors is determined by DINEOF.

TITLE

TITLE contains a description of the data product.

SOURCE

SOURCE contains a brief description of the source of the data (i.e. the stage of the processing chain).

VERSION

VERSION is the ARC-Lake version number.

CREATION_DATE

CREATION_DATE is the creation date of the original unaveraged ARC-Lake products from which all other products are derived.

DAY_NIGHT

DAY_NIGHT indicates whether observations are made during daytime or night time. Data are flagged in this manner based on the solar zenith angle: < 90° = daytime, ≥ 90° = night time.

DATE

DATE is present in the DG product only. It is the date of observation.

ARCLAKE_NAME

ARCLAKE_NAME is present in the PL product only. It is ARC-Lake code name for the lake for which the PL product contains data.

ARCLAKE_ID

ARCLAKE_ID is present in the PL product only. It is ARC-Lake ID for the lake for which the PL product contains data. It should correspond to the lake ID given in the PL product filename and the lake IDs given in the variable LAKEID. A list of associations between lake IDs and lake names are is given in Table 28 in the Appendix.

LONGITUDE_CONVERSION

LONGITUDE_CONVERSION contains details of how to calculate a longitude value from a longitude subscript on the global grid.

LATITUDE_CONVERSION

LATITUDE_CONVERSION contains details of how to calculate a latitude value from a latitude subscript on the global grid.

CDO

CDO provides a description of the version of CDO used to generate the averaged products.

CONVENTIONS

CONVENTIONS provides the version of CF conventions to which the data product is designed to meet.

General Data Product Information

File Format

All data products are stored in the NetCDF file format.

Global Grid

Spatially-resolved data products are stored for cells at a longitude/latitude resolution of 0.05°x0.05°.

Positioning Per-Lake Data on the Global Grid

Spatially-resolved per-lake data are stored on a fixed longitude/latitude grid for each time-step (e.g. day of observation or averaging period). This includes time-steps where all observations are flagged as cloud or ice covered (i.e. NLSWT=0 for all grid cells). These variables are stored in 3-D arrays with dimensions [LON, LAT, TIME], where LON and LAT represent the longitude and latitude dimensions in terms of 0.05°x0.05° cells, and TIME represents the number of days where the lake is observed.

The location of the lake grid is given in terms of indices of a global grid at 0.05°x0.05° resolution (longitude range [-180,180], latitude range [90,-90]). This global grid is defined by the variables GLOBAL_LON_ZERO, GLOBAL_LAT_ZERO, and GLOBAL_RESOLUTION. The indices that provide the location information for the boundaries of the lake grid are held in the variables LONGRIDBOUNDS and LATGRIDBOUNDS, which contains the minimum and maximum indices for longitude and latitude. Using these variables the data for a given time-step can easily be placed in a 2-D global grid, as outlined in example lines of IDL code below.

```
IDL> lswt_grid = $
IDL> FLTARR((360/GLOBAL_RESOLUTION), (180/GLOBAL_RESOLUTION))
IDL> lswt_grid[LONGRIDBOUNDS[0]:LONGRIDBOUNDS[1],$
IDL> LATGRIDBOUNDS[0]:LATGRIDBOUNDS[1]] = $
IDL> LSWT[*,*,time_step]
```

Arrays of longitude and latitude values for the local grid cells are available in the variables, LON and LAT. These values represent the centre of grid cells.

Uncompressing the Unaveraged Global Observation Data Product

The unaveraged daily global product comprises of one file per day and contains data for all lakes observed that day. Only data in locations where the satellite instrument observes a lake on the given day are stored. Consequently, the data are stored in 1-D arrays with associated location information, rather than on a 2-D global grid. Storing the data in this way reduces the file size to approximately 0.1% that required when a 2-D grid is used. CF 1.4 compression by gathering techniques (http://cf-pcmdi.llnl.gov/documents/cf-conventions/1.4/cf-conventions.html#compression-by-gathering) are used to store the data in this way.

The location of these cells is given in terms of a global grid at 0.05°x0.05° resolution (longitude range [-180,180], latitude range [90,-90]). This global grid is defined by the variables LON, and LAT, which contain the longitude and latitude values for each cell on the global grid. The variable GRIDINDEX defines the location of each observation cell on this global grid, in the form of indices of a 1-D array representing the full 2-D longitude/latitude grid (where the longitude is the fastest varying component). Indices of the 2-D grid can be determined using the conversions given by the

variables LONINDEX_CONVERSION and LATINDEX_CONVERSION, as outlined in the example lines of IDL code below.

```
IDL> LSWT_2d = FLTARR((360/GLOBAL_RESOLUTION), (180/GLOBAL_RESOLUTION))
IDL> lonindex = GRIDINDEX MOD LON
IDL> latindex = GRIDINDEX / LON
IDL> LSWT_2d[lonindex,latindex]=LSWT
```

In this example, LON is the dimension rather than the variable of the same name. Longitude and latitude values can be obtained by direct look-up of the variables LON and LAT using LONINDEX and LATINDEX as calculated above. Alternatively, they can be calculated using the *scale* and *offset* variables provided for each. Details of how to apply these are given in the variables, LONGITUDE_CONVERSION and LATITUDE_CONVERSION, and are also repeated below.

$$Longitude = (lonindex \times LON\_SCALE) + LON\_OFFSET$$

$$Latitude = (lonindex \times LAT\_SCALE) + LAT\_OFFSET$$

These longitude and latitude values represent the centre of the 0.05°x0.05° cells.

Scaling and Offsets in Averaged Global Data Products

The spatially-resolved averaged global data products comprise of one file per averaging period and contain data for all lakes. Unlink the unaveraged global files, data are stored on the full 2-D global grid (i.e. compression by gathering techniques are not applied). To reduce storage requirements, data are packed using the SCALE_FACTOR and ADD_OFFSET attributes, where possible. For example, LSWT is stored as integer values with SCALE_FACTOR=0.002 and ADD_OFFSET=260.0. This allows LSWT values with approximate range of 260-325 K to be stored with arithmetic precision of 0.002 K.

Averaging Methods

All spatial and temporal averaging applied to the unaveraged data to create the averaged data products is applied using the Climate Data Operators (CDO) software (https://code.zmaw.de/projects/cdo).

For reconstruction based products the averaging is performed over all data in the averaging period, as the reconstructions are temporally complete.

For observation based products an alternative averaging method is implemented, to reduce the impact of inconsistencies in sampling across the time periods (e.g. in a monthly mean for a month where temperatures are rising, a lack of observations in the later part of the month may result in an underestimate of the monthly mean LSWT). The mean LSWT over a time interval, *time*, is defined as:

$$O\_LSWT_{time} = \frac{\sum(O\_LSWT_d - C\_LSWT_d)}{nd} + C\_LSWT_{time}$$

Where: O_$LSWT_d$ are the temporally incomplete LSWT observations, C_$LSWT_d$ are the climatological daily mean LSWT, and C_$LSWT_{time}$ are the climatological mean LSWT over the time interval, *time*. The subscript, *d*, indicates the day of observation, and *nd* the number of days of observations. O_LSWT_{time} is calculated for each grid cell independently. Climatology data derived from the reconstructions are used as the reference climatologies, C_$LSWT_d$ and C_$LSWT_{time}$.

Land / Water Mask

A global land/water mask on the ARC-Lake product resolution (0.05^{o}x0.05^{o}) is also available. This is required for working with the averaged global products, as the LAKEID is not included in these products (to minimize file sizes).

File Name

Basic File Name Format	Example
AL_LW_MASK_XX.nc	AL_LW_MASK_20.nc

Table 25. File name for the ARC-Lake land/water mask on the 0.05°x0.05° global grid. Here XX=20 indicates the grid resolution of $^{1}/_{20}$°.

Dimensions

Dimension Name	Description
LON	Longitude.
LAT	Latitude

Table 26. Dimensions in the ARC-Lake land/water mask file.

Variables

Variable Name	Type	Description [units]	Contents / Array Dimensions
LON	FLOAT	Longitude at centre of grid cell. [degrees_east]	[LON]
LAT	FLOAT	Latitude at centre of grid cell. [degrees_north]	[LAT]
LAKEID	INT	Lake ID (>0 = valid lake ID)	[LON,LAT]
FLAGMIX	INT	Flag to indicate is more than one lake is present in the cell.	[LON,LAT]
NLAKE	INT	Number of lake cells at the full (source) mask resolution in the cell.	[LON,LAT]
GLOBAL_LON_ZERO	FLOAT	Longitude at centre of westernmost cell of global grid (corresponding to lonindex=0) [degrees_east]	-179.95
GLOBAL_LAT_ZERO	FLOAT	Latitude at centre of northernmost cell of global grid (corresponding to latindex=0)	89.975
GLOBAL_RESOLUTION	FLOAT	Resolution of grid cells	0.05
TITLE	STRING	Data product type	ARCLake – Land/Water Mask
SOURCE	STRING	Source of data	ARCLake
VERSION	STRING	ARCLake version number	1.1
CREATION_DATE	STRING	Date of creation (YYYYMMDD)	20110318

Table 27. Overview of variables and global attributes present in the ARC-Lake land/water mask product.

Detailed Data Description

Overview

Dimensions and variables are defined as for the data products. Two new variables are introduced and are described below.

FLAG_MIX

FLAG_MIX indicates whether each 0.05°x0.05° grid cell contains a single or multiple lakes: FLAG_MIX=0 indicates a single lake, FLAG_MIX=1 indicates that more than one lake exists in the cell. In cases where more than one lake exists, the cell average values may include data from both lakes.

NLAKE

NLAKE contains the number of lake cells at the full source mask resolution ($^{1}/_{120}$°x$^{1}/_{120}$°) within the 0.05°x0.05° grid cell.

References

Alvera-Azcárate, A., Barth, A., Rixen, M., and Beckers, J. 2005. Reconstruction of incomplete oceanographic data sets using empirical orthogonal functions: application to the Adriatic Sea surface temperature. *Ocean Modelling*, Vol. 9, pp. 325-346.

Lehner, B., and Döll, P. 2004. Development and validation of a global database of lakes, reservoirs and wetlands. *Journal of Hydrology*, Vol. 296, No. 1-4, pp. 1-22.

MacCallum, S. N., and Merchant, C. J. 2010, *ARC-Lake Algorithm Theoretical Basis Document*, School of GeoSciences, The University of Edinburgh.

Appendix

Lake IDs

Table 28 provides an alphabetical list of lake names and their associated lake IDs. These lake IDs correspond to the LAKEID and ARCLAKE_ID variables in the data products. The lake IDs listed in Table 28 also correspond to those used in the data product file names (e.g. ALID0166_PLOBS3D.nc contains data for Lake Abaya). Longitude and latitude values given in Table 28 represent the nominal lake centre. Depending on the shape of the lake and the location of islands within the lake, these coordinates may lie over land.

Lake ID	Lake Name	Longitude	Latitude	Country
166	ABAYA	37.83	6.30	Ethiopia
527	ABE	41.79	11.17	Ethiopia; Djibouti
152	ABERDEEN	-98.59	64.55	Canada
418	ABY	-3.23	5.23	Ivory Coast; Ghana
58	ALAKOL	81.75	46.11	Kazakhstan
30	ALBERT	30.91	1.67	Uganda; DR Congo
210	ALEXANDRINA	139.09	-35.52	Australia
1748	ALMANOR	-121.19	40.26	United States
56	AMADJUAK	-71.13	64.99	Canada
354	ANG-LA JEN	83.09	31.53	China
324	ANGIKUNI	-100.04	62.27	Canada
4	ARAL	60.08	45.13	Kazakhstan; Uzbekistan
117	ARGENTINO	-73.03	-50.33	Argentina; Chile
334	ARTILLERY	-107.82	63.17	Canada
345	ASHUANIPI	-66.14	52.69	Canada
115	ASTRAY	-66.32	54.38	Canada
23	ATHABASCA	-109.96	59.10	Canada
311	ATLIN	-133.75	59.57	Canada
312	AYAKKUM	89.35	37.55	China
226	AYLMER	-108.46	64.15	Canada
181	BAGHRASH	87.07	41.98	China
8	BAIKAL	108.14	53.63	Russia
97	BAKER	-95.28	64.13	Canada
310	BALATON	17.83	46.88	Hungary
17	BALKHASH	73.95	45.91	Kazakhstan
536	BANGONG	79.71	33.61	China
229	BARUN-TOREY	115.81	50.07	Russia
205	BAY	121.26	14.36	Philippines
145	BECHAROF	-156.40	57.85	United States
160	BELOYE	37.64	60.18	Russia
267	BEYSEHIR	31.52	37.78	Turkey
155	BIENVILLE	-72.98	55.05	Canada
280	BIG TROUT	-90.02	53.77	Canada
268	BIWA	136.08	35.25	Japan
333	BLACK	-105.73	59.05	Canada
191	BRAS D'OR	-60.83	45.95	Canada
94	BUENOS AIRES	-72.50	-46.66	Chile; Argentina
299	BUFFALO	-115.49	60.22	Canada
291	BUYR	117.69	47.81	Mongolia; China
257	CARATASCA	-83.85	15.35	Honduras

1	CASPIAN	50.36	41.85	Kazakhstan; Russia; Turkmenistan; Azerbaijan; Iran
265	CAXUANA	-51.50	-2.04	Brazil
57	CEDAR	-100.14	53.33	Canada
165	CHAMPLAIN	-73.27	44.45	United States; Canada
233	CHAO	117.57	31.57	China
153	CHAPALA	-103.05	20.21	Mexico
204	CHILKA	85.38	19.69	India
256	CHILWA	35.71	-15.32	Malawi
84	CHIQUITA	-62.61	-30.74	Argentina
119	CHISHI	29.72	-8.71	Zambia
323	CHURCHILL	-108.29	55.96	Canada
125	CLAIRE	-112.08	58.59	Canada
1188	CLEAR	-122.77	39.02	United States
275	CLINTON COLDEN	-107.45	63.94	Canada
277	COARI	-63.37	-4.25	Brazil
219	COLHUE HUAPI	-68.76	-45.47	Argentina
352	CONSTANCE	9.28	47.65	Germany; Switzerland; Austria
162	CONTWOYTO	-110.66	65.59	Canada
284	CORO	-69.86	11.56	Venezuela
137	CREE	-106.64	57.47	Canada
251	CROSS	-97.58	54.71	Canada
351	DAUPHIN	-99.77	51.27	Canada
244	DEAD	35.49	31.52	Jordan; West Bank; Israel
326	DESCHAMBAULT	-103.45	54.78	Canada
281	DORE	-107.28	54.76	Canada
49	DUBAWNT	-101.44	63.13	Canada
128	EAU CLAIRE	-74.40	56.15	Canada
297	EBI	82.92	44.86	China
305	EBRIE	-4.26	5.30	Ivory Coast
69	EDWARD	29.61	-0.39	DR Congo; Uganda
390	EGRIDIR	30.85	38.07	Turkey
254	ENNADAI	-101.31	60.96	Canada
723	ENRIQUILLO	-71.58	18.49	Dominican Republic
12	ERIE	-81.16	42.25	Canada; United States
149	ESKIMO	-132.76	69.10	Canada
270	EVANS	-77.02	50.97	Canada
1029	EVORON	136.51	51.48	Russia
156	EYASI	35.04	-3.58	Tanzania
304	FAGNANO	-68.03	-54.55	Argentina; Chile
315	FERGUSON	-105.27	69.41	Canada
404	FROBISHER	-108.22	56.37	Canada
227	GARRY	-99.40	65.95	Canada
327	GENEVA	6.25	46.37	Switzerland; France
172	GODS	-94.21	54.62	Canada
363	GRANVILLE	-100.21	56.40	Canada
252	GRAS	-110.38	64.54	Canada
9	GREAT BEAR	-121.30	65.91	Canada
11	GREAT SLAVE	-114.37	62.09	Canada
253	GUILLAUME-DELISLE	-76.28	56.33	Canada
294	HAR	93.21	48.05	Mongolia
142	HAR US	92.30	48.06	Mongolia
302	HAR-HU	97.59	38.31	China

214	HAUKIVESI	28.52	62.10	Finland
339	HAZEN	-70.94	81.80	Canada
288	HIGHROCK	-100.44	55.83	Canada
189	HOTTAH	-118.44	64.95	Canada
59	HOVSGOL	100.48	51.02	Mongolia
75	HULUN	117.38	48.97	China
109	HUNGTZE	118.53	33.34	China
5	HURON	-82.21	44.78	Canada; United States
121	HYARGAS	93.30	49.13	Mongolia
62	ILIAMNA	-154.90	59.56	United States
144	INARI	27.83	69.04	Finland
293	INDIAN RIVER	-80.64	28.24	United States
174	ISLAND	-94.70	53.85	Canada
25	ISSYKKUL	77.25	42.46	Kyrgyzstan
1441	ISTADA	67.92	32.48	Afghanistan
245	IZABAL	-89.11	15.57	Guatemala
141	KAGHASUK	-164.22	60.79	United States
246	KAMINAK	-94.90	62.20	Canada
320	KAMINURIAK	-95.79	62.96	Canada
264	KAMlLUKUAK	-101.73	62.28	Canada
287	KAOYU	119.31	32.87	China
197	KARA-BOGAZ-GOL	53.54	41.23	Turkmenistan
124	KASBA	-102.27	60.34	Canada
346	KEITELE	25.99	62.89	Finland
45	KHANKA	132.42	44.94	Russia; China
218	KHANTAYSKOE	91.18	68.36	Russia
67	KIVU	29.23	-2.04	DR Congo; Rwanda
41	KOKO	100.18	36.89	China
344	KRASNOE	174.44	64.53	Russia
262	KULUNDINSKOE	79.58	52.98	Russia
325	KWANIA	32.65	1.72	Uganda
382	KYARING	88.32	31.13	China
99	KYOGA	33.01	1.50	Uganda
331	LABAZ	99.57	72.27	Russia
16	LADOGA	31.39	60.84	Russia
147	LESSER SLAVE	-115.49	55.43	Canada
140	LIMFJORDEN	9.17	56.78	Denmark
209	LLANQUIHUE	-72.79	-41.14	Chile
357	LOWER SEAL	-73.42	56.49	Canada
175	LUANG	100.38	7.46	Thailand
184	MACKAY	-111.30	63.96	Canada
101	MADRE	-97.66	24.64	Mexico
163	MALAREN	16.19	59.44	Sweden
350	MALHEUR	-118.83	43.34	United States
176	MANAGUA	-86.35	12.32	Nicaragua
231	MANGUEIRA	-52.84	-33.16	Brazil
37	MANITOBA	-98.80	50.99	Canada
368	MANOUANE	-70.99	50.76	Canada
250	MANYCH-GUDILO	42.98	46.26	Russia
100	MARTRE	-117.91	63.33	Canada
6	MICHIGAN	-87.09	43.86	United States
366	MILLE LACS	-93.65	46.24	United States
224	MINTO	-74.71	57.34	Canada

46	MIRIM	-53.25	-32.89	Brazil; Uruguay
76	MISTASSINI	-73.81	50.82	Canada
883	MONO	-118.96	38.01	United States
286	MURRAY	141.53	-6.95	Papua New Guinea
36	MWERU	28.74	-9.01	Zambia; DR Congo
343	NAHUEL HUAPI	-71.52	-40.92	Argentina
377	NAKNEK	-155.67	58.64	United States
91	NAM	90.66	30.71	China
322	NATRON	36.02	-2.34	Tanzania; Kenya
338	NERPICH'YE	162.77	56.39	Russia
32	NETILLING	-70.28	66.42	Canada
300	NGORING	97.71	34.93	China
21	NICARAGUA	-85.36	11.57	Nicaragua
38	NIPIGON	-88.55	49.80	Canada
198	NIPISSING	-79.92	46.24	Canada
211	NONACHO	-108.92	61.82	Canada
303	NORTH MOOSE	-100.16	54.05	Canada
83	NUELTIN	-99.40	60.25	Canada
10	NYASA	34.59	-11.96	Malawi; Mozambique; Tanzania
114	OKEECIIOBEE	-80.86	26.95	United States
336	OLING	97.27	34.92	China
207	OMULAKH	145.59	72.29	Russia
18	ONEGA	35.35	61.90	Russia
15	ONTARIO	-77.77	43.85	Canada; United States
187	ORIVESI	29.59	62.35	Finland
157	PAIJANNE	25.49	61.71	Finland
697	PANGONG	78.61	33.82	India; China
353	PAYNE	-73.82	59.40	Canada
50	PEIPUS	27.59	58.41	Russia; Estonia
349	PERLAS	-83.67	12.54	Nicaragua
222	PETER POND	-108.55	55.84	Canada
195	PIELINEN	29.71	63.16	Finland
213	PLAYGREEN	-97.75	54.07	Canada
232	POINT	-113.84	65.31	Canada
649	POMO	90.40	28.55	China
133	POOPO	-67.06	-18.81	Bolivia
395	PRINCESS MARY	-97.66	63.93	Canada
164	PURUVESI	29.02	61.77	Finland
273	PYA	30.98	66.07	Russia
240	PYASINO	87.78	69.77	Russia
1240	PYHAJARVI	22.28	61.00	Finland
411	PYRAMID	-119.55	40.03	United States
130	RAINY	-92.97	48.61	Canada; United States
358	RAZELM	28.97	44.83	Romania
151	RED	-95.08	48.04	United States
28	REINDEER	-102.27	57.19	Canada
321	ROGOAGUADO	-65.73	-12.91	Bolivia
127	RONGE	-104.83	55.11	Canada
22	RUDOLF	36.08	3.53	Kenya; Ethiopia
146	SAINT CLAIR	-82.73	42.50	Canada; United States
158	SAINT JEAN	-72.02	48.66	Canada
285	SAINT JOSEPH	-90.81	51.04	Canada
282	SAKAMI	-76.75	53.22	Canada

194	SALTON	-115.83	33.30	United States
167	SAN MARTIN	-72.84	-48.75	Chile; Argentina
356	SANDY	-93.03	53.00	Canada
241	SARYKAMYSHSKOYE	57.61	41.88	Turkmenistan
247	SASYKKOL	80.91	46.58	Kazakhstan
313	SCOTT	-106.07	60.02	Canada
228	SEG	33.76	63.32	Russia
170	SELAWIK	-160.73	66.51	United States
271	SELETYTENIZ	73.18	53.23	Kazakhstan
292	SELWYN	-104.68	60.00	Canada
135	SEVAN	45.29	40.39	Armenia
579	SHAMO	37.55	5.83	Ethiopia
143	SHERMAN	-97.73	67.79	Canada
236	SIMCOE	-79.42	44.47	Canada
27	SMALLWOOD	-64.31	54.19	Canada
365	SNOWBIRD	-102.94	60.64	Canada
319	SOUTH HENIK	-97.29	61.37	Canada
225	SOUTH MOOSE	-100.04	53.83	Canada
2	SUPERIOR	-88.23	47.72	Canada; United States
85	SYVASH	34.74	45.96	Ukraine
380	TAHOE	-120.04	39.09	United States
66	TAI	120.24	31.21	China
178	TAKIYUAK	-113.17	66.28	Canada
235	TAMIAHUA	-97.57	21.66	Mexico
55	TANA	37.31	11.95	Ethiopia
7	TANGANYIKA	29.46	-6.07	DR Congo; Tanzania; Zambia; Burundi
215	TANGRA	86.59	31.05	China
73	TAPAJOS	-55.14	-2.88	Brazil
316	TATHLINA	-117.64	60.54	Canada
295	TAUPO	175.90	-38.81	New Zealand
43	TAYMYR	100.76	74.48	Russia
373	TEBESJUAK	-98.98	63.76	Canada
120	TENGIZ	68.90	50.44	Kazakhstan
179	TERINAM	85.61	30.90	China
212	TESHEKPUK	-153.60	70.59	United States
20	TITICACA	-69.30	-15.92	Peru; Bolivia
150	TOBA	98.90	2.61	Indonesia
186	TOP	32.09	65.62	Russia
332	TOWUTI	121.52	-2.79	Indonesia
367	TROUT	-121.13	60.58	Canada
269	TULEMALU	-99.48	62.99	Canada
255	TUMBA	17.98	-0.82	DR Congo
425	UBINSKOE	80.05	55.47	Russia
239	ULUNGUR	87.30	47.22	China
314	UPEMBA	26.40	-8.65	DR Congo
53	UVS	92.81	50.33	Mongolia; Russia
51	VAN	42.98	38.66	Turkey
29	VANERN	13.22	58.88	Sweden
95	VATTERN	14.57	58.33	Sweden
1820	VESIJARVI	25.39	61.09	Finland
3	VICTORIA	33.23	-1.30	Tanzania; Uganda; Kenya
171	VIEDMA	-72.56	-49.59	Argentina

136	VYG	34.84	63.54	Russia
1128	WALKER	-118.71	38.70	United States
876	WEISHAN	117.24	34.61	China
169	WHOLDAIA	-104.15	60.69	Canada
340	WINNEBAGO	-88.42	44.02	United States
13	WINNIPEG	-97.25	52.12	Canada
31	WINNIPEGOSIS	-100.05	52.37	Canada
68	WOLLASTON	-103.33	58.30	Canada
44	WOODS	-94.91	49.38	Canada; United States
134	XINGU	-52.20	-2.16	Brazil
261	YAMDROK	90.76	28.97	China
126	YATHKYED	-98.07	62.69	Canada
105	ZILING	88.95	31.77	China

Table 28. Alphabetical list of lakes included in Phase One of the ARC-Lake project and their corresponding Lake IDs. Longitude values are given in degrees east. Latitude values are given in degrees north. Where more than one country is listed, the country in which the largest fraction of the lake lies is listed first.