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D1.2: Data Access Requirement Document (DARD)

Reference: CCI-LAKES-0017CCI-DARD

Issue: 2.0

Date: 29 November 2021



lakes
cci

Chronology Issues:			
Issue:	Date:	Reason for change:	Author
1.0	9 August 2019	Initial Version	B. Calmettes
1.1	29 Oct. 2019	Updates following ESA review	B. Calmettes
1.2	15 Feb. 2021	Updates due to CRDP V1.1 generation and ECVs Consistency Option	B. Calmettes S. Simis
1.3	29 April 2021	Addition of a chapter on the LIT option following the ESA Review	B. Coulon
1.4	7 Sept. 2021	Completion of the chapter dedicated to the required data for LIT	C. Duguay
2.0	29 Nov. 2021	Accompanying CRDPv2.0, including corrections following review of document revision 1.4	B. Coulon

People involved in this issue:			Signature
Written by:	B. Calmettes S Simis	CLS PML	
Checked by:	J.F. Crétaux S. Simis	LEGOS PML	
Approved by:	B. Coulon	CLS	
Accepted by:	C. Albergel	ESA	

Distribution:		
Company	Names	Contact Details
ESA	C. Albergel	clementalbergel@esa.int
BC	K. Stelzer	kerstin.stelzer@brockmann-consult.de
CLS	B. Coulon B. Calmettes A. Mangilli P. Thibaut	bcoulon@groupcls.com bcalmettes@groupcls.com amangilli@groupcls.com pthibaut@groupcls.com
CNR	C. Giardino M. Pinardi	giardino.c@irea.cnr.it pinardi.m@irea.cnr.it
Eola	E. Zakharova	zavocado@gmail.com
GeoEcoMar	A. Scrieci	albert.scrieci@geoecomar.ro
H2OG	C. Duguay Y. WU	claudeduguay@h2ogeomatics.com mark.wu@h2ogeomatics.com
LEGOS	J.F. Crétaux A. Kouraev	jean-francois.cretaux@legos.obs-mip.fr alexei.kouraev@legos.obs-mip.fr
NORCE	E. Malnes	eirik.malnes@norceresearch.no
PML	S. G. H. Simis	stsi@pml.ac.uk
SERTIT	H. Yésou	herve.yesou@unsitra.fr
TRE-ALTAMIRA	Pablo Blanco	Pablo.blanco@tre-altamira.com
UoR	C. Merchant L. Carrea	c.j.merchant@reading.ac.uk l.carrea@reading.ac.uk
UoS	A. Tyler E. Spyraeos	a.n.tyler@stir.ac.uk evangelos.spyrakos@stir.ac.uk

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1. Introduction

The purpose of this data access requirement document (DARD) for the Lakes Climate Change Initiative project (Lakes_cci) is to identify all data (input, reference and ancillary data) necessary to generate and validate version 2 (V2) of the lakes CCI harmonised dataset as well as the initial experimental release of Lake Ice Thickness products.

The required data can be classified into several types:

- Satellite data from multiple satellites
- Associated ancillary data
- Validation data from in situ sources

All these data types are detailed in this document.

2. Data description

Lakes_cci consists of multiple thematic ECVs derived from multiple satellites. This Data Access Requirement Document (DARD), therefore, identifies data for each of the main products: Lake Water Level (LWL), Lake Water Extent (LWE), Lake Ice Cover (LIC), Lake Surface Water Temperature (LSWT), Lake Water Leaving Reflectance. It also identifies data used for Global Consistency and Lake Ice Thickness studies. For each data type a table is presented containing, as relevant:

- Data type: Origin of the input data. This can be satellite data, ancillary data or validation data.
- Output product: The name of the output variable using the input data
- Product input: The name of the input product
- Input variable: The name of the variables in the input product
- Source: The name of the source
- Spatial resolution: The spatial resolution in degrees of the input data
- Temporal resolution: The temporal resolution of the input data
- Temporal coverage: The time period for which data are available
- File format: Format of the input file
- Size: The size of a file (per time step if appropriate)
- Public/private: Indicates if the data is public or private
- Access point: The address of the access point
- Comment: Free additional information

3. Required data for Lake Water Level (LWL)

Data Type	Satellite data
Input Product	TOPEX/Poseidon MGDR-B
Input variable	<p>alt_20hz (20 Hz altitude of the satellite)</p> <p>range_20hz_ku (20 Hz Ku band corrected altimeter range)</p> <p>sig0_20hz_ku (20 Hz Ku band corrected backscatter coefficient)</p> <p>ice_range_20hz_ku (20 Hz Ku band altimeter range (ice retracking))</p> <p>model_dry_tropo_corr (model dry tropospheric correction)</p> <p>model_wet_tropo_corr (model wet tropospheric correction)</p> <p>rad_wet_tropo_corr (model wet tropospheric correction)</p> <p>iono_corr_alt_ku (altimeter correction on Ku band)</p> <p>iono_corr_gim_ku (GIM ionospheric range correction on Ku band (MLE3 retracking))</p> <p>solid_earth_tide (solid earth tide height)</p> <p>pole_tide (geocentric pole tide height)</p> <p>geoide (geoide height)</p>
Source	CTOH
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	1993-2001
File format	NetCDF
Version	Not available
Size	0.7MB per file (~26 MB/year)
Public/Private	public
Access point	http://ctoh.legos.obs-mip.fr/data
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Envisat
Input variable	<p>alt_20hz (20 Hz altitude of the satellite)</p> <p>range_20hz_ku (20 Hz Ku band corrected altimeter range)</p> <p>sig0_20hz_ku (20 Hz Ku band corrected backscatter coefficient)</p> <p>ice_range_20hz_ku (20 Hz Ku band altimeter range (ice retracking))</p> <p>model_dry_tropo_corr (model dry tropospheric correction)</p> <p>model_wet_tropo_corr (model wet tropospheric correction)</p> <p>rad_wet_tropo_corr (model wet tropospheric correction)</p> <p>iono_corr_alt_ku (altimeter correction on Ku band)</p> <p>iono_corr_gim_ku (GIM ionospheric range correction on Ku band (MLE3 retracking))</p> <p>solid_earth_tide (solid earth tide height)</p> <p>pole_tide (geocentric pole tide height)</p> <p>geoide (geoide height)</p>
Source	CTOH
Spatial Resolution	300m
Temporal resolution	30-35 days
Temporal coverage	2002-2012
File format	NetCDF
Version	Reprocessed V3.0
Size	0.7MB per file (~26 MB/year)
Public/Private	public
Access point	http://ctoh.legos.obs-mip.fr/data
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Jason-1 GDR-E
Input variable	<p>alt_20hz (20 Hz altitude of the satellite)</p> <p>range_20hz_ku (20 Hz Ku band corrected altimeter range)</p> <p>sig0_20hz_ku (20 Hz Ku band corrected backscatter coefficient)</p> <p>ice_range_20hz_ku (20 Hz Ku band altimeter range (ice retracking))</p> <p>model_dry_tropo_corr (model dry tropospheric correction)</p> <p>model_wet_tropo_corr (model wet tropospheric correction)</p> <p>rad_wet_tropo_corr (model wet tropospheric correction)</p> <p>iono_corr_alt_ku (altimeter correction on Ku band)</p> <p>iono_corr_gim_ku (GIM ionospheric range correction on Ku band (MLE3 retracking))</p> <p>solid_earth_tide (solid earth tide height)</p> <p>pole_tide (geocentric pole tide height)</p> <p>geoide (geoide height)</p>
Source	CTOH
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2001-2013
File format	NetCDF
Version	Standard E
Size	60 Gb/year
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Jason-2 GDR-D
Input variable	alt_20hz (20 Hz altitude of the satellite) range_20hz_ku (20 Hz Ku band corrected altimeter range) sig0_20hz_ku (20 Hz Ku band corrected backscatter coefficient) ice_range_20hz_ku (20 Hz Ku band altimeter range (ice retracking)) model_dry_tropo_corr (model dry tropospheric correction) model_wet_tropo_corr (model wet tropospheric correction) rad_wet_tropo_corr (model wet tropospheric correction) iono_corr_alt_ku (altimeter correction on Ku band) iono_corr_gim_ku (GIM ionospheric range correction on Ku band (MLE3 retracking)) solid_earth_tide (solid earth tide height) pole_tide (geocentric pole tide height) geoide (geoide height)
Source	Aviso
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2008-present
File format	NetCDF
Version	Standard D
Size	60 Gb/year
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Jason-3 GDR-E
Input variable	alt_20hz (20 Hz altitude of the satellite) range_20hz_ku (20 Hz Ku band corrected altimeter range) sig0_20hz_ku (20 Hz Ku band corrected backscatter coefficient) ice_range_20hz_ku (20 Hz Ku band altimeter range (ice retracking)) model_dry_tropo_corr (model dry tropospheric correction) model_wet_tropo_corr (model wet tropospheric correction) rad_wet_tropo_corr (model wet tropospheric correction) iono_corr_alt_ku (altimeter correction on Ku band) iono_corr_gim_ku (GIM ionospheric range correction on Ku band (MLE3 retracking)) solid_earth_tide (solid earth tide height) pole_tide (geocentric pole tide height) geoide (geoide height)
Source	Aviso
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2008-present
File format	NetCDF
Version	Standard E
Size	60 Gb/year
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	SARAL/AltiKa
Input variable	alt (1 Hz altitude of the satellite) alt_40hz (40 Hz altitude of the satellite) range (1 Hz corrected altimeter range) range_40z (40 Hz corrected altimeter range) sig0 (Corrected backscatter coefficient) sig0_40Hz (40 Hz corrected backscatter coefficient) ice_sig0_40hz (40 Hz backscatter coefficient (sea-ice retracking)) ice2_sig0_40hz (40 Hz backscatter coefficient (ice-2 retracking)) model_dry_tropo_corr (model dry tropospheric correction) model_wet_tropo_corr (model wet tropospheric correction) rad_wet_tropo_corr (radiometer wet tropospheric correction) iono_corr_gim (GIM ionospheric correction) solid_earth_tide (solid earth tide height) pole_tide (geocentric pole tide height) geoide (geoide height)
Source	Aviso
Spatial Resolution	150m
Temporal resolution	35 days
Temporal coverage	2013-present
File format	NetCDF
Version	-
Size	60 Gb/year
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Sentinel-3a L2 PDGS Land STC
Input variable	<p>alt_20_ku (altitude of the satellite: 20 Hz Ku band)</p> <p>range_ocean_20_ku (corrected ocean altimeter range: 20 Hz Ku band)</p> <p>sig0_ocean_20_ku (corrected ocean backscatter coefficient: 20 Hz Ku band)</p> <p>mod_dry_tropo_cor_meas_altitude_01 (model dry tropospheric correction at measurement altitude: 1 Hz)</p> <p>mod_wet_tropo_cor_meas_altitude_01 (model wet tropospheric correction at measurement altitude: 1 Hz)</p> <p>rad_wet_tropo_cor_01_ku (radiometer wet tropospheric correction: 1 Hz Ku band)</p> <p>iono_cor_alt_20_ku (altimeter ionospheric correction: 1Hz Ku band)</p> <p>iono_cor_gim_01_ku (GIM ionospheric correction: 1Hz)</p> <p>solid_earth_tide_01 (Solid earth tide height: 1Hz)</p> <p>pole_tide (Geocentric tide height: 1Hz)</p> <p>geoide (geoide height)</p>
Source	Copernicus Open Access Hub
Spatial Resolution	300m
Temporal resolution	27 days
Temporal coverage	2016-present
File format	NetCDF
Version	SM2 06.15 PB 2.43
Size	64 Gb/year
Public/Private	public
Access point	https://scihub.copernicus.eu
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Sentinel-3b L2 PDGS Land STC
Input variable	<p>alt_20_ku (altitude of the satellite: 20 Hz Ku band)</p> <p>range_ocean_20_ku (corrected ocean altimeter range: 20 Hz Ku band)</p> <p>sig0_ocean_20_ku (corrected ocean backscatter coefficient: 20 Hz Ku band)</p> <p>mod_dry_tropo_cor_meas_altitude_01 (model dry tropospheric correction at measurement altitude: 1 Hz)</p> <p>mod_wet_tropo_cor_meas_altitude_01 (model wet tropospheric correction at measurement altitude: 1 Hz)</p> <p>rad_wet_tropo_cor_01_ku (radiometer wet tropospheric correction: 1 Hz Ku band)</p> <p>iono_cor_alt_20_ku (altimeter ionospheric correction: 1Hz Ku band)</p> <p>iono_cor_gim_01_ku (GIM ionospheric correction: 1Hz)</p> <p>solid_earth_tide_01 (Solid earth tide height: 1Hz)</p> <p>pole_tide (Geocentric tide height: 1Hz)</p> <p>geoide (geoide height)</p>
Source	Copernicus Open Access Hub
Spatial Resolution	300m
Temporal resolution	27 days
Temporal coverage	2018-present
File format	NetCDF
Version	SM2 06.15 PB 2.43
Size	64 Gb/year
Public/Private	public
Access point	https://scihub.copernicus.eu
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Ancillary data
Input Product	Water Occurrence product - JRC's Global Surface Water
Input variable	land mask
Source	JRC
Spatial Resolution	30m
Temporal resolution	n/a
Temporal coverage	1984-2015
File format	tif
Version	V1_0
Size	6.4Gb
Public/Private	public
Access point	https://global-surface-water.appspot.com/
Comments	Used to select points over water. Computed in 2016 by JRC over the 1985-2015 time period

Data Type	Validation data
Input Product	G-REALM Global Reservoir/Lakes
Input variable	lake height variation with respect to Jason-2 reference pass mean level
Source	G-REALM
Spatial Resolution	n/a
Temporal resolution	10 days
Temporal coverage	1992-2018
File format	txt
Version	TPJOJ.2.3
Size	max 70 KB/lake
Public/Private	public
Access point	https://ipad.fas.usda.gov/cropexplorer/global_reservoir/
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Validation data
Input Product	Database for Hydrological Time Series of Inland Waters
Input variable	Water level
Source	Dahiti
Spatial Resolution	n/a
Temporal resolution	irregular
Temporal coverage	depends on the lake
File format	NetCDF
Version	6.0
Size	max 40 KB/lake
Public/Private	public/private
Access point	https://dahiti.dgfi.tum.de/en/
Comments	

Data Type	Validation data
Input Product	Hydrolare in-situ data
Input variable	Water level
Source	Hydrolare
Spatial Resolution	n/a
Temporal resolution	monthly
Temporal coverage	depends on the lake
File format	excel
Version	Not available
Size	max 500 KB (multiple stations)
Public/Private	public/private
Access point	http://hydrolare.net/
Comments	In situ data

D1.2: Data Access Requirement Document (DARD)

Data Type	Validation data
Input Product	Hidricos Argentina in-situ data
Input variable	Water level
Source	Hidricos Argentina
Spatial Resolution	n/a
Temporal resolution	irregular
Temporal coverage	depends on the lake
File format	excel
Version	Not available
Size	max 350 kKB/lake
Public/Private	public
Access point	http://bdhi.hidricosargentina.gob.ar/
Comments	in-situ data

Data Type	Validation data
Input Product	US Army Corps of Engineer in-situ data
Input variable	Water level
Source	US Army Corps of Engineer
Spatial Resolution	n/a
Temporal resolution	monthly
Temporal coverage	depends on the lake
File format	csv
Version	Not available
Size	51 KB (4 lakes)
Public/Private	public
Access point	https://www.lre.usace.army.mil/
Comments	in-situ data

4. Required data for Lake Water Extent (LWE)

Data Type	Satellite data
Input Product	Satellite altimetry
Input variable	LWL
Source	Hydroweb
Spatial Resolution	irregular
Temporal resolution	irregular (2 - 35 days)
Temporal coverage	1992-present
File format	txt
Version	v1
Size	max 200kb per lake
Public/Private	public
Access point	http://hydroweb.theia-land.fr/
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Landsat 5,7,8
Input variable	Surface reflectance & Water index (NDWI, AWI, ...) Hypsometry coefficient
Source	NASA
Spatial Resolution	30 m
Temporal resolution	16 days
Temporal coverage	19865-present
File format	hdf
Version	Not available
Size	Natural, Thermal and Quality full resolution images: ~9Mb per image
Public/Private	public
Access point	https://www.usgs.gov/land-resources/nli/landsat/data-tools
Comments	

Data Type	Satellite data
Input Product	ERS 1-2 SAR
Input variable	water backscattering, extraction based on Kmean, Hypsometric coefficient
Source	ESA
Spatial Resolution	30m
Temporal resolution	35 days
Temporal coverage	1991-2000
File format	CEOS, ENVISAT format
Version	Not available
Size	~ 700 MB
Public/Private	public
Access point	https://earth.esa.int/web/guest/data-access
Comments	Data on demand

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	ENVISAT ASAR
Input variable	Water backscattering, extraction based on Kmean, Hypsometric coefficient
Source	ESA
Spatial Resolution	30 or 75 m
Temporal resolution	35 days
Temporal coverage	2002-2010
File format	CEOS, ENVISAT format
Version	Not available
Size	~ 700 MB
Public/Private	Public
Access point	https://earth.esa.int/web/guest/data-access
Comments	Data on demand

Data Type	Satellite data
Input Product	SENTINEL 1
Input variable	Water backscattering, extraction based on Kmean, Hypsometric coefficient
Source	ESA
Spatial Resolution	20m
Temporal resolution	6 days
Temporal coverage	2014-present
File format	Sentinel-SAFE File Format
Version	Not available
Size	~ 1.4 GB
Public/Private	Public
Access point	https://scihub.copernicus.eu/dhus
Comments	The Sentinel1 revisited rate is significantly greater at higher latitudes than at the equator. Subsequently, there is not the same acquisition rate of acquisition over the lakes. The acquisition rate it is much more over Europe (and some keys areas) but less for other regions (until 12 days)

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Sentinel 2
Input variable	Top of atmosphere reflectances in cartographic geometry Bottom of atmosphere reflectances in cartographic geometry
Source	ESA
Spatial Resolution	10m
Temporal resolution	5 days
Temporal coverage	2015-present
File format	SAFE
Version	Not available
Size	Estimated size in Gb with lossless compression (around 6bits/pixel on average): 3.280 per image
Public/Private	public
Access point	https://scihub.copernicus.eu/dhus
Comments	

Data Type	Validation data
Input Product	in-situ bathymetric curves (Russian hydrological service)
Input variable	Bathymetry
Source	Multiple
Spatial Resolution	Not applicable
Temporal resolution	Not applicable
Temporal coverage	Not applicable
File format	excel
Version	Not available
Size	10 kb
Public/Private	private
Access point	na
Comments	available at the LEGOS archive

D1.2: Data Access Requirement Document (DARD)

Data Type	Ancillary data
Input Product	Bathymetry Legos database
Input variable	Bathymetry
Source	LEGOS
Spatial Resolution	1 km
Temporal resolution	Not applicable
Temporal coverage	Not applicable
File format	binaire
Version	Not applicable
Size	20 Mb
Public/Private	private
Access point	Not applicable
Comments	available at the LEGOS archive

5. Required data for Lake Ice Cover (LIC)

Data Type	Satellite data
Input Product	MODIS Terra/Aqua (MOD02/MYD02), Collection 6.1
Input variable	MODIS Level 1B Calibrated Radiance and Reflectance Swath 250m, 500m, 1km and quality flags
Source	NASA
Spatial Resolution	250m, 500m, 1km
Temporal resolution	Daily
Temporal coverage	2000-present
File format	HDF
Version	V6.1
Size	20 TB / year (estimated)
Public/Private	public
Access point	https://ladsweb.modaps.eosdis.nasa.gov/archive/allData/61(.../MOD02QKM, .../MOD02HKM, .../MOD021KM, .../MYD02QKM, .../MYD02HKM, .../MYD021KM)
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Ancillary data
Input Product	Maximum Water Extent raster
Input variable	land/water mask
Source	LC CCI / PML
Spatial Resolution	150m
Temporal resolution	epoch
Temporal coverage	2000-2012
File format	netcdf / WKT
Version	
Size	127Mb (netcdf) / 213 Mb (polygons)
Public/Private	public/private
Access point	https://www.esa-landcover-cci.org
Comments	LC CCI land/water mask used to delineate maximum water extent of individual water bodies: https://github.com/pmlrsg/lake-polygons-PML

D1.2: Data Access Requirement Document (DARD)

Data Type	Validation data
Input Product	MODIS Terra/Aqua (MOD02/MYD02), Collection 6.1
Input variable	Atmospherically Corrected Surface Reflectance 5-Min L2 Swath 250m (Bands 1 and 2)
Source	NASA
Spatial Resolution	250m
Temporal resolution	Daily
Temporal coverage	2000-present
File format	HDF
Version	V6.1
Size	Sample of ~30 lakes extracted from original MODIS dataset
Public/Private	public
Access point	Available from NASA at https://ladsweb.modaps.eosdis.nasa.gov/archive/allData/61(.../MOD02QKM, .../MOD02HKM, .../MOD021KM, .../MYD02QKM, .../MYD02HKM, .../MYD021KM)
Comments	RGB colour composite generated from Bands 1 and 2 are used for visual assesment (validation) of ice presence/absence

6. Required data for Lake Surface Water Temperature (LSWT)

Data Type	Satellite data
Input Product	ERS-2 ATSR2
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	ESA
Spatial Resolution	1km
Temporal resolution	Daily
Temporal coverage	1995-2003
File format	Envisat binary formatted, type ".E2"
Version	v2.1
Size	TB
Public/Private	public
Access point	https://catalogue.ceda.ac.uk
Comments	

Data Type	Satellite data
Input Product	Envisat AATSR
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	ESA
Spatial Resolution	1km
Temporal resolution	Daily
Temporal coverage	2002-2012
File format	Envisat binary formatted, type ".N1"
Version	v2.1
Size	TB
Public/Private	public
Access point	https://catalogue.ceda.ac.uk
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	MetOpA AVHRR
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	EUMETSAT
Spatial Resolution	1km
Temporal resolution	Daily
Temporal coverage	2007-present
File format	EPS native format
Version	v1
Size	TB
Public/Private	public
Access point	https://catalogue.ceda.ac.uk
Comments	

Data Type	Satellite data
Input Product	MetOpB AVHRR
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	EUMETSAT
Spatial Resolution	1km
Temporal resolution	Daily
Temporal coverage	2012-present
File format	EPS native format
Version	v1
Size	TB
Public/Private	public
Access point	https://catalogue.ceda.ac.uk
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Ancillary data
Input Product	ECMWF ERA5
Input variable	Atmospheric temperature and water vapour, surface pressure, mean sea level pressure, U and V components 10m wind, 2m air temperature, 2m dew point temperature, skin temperature, total column water vapour
Source	ECMWF
Spatial Resolution	30km
Temporal resolution	hourly
Temporal coverage	1979-present
File format	GRIB1
Version	v1
Size	10 TB
Public/Private	public
Access point	https://catalogue.ceda.ac.uk
Comments	

Data Type	Ancillary data
Input Product	ESA CCI LC Water Body mask
Input variable	land/water mask
Source	LC CCI / University of Reading
Spatial Resolution	300m
Temporal resolution	epoch
Temporal coverage	2005-2010
File format	NetCDF
Version	v3.0
Size	GB
Public/Private	public
Access point	https://catalogue.ceda.ac.uk
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Validation data
Input Product	In situ water temperature measurements
Input variable	water temperature at up to 1m depth
Source	University of Reading
Spatial Resolution	n/a
Temporal resolution	n/a
Temporal coverage	Full period
File format	csv
Version	v1
Size	~150 locations on ~50 lakes
Public/Private	public/private
Access point	University of Reading
Comments	in situ data

7. Required data for Lake Water Leaving Reflectance (LWLR)

Data Type	Ancillary data
Input Product	Maximum Water Extent raster
Input variable	land/water mask
Source	LC CCI / PML
Spatial Resolution	150m
Temporal resolution	epoch
Temporal coverage	2000-2012
File format	netcdf / WKT
Version	1.3
Size	127Mb (netcdf) / 213 Mb (polygons)
Public/Private	public
Access point	https://www.esa-landcover-cci.org (input raster) https://doi.org/10.5281/zenodo.3349547 (polygons)
Comments	LC CCI land/water mask used to delineate maximum water extent of individual water bodies: https://github.com/pmlrsg/lake-polygons-PML

D1.2: Data Access Requirement Document (DARD)

Data Type	Validation data
Input Product	in situ validation data of lake water quality
Input variable	Normalized water-leaving reflectance, Chl-a, TSM, aCDOM
Source	LIMNADES
Spatial Resolution	n/a
Temporal resolution	n/a
Temporal coverage	
File format	SQL database
Version	
Size	n/a
Public/Private	Private (community-owned)
Access point	www.limnades.org
Comments	Most matchups are for the MERIS period, relatively few data are currently available for OLCI validation.

Data Type	Satellite data
Input Product	Orbview2-SeaWifs
Input variable	L1A LAC Top-of-atmosphere radiance and quality flags
Source	NASA
Spatial Resolution	1.1km
Temporal resolution	irregular (days)
Temporal coverage	1997-2010
File format	HDF
Version	R2010 or latest available from NASA via OC CCI
Size	3.6 Tb (compressed)
Public/Private	Public
Access point	https://oceandata.sci.gsfc.nasa.gov/SeaWiFS/ All data curated on PML servers for fast access
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	MODIS-Aqua
Input variable	L1A LAC Top-of-atmosphere radiance and quality flags, attitude files and LUTs
Source	NASA
Spatial Resolution	1000m
Temporal resolution	1-2 days
Temporal coverage	2002-present
File format	NetCDF
Version	R2014 or latest available
Size	197 Tb (compressed)
Public/Private	Public
Access point	https://ladsweb.modaps.eosdis.nasa.gov All data curated on PML servers for fast access
Comments	

Data Type	Satellite data
Input Product	Envisat MERIS Reduced-Resolution
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	ESA
Spatial Resolution	1200m
Temporal resolution	2-3 days
Temporal coverage	2002-2012
File format	N1
Version	3rd reprocessing (4th if/when available)
Size	18.6 Tb (compressed)
Public/Private	Public
Access point	https://earth.esa.int/web/guest/data-access All data curated on PML servers for fast access.
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Sentinel-3 OLCI-A Non-time-critical
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	ESA
Spatial Resolution	300m
Temporal resolution	1-2 days
Temporal coverage	2016-present
File format	SAFE
Version	Baseline 2.04 and up (latest reprocessing available)
Size	60 Tb / year (estimated)
Public/Private	Public
Access point	https://scihub.copernicus.eu/dhus All data curated on PML servers for fast access.
Comments	

Data Type	Satellite data
Input Product	Sentinel-3 OLCI-B Non-time-critical
Input variable	L1B Top-of-atmosphere radiance and quality flags
Source	ESA
Spatial Resolution	300m
Temporal resolution	1-2 days
Temporal coverage	2018-present
File format	SAFE
Version	Baseline 2.38 and up (latest reprocessing available)
Size	60 Tb / year (estimated)
Public/Private	Public
Access point	https://scihub.copernicus.eu/dhus All data curated on PML servers for fast access.
Comments	

8. Required data for Global Consistency option

In addition to the merged CRDP and intermediary processing outputs, the work references the ECMWF ERA5:

Data Type	Ancillary data
Input Product	ECMWF ERA5
Input variable	Lake ice depth, Lake ice temperature, Lake mix-layer depth, Lake mix-layer temperature, Lake shape factor, Snowfall, Skin temperature, Total precipitation, Temperature of snow layer, 10 metre U wind component, 10 metre V wind component
Source	ECMWF
Spatial Resolution	30km
Temporal resolution	Hourly (one time-step extracted)
Temporal coverage	1979-present (1992-present extracted)
File format	netCDF
Version	v1
Size	221 GB
Public/Private	public
Access point	C3S API
Comments	

9. Required data for Lake Ice Thickness (LIT) option

9.1 Algorithm Based on Radar Backscatter and Brightness Temperature

Data Type	Satellite data
Input Product	Envisat
Input variable	hz18_ku_ice1 (18 Hz Ku band backscatter coefficient, Ice1 retracking) interpole_238_temp_mwr (brightness temperature, 23.8 GHz) interpole_365_temp_mwr (brightness temperature, 36.5 GHz)
Source	CTOH
Spatial Resolution	300m
Temporal resolution	35 days
Temporal coverage	2002-2008
File format	NetCDF
Version	Reprocessed V3.0
Size	0.7MB per file (~26 MB/year)
Public/Private	public
Access point	http://ctoh.legos.obs-mip.fr/data
Comments	

Data Type	Satellite data
Input Product	Jason-2 GDR-D
Input variable	ice_sig0_20hz_ku (20 Hz Ku band backscatter coefficient, Ice retracking) tb_187 (18.7 GHz main beam brightness temperature) tb_238 (23.8 GHz main beam brightness temperature) tb_340 (34.0 GHz main beam brightness temperature)
Source	Aviso
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2008-present
File format	NetCDF
Version	Standard D
Size	60 Gb/year
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Jason-3 GDR-E
Input variable	ice_sig0_20hz_ku (20 Hz Ku band backscatter coefficient, Ice retracking) tb_187 (18.7 GHz main beam brightness temperature) tb_238 (23.8 GHz main beam brightness temperature) tb_340 (34.0 GHz main beam brightness temperature)
Source	Aviso
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2016-present
File format	NetCDF
Version	Standard E
Size	60 Gb/year
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Ancillary satellite data
Input Product	MODIS Terra, MODIS Aqua, Suomi NPP/VIIRS
Input variable	Corrected Reflectance True Color composite images subset extracted from MOD02QKM doi:10.5067/MODIS/MOD02QKM.061 ; MOD02HKM doi:10.5067/MODIS/MOD02HKM.061 ; MOD021KM doi:10.5067/MODIS/MOD021KM.061
Source	NASA
Spatial Resolution	250m
Temporal resolution	Daily
Temporal coverage	2000-present (Terra), 2002-present (Aqua), 2012-present (Suomi NPP)
File format	HDF
Version	v6
Size	20 TB / year (estimated)
Public/Private	public
Access point	Available from NASA at https://worldview.earthdata.nasa.gov/
Comments	

9.2 Algorithm Based on Radar Waveforms

Data Type	Satellite data
Input Product	Envisat
Input variable	Waveform (Ku band)
Source	ESA
Spatial Resolution	300m
Temporal resolution	35 days
Temporal coverage	2002-2008
File format	NetCDF
Version	Reprocessed V3.0
Public/Private	public
Comments	

Data Type	Satellite data
Input Product	Jason-2 GDR
Input variable	Waveform (20 Hz Ku band power waveform)
Source	Aviso
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2008-present
File format	NetCDF
Version	Standard
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

D1.2: Data Access Requirement Document (DARD)

Data Type	Satellite data
Input Product	Jason-3 GDR-D
Input variable	Waveform (20 Hz Ku band power waveform)
Source	Aviso
Spatial Resolution	300m
Temporal resolution	10 days
Temporal coverage	2016-present
File format	NetCDF
Version	Standard D
Public/Private	public
Access point	https://www.aviso.altimetry.fr
Comments	

9.3 Required Data for Both LIT Retrieval Algorithms

Data Type	Ancillary data
Input Product	Lake ice thickness and on-ice snow depth estimates from Canadian Lake Ice Model (CLIMo)
Input variable	Ice thickness and on-ice snow depth
Source	H2O Geomatics/University of Waterloo
Spatial Resolution	30 km (determined by ECMWF ERA5 which provides atmospheric forcings)
Temporal resolution	daily
Temporal coverage	1979-present (1998-present extracted)
File format	csv
Version	v1
Size	~190 KB per lake
Public/Private	public/private
Access point	H2O Geomatics/University of Waterloo
Comments	Lake ice model output data

D1.2: Data Access Requirement Document (DARD)

Data Type	Validation data
Input Product	Canadian Ice Thickness Program
Input variable	Ice thickness and on-ice snow depth (sea ice and lake ice close to shore)
Source	Environment and Climate Change Canada
Spatial Resolution	n/a
Temporal resolution	Weekly, starting after freeze-up when the ice is safe to walk on, and continuing until break-up or when the ice becomes unsafe
Temporal coverage	Depends on the lake; only two lakes (Baker Lake and Great Slave) that have suitable records for validation of satellite retrieval algorithms <ul style="list-style-type: none"> - Great Slave Lake (Back Bay near Yellowknife, Northwest Territories): 1958-1996 and 2002-2016 - Baker Lake (Nunavut): 1958-2000 and 2002-2021
File format	Excel (xls)
Version	Ice Thickness Program Collection, 1947 to 2002 Ice Thickness Program Collection, Fall 2002 to Summer 2021
Size	4.1 MB (Ice Thickness Program Collection, 1947 to 2002; several sea ice and few lake ice sites) 182 KB (Ice Thickness Program Collection, Fall 2002 to Summer 2021; 11 sites total, including sea ice and lake ice)
Public/Private	public
Access point	https://www.canada.ca/en/environment-climate-change/services/ice-forecasts-observations/latest-conditions/archive-overview/thickness-data.html
Comments	in-situ data

10. Summary and Risks

The data access requirement (DARD) provides descriptions of all datasets required for the successful generation and validation of all component products for the Lakes essential climate variable within the ESA CCI.

The following table summarises the information on satellite/sensor combinations used to generate the Lakes ECV products in version 2.0 of the Climate Research Data Package.

D1.2: Data Access Requirement Document (DARD)

Satellite	Sensor	Product				
		LWL	LWE	LSWT	LIC	LWLR
Topex/Poseidon	Poseidon-1					
Jason-1	Poseidon-2					
Jason-2	Poseidon-3					
Jason-3	Poseidon-3B					
ENVISAT	Radar Altimeter (RA-2)					
	AATSR					
	MERIS					
SARAL	AltiKa					
Geosat Follow On	Radar Altimeter					
Sentinel-1	C-band SAR					
Sentinel-2	MSI					
Sentinel-3A/B	SRAL					
	OLCI					
	OLCI-SLSTR					
Landsat-4	MSS, TM					
Landsat-5	MSS, TM					
Landsat-7	ETM+					
Landsat-8	OLI					
Terra/Aqua	Modis					
Suomi NPP	VIIRS					
ERS-1	RA					
	AMI					
	SAR					
ERS-2	RA					
	AMI					
	SAR					
METOP-A/B	AVHRR					

D1.2: Data Access Requirement Document (DARD)

Satellite	Sensor	Product				
		LWL	LWE	LSWT	LIC	LWLR
Orbview-2	SeaWIFS					

No risks related to data availability are currently identified. This is due to the fact that all product teams are already working with the data streams they require to generate the Lakes_cci products. Multiple access points (data curated at the production centres) may exist to ensure data are searchable and accessible without delay. No risks regarding the use of conflicting data versions have been identified - although this remains an issue to be tracked to guarantee overall product consistency.

Annex A. Project Acronyms

This is a generic list containing all the acronyms used in the project

AATSR	Advanced Along Track Scanning Radiometer
AATSR	Advanced Along Track Scanning Radiometer
AERONET-OC	AErosol RObotic NETwork - Ocean Color
AMI	Active Microwave Instrument
AMSR-E	Advanced Microwave Scanning Radiometer for EOS
APP	Alternating Polarization mode Precision
ASAR	Advanced Synthetic Aperture Radar
ASLO	Association for the Sciences of Limnology and Oceanography
ATBD	Algorithm Theoretical Basis Document
ATSR	Along Track Scanning Radiometer
AVHRR	Advanced very-high-resolution radiometer
BAMS	Bulletin of the American Meteorological Society
BC	Brockman Consult
C3S	Copernicus Climate Change Service
CCI	Climate Change Initiative
CDR	Climate Data Record
CEDA	Centre for Environmental Data Archival
CEMS	Centre for Environmental Monitoring from Space
CEOS	Committee on Earth Observation Satellites
CGLOPS	Copernicus Global Land Operation Service
CLIMo	Canadian Lake Ice Model
CIS	Canadian Ice Service
CLS	Collecte Localisation Satellite
CMEMS	Copernicus Marine Environment Monitoring Service
CMUG	Climate Modelling User Group
CNES	Centre national d'études spatiales
CNR	Compagnie Nationale du Rhône
CORALS	Climate Oriented Record of Altimetry and Sea-Level
CPD	Communiation Plan Document
CR	Cardinal Requirement
CRG	Climate Research Group
CSWG	Climate Science Working Group
CTOH	Center for Topographic studies of the Ocean and Hydrosphere

D1.2: Data Access Requirement Document (DARD)

DUE	Data User Element
ECMWF	European Centre for Medium-Range Weather Forecasts
ECV	Essential Climate Variable
ELLS-IAGRL	European Large Lakes Symposium-International Association for Great Lakes Research
ENVISAT	Environmental Satellite
EO	Earth Observation
EOMORES	Earth Observation-based Services for Monitoring and Reporting of Ecological Status
ERS	European Remote-Sensing Satellite
ESA	European Space Agency
ESRIN	European Space Research Institute
ETM+	Enhanced Thematic Mapper Plus
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAQ	Frequently Asked Questions
FCDR	Fundamental Climate Data Record
FIDUCEO	Fidelity and Uncertainty in Climate data records from Earth Observations
FP7	Seventh Framework Programme
GAC	Global Area Coverage
GCOS	Global Climate Observing System
GEMS/Water	Global Environment Monitoring System for freshwater
GEO	Group on Earth Observations
GEWEX	Global Energy and Water Exchanges
GloboLakes	Global Observatory of Lake Responses to Environmental Change
GLOPS	Copernicus Global Land Service
GTN-H	Global Terrestrial Network - Hydrology
GTN-L	Global Terrestrial Network - Lakes
H2020	Horizon 2020
HYDROLARE	International Data Centre on Hydrology of Lakes and Reservoirs
ILEC	International Lake Environment Committee
INFORM	Index for Risk Management
IPCC	Intergovernmental Panel on Climate Change
ISC	International Science Council
ISO	International Organization for Standardization
ISRO	Indian Space Research Organisation
JRC	Joint Research Centre
KPI	Key Performance Indicators

D1.2: Data Access Requirement Document (DARD)

LEGOS	Laboratoire d'Etudes en Géophysique et Océanographie Spatiales
LIC	Lake Ice Cover
LIT	Lake Ice Thickness
LSWT	Lake Surface Water Temperature
LWE	Lake Water Extent
LWL	Lake Water Level
LWLR	Lake Water Leaving Reflectance
MERIS	MEdium Resolution Imaging Spectrometer
MGDR	Merged Geophysical Data Record
MODIS	Moderate Resolution Imaging Spectroradiometer
MSI	MultiSpectral Instrument
MSS	MultiSpectral Scanner
NASA	National Aeronautics and Space Administration
NERC	Natural Environment Research Council
NetCDF	Network Common Data Form
NOAA	National Oceanic and Atmospheric Administration
NSERC	Natural Sciences and Engineering Research Council
NSIDC	National Snow & Ice Data Center
NTU	Nephelometric Turbidity Unit
NWP	Numerical Weather Prediction
OLCI	Ocean and Land Colour Instrument
OLI	Operational Land Imager
OSTST	Ocean Surface Topography Science Team
PML	Plymouth Marine Laboratory
PRISMA	PRecursore IperSpettrale della Missione Applicativa
Proba	Project for On-Board Autonomy
R	Linear Correlation Coefficient
RA	Radar Altimeter
RMSE	Root Mean Square Error
SAF	Satellite Application Facility
SAR	Synthetic Aperture Radar
SeaWiFS	Sea-viewing Wide Field-of-view Sensor
SIL	International Society of Limnology
SLSTR	Sea and Land Surface Temperature Radiometer
SoW	Statement of Work
SPONGE	SPaceborne Observations to Nourish the GEMS

D1.2: Data Access Requirement Document (DARD)

SRD	System Requirements Document
SSD	System Specification Document
SST	Sea Surface Temperature
STSE	Support To Science Element
SWOT	Surface Water and Ocean Topography
TAPAS	Tools for Assessment and Planning of Aquaculture Sustainability
TB	Brightness Temperature
TM	Thematic Mapper
TOA	Top Of Atmosphere
TR	Technical Requirement
UNEP	United Nations Environment Programme
UoR	University of Reading
US	United States
VIIRS	Visible Infrared Imaging Radiometer Suite
WCRP	World Climate Research Program
WHYCOS	World Hydrological Cycle Observing Systems
WMO	World Meteorological Organization
WP	Work Package