

Manuals, Standard Practices & Standard Operating Procedures

Compiled for Arctic HYCOS by Aldís Elfarsdóttir, Intern at IMO

Last updated: February 12, 2018

Freshwater Ice On/Off (59)				
Databases	Manuals/Standards	Reviews / Historic	Satellite / Remote	Field & Simulation
1. NSIDC Global Lake and River Ice Phenology Database	12. New Brunswick River Ice Manual 2011	21. Turcotte & Morse 2013 Global river ice classification model	45. Karetnikov 2017 Lake Ladoga ice over 100 yrs	57. Fang et al. 1996 Simulation and observation of lake ice freeze up
2. Minnesota - lake ice maps & dates	13. WMO Colour Code: Concentration/Stage of Dev - Lake Ice	22. Prowse et al. 2007) Review of climatic drivers, trends	46. Moore & Gregory 1980s Satellite Imagery for Ice Break-up along the Mackenzie River 1975-77	58. Timalsina et al. 2013 Simulation of the ice regime in a Norwegian regulated river
3. Canadian Ice Service: Great Lakes Regional Ice Charts	14. EPA 2016 Technical Documentation: Lake Ice	23. Brown & Duguay 2010 Ice cover in lake-climate	47. Stalder et al. 2016-2018 VIIRS Swiss Lakes	
4. GLSEA	15. Assel & Herche 1998 Ice-on, ice-off, and ice duration for lakes and rivers with long-term trends	24. Prowse et al 2012 Changes in Arctic Lake and River Ice	48. Latifovic & Pouliot 2007 historical satellite data record Canada climate-lake	SWIP
5. IceWatch sign up to download data	16. (Book) Gray & Prowse, in Handbook of Hydrology 1993	25. DeBeer et al 2016 western Canada	49. Surdu et al. 2015 N.Alaska on/off using ASAR Wide Swath, ScanSAR	59. Brown & Duguay 2011 Shallow Water Ice Profiler
6. Canadian Ice Service: Great Lakes 1981-2010	17. Kuusisto 1993 Detection Strategies for Snow and Ice	26. Takacs et al 2013 Anthropogenic effects on ice regime	50. Bartsch et al. 2008 open water surface detection Siberia ENVISAT ASAR wide swath	
7. Freeze-up, Break-up charts for N. Canada	18. Closa et al 2003. ASAR Wide Swath Mode products IEEE	27. Livingstone et al. 2010. Lake ice phenology.	51. Duguay et al. 2002 RADARSAT backscatter characteristics of shallow lake ice	
8. Global Lakes Wetlands Database - lakes to track/measure	19. Assel 2004) GLERL Technical Report - Lake Erie Ice Cover Climatology 1898-2002	28. Magnuson et al. 2000 Historical trends in Northern Hemisphere	52. Jones et al. 2013. Ground penetrating radar and TerraSAR-X satellite data	
9. Scott Polar Research Institute - search for floating ice, lake, river or land ice	20. IPCC 2007 Working Group I: Changes in Freeze-up and Breakup Dates	29. Hewitt et al. 2018 Laurentian Great Lakes Region	MODIS & AVHRR	
10. Lake Ice Analysis Group: North Temperate Lakes data protocol and workshop 1996		30. Benson et al. 2012 N. hemisphere lake-ice 1855-2005	53. Muhammad et al. 2016 MODIS ice-off Mackenzie	
11. NOAA Great Lakes Ice Atlas: Ice Charts 1973-2002		31. Cleve & Martin 1991 US research network	54. Reed et al. 2009 MODIS lake ice southwest Alaska	
		32. Arp et al. 2015 ice-out Arctic lakes	55. Gou et al. 2017 MODIS data products for lake ice phenology of Nam Co, Tibetan Plateau	
		33. Bartsch et al. 2017 ground-fast lake ice	56. Nonaka et al. lake ice breakup dates and local air temperature Eurasian continent	
		34. Jeffries et al. 2013. remote sensing		
		35. Korhonen, J. 2006 Long-term changes in lake ice Finland		
		36. Skinner 1986 break-up freeze-up lake and sea ice N. Canada		
		37. Williams 1971 Predicting the date of lake ice break-up		
		38. Livingstone 1999 lake breakup Siberia since 1869		
		39. Hodgkins 2010 ice-out New England 1807–2008		
		40. Hodgkins 2013. 175 years of lake ice-out New England		
		41. Takacs & Kern 2015 River Drava ice regime since 1875		
		42. Lind et al. 2016 ice formation in 25 boreal streams		
		43. Jensen et al 2007 ice phenology Laurentian Great Lakes		
		44. Beltaos and Prowse 2001 Climate impacts on extreme ice jam events in Canadian rivers		

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Freshwater Ice Thickness (53)					
Databases/sets	Manuals/Standards	Reviews / Historic	Ground Sensors	Satellite / Remote	Field & Models
1. NOAA/GLERL 1995. Great Lakes 1966-1979	9. Canada e3 Plus Framework: Snowmobiles	15. Nordell & Westerström 1994 Method for continuous measurement	24. Chang & Dou 2011 Capacitive Sensor Measuring System	41. GMES (2012) Finnish experience sea ice monitoring	49. Gold 1960. Load bearing capacity of ice covers.
2. Polar Data Catalogue: Canadian Lake Ice	10. Korhonen 2015 Finnish methods	16. Fransson, L., 1991. Methods to measure ice cover thickness (Metoder att mata istjocklek). Swedish	25. Kang et al. 2014 northern lakes AMSR-E	42. SATCOM (2016) Satellite comms to support sea ice monitoring (p. 68)	50. Ashton et al. 2011 drill hole data set for river and lake ice thickness
3. Canadian Ice Service: Regional Ice Charts	11. (Book) River Ice Data Instrumentation	17. Brown & Duguay 2010 Ice cover in lake-climate interactions	26. ISOPE 2009 Electromagnetic Sensor Sled	43. EC (2012) Space and the Arctic sea	51. Kamari et al. 2017 GPR radar data and ground truth ice thickness
4. Canadian Ice Service: Lake Ice Climatic Atlas 1981-2010	12. Wadhams NCBI 2012 review of current techniques	18. Prowse et al. 2011 Past and Future Changes in Arctic Lake and River Ice	27. Campbell & Orange 1974 EM sled	44. Hirose et al. 2008 C-band Synthetic Aperture Radar remote sensing	52. Dibiasio et al. 2017 Device Design
5. Polar Data Catalogue: Physicochemical Lake Profiles 1954-2012	13. Minnesota Ice Thickness Guidelines	19. DeBeer et al. (2016) Recent changes over interior of western Canada	28. Prinsenberg et al. 2011 EM sensor	45. Hall et al. 1981 passive microwave sensors	53. Bruijn et al. 2014 Netherlands ice thickness models
6. Russian river ice thickness and freeze up from 50 stations	14. Menge 2016 overview of methods sea ice	20. (Book) Prowse 2012 Lake and River ice in Canada	29. Bedford Institute of Oceanography: GPR	46. Beckers et al. 2014 ESA Cryosat-2 retrievals of freshwater lake ice	
7. Alaskan North Slope lake ice thickness (Excel: 1962-2017)		21. Arp et al. 2015 Depth, ice thick, and ice-out timing cause divergent hydrologic responses among Arctic lakes	30. Gunn et al. 2017 FMCW radar / SWIP	47. Lalumiere airborne GPR for oil in ice detection and ice thickness	
8. Canadian Ice Thickness Program 1947-2016		22. Brooks 2012 thesis quantifying peak freshwater ice in N hemisphere	31. Annan & Davis (1977) Impulse radar	48. Gunn et al. 2015 ground and space based radar data for lake ice with bubbles	
		23. Brown et al. 2002 Canadian freshwater ice and global climate monitoring: AVHRR and RADARSAT	32. Whitaker et al. 2015 reflectometer sensors		
			33. Joseph et al. (1994) reflectometer		
			34. Yang et al. 2013 Magnetostrictive Delay Line		
			35. Dou & Chang 2012 Magnetostrictive Delay Line		
			36. Bedford Institute of Oceanography: EM		
			37. Pour et al. Svalbard lakes MODIS & ASMR-E		
			SWIP		
			38. Blazevic 2009 Nunavik Lake Ice Service: Inuit and Remote Sensing		
			39. Brown & Duguay 2011 Shallow Water Ice Profiler		
			40. Ocean Networks Canada 2011 SWIP Manual		

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Water temp SOPs (39)			
Databases	Manuals/SOPs	Reviews / Historic Case Studies	Field Protocols
1. Polar Data Catalogue - 1954-2012 Physicochemical Lake Profiles	International	27. Šporka et al. (2006) Water temps and ice cover in the lakes of the Tatra Mountains	33. Tidbit v2 temp Logger by Onset Computer Corporation
2. Global lake surface water temps in situ and satellites; 1985-2009	6. IEEE/OES (2005) Instruments for meas under ice	28. Washington 1990 Citizen-Volunteer 25 Lakes temp v depth pg. 72-113	34. Maine (2009) SOP Maine Volunteer River Monitoring Program- YSI DO200 Handheld Meter
3. NSF Arctic Data Center - temp-depth	7. UNEP/WHO (1996) Practical Guide Freshwater Quality Studies and Monitoring Programmes	29. USGS 1997 CA monitoring temp v depth p. 22-215	35. HOBO 30-Foot Depth Water Level Data Logger
4. New Zealand Measurement Standards Lab - Technical Guides	8. ASTM International temp measurement standards	30. Clifton USGS 1982 Water quality data for Smith and Bybee Lakes Oregon - p.12-13 temp v depth	36. Student - temp at different depths procedure
5. USGS Current Water Quality 2018 temp for rivers, lakes	9. (cited in UNEP/WHO 1996) WHO 1992 GEMS/WATER Operational Guide. 3rd ed., Unpublished doc, GEMS/W.92.1	31. Ludovicus et al. 2012 model of global freshwater surface temp	37. Water Level temp Meter Model 201 Data Sheet by Solinst
	10. Hutton 1983 Field Testing of Water in Developing Countries.	32. Sharma et al. 2015 Global database lake surface temps collected in situ and satellite 1985-2009	38. Mississippi Water temp Project 2006 - volunteer measurement methods
	11. 1989 Hach Water Analysis Handbook		39. Underwater temp logger
	12. Globe 2014 Hydrosphere: Water temp Protocol for Thermometer Probes: Field Guide		40. Star Oddi - oceans, rivers, lakes
	National		
	13. LAWA 1987 Grundwasser - Richtlinien für Beobachtung und Auswertung - Teil 2: Grundwassertemperatur in EU 2000/60/EC		
	14. USGS 2006 Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Techniques & Methods 1-D3		
	15. EPA 2017 SOP Calibration of Field Instruments		
	16. USGS 2006 Field Manual temp-measurement		
	17. USDA 2005 Measuring Stream temp with Digital Data Loggers: A User's Guide		
	18. EPA 2014 Best Practices for Continuous Monitoring of temp and Flow in Wadeable Streams		
	19. UK 2012 - Beginner's Guide to temp Measurement: Measurement Good Practice Guide No. 125 pg. 29		
	20. Australia DEHP 2009 monitoring and sampling manual for in situ water quality measurements		
	State (U.S.)		
	21. California Water Resources Control Board (2010). SOP (SOP) 3.1.2.2: Measuring temp with a Thermistor Thermometer		
	22. Colorado (2015). SOPs for the Collection of Stream Water temps Utilizing the Deployment of temp Data Loggers		
	23. Minnesota (2012) SOPs for Water Quality Monitoring Red River Watershed		
	24. Montana (2005). temp Data Logger Protocols SOP		
	25. Washington 1991 Citizen's Guide to Monitoring Lakes & Streams		
	26. USGS 2014 Guidelines for the Collection of Continuous Stream Water-temp Data in Alaska		