

Rapid and highly variable warming of lake surface waters around the globe

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Table. Summer surface water temperature (SSWT) trends for each of the 235 lakes between 1985-2009. Included are lake names and alternative names, geographic location, satellite or in situ data, significance of the trend, and the lake summer surface water temperature trend. Trends were calculated using conservative methods; thus it is possible that trends are underestimated and should be larger.

Lake name	Country	Dataset (S=satellite, I=in situ)	Significance of the trend (* if significant at p value < 0.5)	Lake SSWT trend	
				(°F per decade)	(°C per decade)
Abaya	Ethiopia	S	>0.1	0.34	0.19
Ai pi/Ebner	China	S	0.01*	1.12	0.62
Alakol	Kazakhstan	S	0.01*	0.83	0.46
Albert	Uganda, DRC	S	0.01*	1.12	0.62
Aleknagik	USA-Alaska	I	0.03*	1.53	0.85
Allequash	USA-Wisconsin	I	0.003*	1.53	0.85
Allgjuttern	Sweden	I	>0.1	0.40	0.22
Annecy	France	I	>0.1	-0.25	-0.14
Annie	USA-Florida	I	>0.1	-0.32	-0.18
Apopka	USA-Florida	I	>0.1	0.09	0.05

Lake name	Country	Dataset (S=satellite, I=in situ)	Significance of the trend (* if significant at p value < 0.5)	Lake SSWT trend	
				(°F per decade)	(°C per decade)
Aral Sea	Kazakhstan, Uzbekistan	S	>0.1	0.40	0.22
Argentina	Argentina, Chile	S	>0.1	-0.13	-0.07
Argyle	Australia	S	>0.1	-0.23	-0.13
Ashokan-East	USA-New York	I	>0.1	0.65	0.36
Ashokan-West	USA-New York	I	>0.1	0.72	0.40
Athabasca	Canada	S	>0.1	0.76	0.42
Ayakkum	China	S	>0.1	0.31	0.17
Bahral Milh/Razazza	Iraq	S	0.01*	0.90	0.50
Baikal-South	Russia	I	>0.1	0.05	0.03
Baikal-South	Russia	S	>0.1	1.22	0.68
Balaton	Hungary	S	0.07*	-1.33	-0.74
Balkhash	Kazakhstan	S	0.04*	0.63	0.35
Bangweulu	Zambia	S	0.06*	0.31	0.17
Barossa Reservoir	Australia	I	0.003*	0.97	0.54
Bay	Philippines	S	>0.1	-0.07	-0.04
Beauclair	USA-Florida	I	>0.1	0.59	0.33
Beloye	Russia	S	0.01*	1.58	0.88
Beysehir	Turkey	S	>0.1	0.18	0.10
Big Muskellunge	USA-Wisconsin	I	0.01*	1.31	0.73
Biwa	Japan	I	0.07*	0.77	0.43
Biwa	Japan	S	>0.1	0.32	0.18
Blue Chalk	Canada	I	>0.1	0.68	0.38
Blue Cypress	USA Florida	I	>0.1	-0.67	-0.37
BoengTonleChhma/ Tonle Sap	Cambodia	S	>0.1	-0.05	-0.03
Bosten	China	S	0.003*	1.03	0.57
Bourget	France	I	0.01*	0.76	0.42
Bras D'Or	Canada	S	0.04*	1.01	0.56
Bratskoye	Russia	S	>0.1	1.04	0.58
Brunnsjön	Sweden	I	>0.1	-0.20	-0.11
Buenos Aires	Chile, Argentina	S	>0.1	0.27	0.15
BuhayratAthTharthar	Iraq	S	0.01*	0.97	0.54
Buyr/Bei'er	Mongolia, China	S	0.01*	1.19	0.66
Cannonsville	USA-New York	I	>0.1	0.76	0.42
Cardinia	Australia	I	>0.1	0.92	0.51

Lake name	Country	Dataset (S=satellite, I=in situ)	Significance of the trend (* if significant at p value < 0.5)	Lake SSWT trend	
				(°F per decade)	(°C per decade)
Caspian Sea	Kazakhstan, Russia, Turkmenistan, Azerbaijan, Iran	S	0.02*	1.35	0.75
Chad	Chad, Nigeria, Niger, Cameroon	S	>0.1	0.61	0.34
Chao	China	S	>0.1	0.07	0.04
Chapala	Mexico	S	>0.1	0.02	0.01
Chardarinskoye/ Shardara	Kazakhstan, Uzbekistan	S	>0.1	-0.22	-0.12
Chilka	India	S	0.03*	0.70	0.39
Chilwa	Malawi	S	0.0001*	0.56	0.31
Chiquita	Argentina	S	>0.1	0.16	0.09
Chishi/Cheshi	Zambia	S	0.01*	0.74	0.41
Chocon	Argentina	S	>0.1	0.40	0.22
Chub	Canada	I	>0.1	0.47	0.26
Claire	Canada	S	>0.1	0.49	0.27
Clearwater	Canada	I	0.10*	0.59	0.33
Colhue Huapi	Argentina	S	>0.1	0.92	0.51
Constance (Upper)	Germany	I	0.0001*	0.95	0.53
Crosson	Canada	I	>0.1	0.34	0.19
Crystal	USA-Wisconsin	I	0.02*	1.06	0.59
Dauphin	Canada	S	0.04*	1.10	0.61
Dead Sea	Jordan, West Bank, Israel	S	0.0001*	1.13	0.63
Denham	USA-Florida	I	>0.1	-0.58	-0.32
Dickie	Canada	I	0.05*	0.86	0.48
Dore	Canada	S	>0.1	0.68	0.38
Dubawnt	Canada	S	>0.1	0.88	0.49
Erie	USA, Canada	I	>0.1	0.14	0.08
Erie	USA, Canada	S	>0.1	0.16	0.09
Erken	Sweden	I	0.07*	1.10	0.61
Eyasi	Tanzania	S	0.08*	1.01	0.56
Feeagh	Ireland	I	>0.1	0.63	0.35
Fiolen	Sweden	I	>0.1	1.04	0.58
Fish	USA-Wisconsin	I	>0.1	0.88	0.49
Fracksjön	Sweden	I	0.0001*	2.43	1.35
Gaoyou	China	S	>0.1	0.38	0.21

Lake name	Country	Dataset (S=satellite, I=in situ)	Significance of the trend (* if significant at p value < 0.5)	Lake SSWT trend	
				(°F per decade)	(°C per decade)
Garda	Italy	I	>0.1	0.27	0.15
Garda	Italy	S	>0.1	-0.02	-0.01
Geneva	Switzerland, France	I	>0.1	0.20	0.11
Geneva	Switzerland, France	S	>0.1	-0.88	-0.49
George	USA-Florida	I	>0.1	0.43	0.24
Great Bear	Canada	S	>0.1	-0.16	-0.09
Great Salt Lake	USA-Utah	S	0.01*	0.88	0.49
Great Slave	Canada	S	>0.1	0.27	0.15
Gyaring/ Zhaling	China	S	0.07*	1.33	0.74
Hannah	Canada	I	0.003*	0.79	0.44
Happy Valley Reservoir	Australia	I	>0.1	0.34	0.19
Har/Hala	Mongolia	S	0.0001*	1.17	0.65
Harp	Canada	I	>0.1	0.50	0.28
Harus	Mongolia	S	0.03*	0.85	0.47
Heney	Canada	I	>0.1	0.43	0.24
Hongze/ Hung-tse	China	S	>0.1	0.81	0.45
Hovsgol/ Kovsgol	Mongolia	S	>0.1	0.49	0.27
Hulun	China	S	>0.1	0.47	0.26
Huron	USA, Canada	I	0.08*	1.53	0.85
Huron	USA, Canada	S	>0.1	0.79	0.44
Hyargas	Mongolia	S	>0.1	0.61	0.34
Iliamna Lake	USA Alaska	S	0.05*	1.85	1.03
IIMen	Russia	S	0.003*	1.17	0.65
Inari	Finland	I	0.06*	0.81	0.45
Issyk kul	Kyrgyzstan	S	0.04*	0.52	0.29
Itaparica	Brazil	S	>0.1	0.05	0.03
Jesup	USA-Florida	I	>0.1	-0.09	-0.05
Kainji	Nigeria	S	>0.1	0.58	0.32
Kallavesi	Finland	I	>0.1	0.61	0.34
Kangaroo Creek Reservoir	Australia	I	0.02*	2.05	1.14
KapchagayskoyeVodo/ Kapshagay	Kazakhstan	S	0.04*	0.92	0.51
Kariba	Zimbabwe, Zambia	S	0.01*	0.23	0.13
Kasba	Canada	S	>0.1	-0.34	-0.19
Kensico	USA-New York	I	0.01*	1.17	0.65

Lake name	Country	Dataset (S=satellite, I=in situ)	Significance of the trend (* if significant at p value < 0.5)	Lake SSWT trend	
				(°F per decade)	(°C per decade)
Kevojärvi	Finland	I	0.04*	1.44	0.80
Khanka	Russia, China	S	>0.1	0.59	0.33
Kinneret	Israel	I	0.003*	0.79	0.44
Kivu	DRC, Rwanda	S	>0.1	0.32	0.18
Kremenshugskoye	Ukraine	S	0.0001*	1.73	0.96
Kulundinskoye	Russia	S	>0.1	0.27	0.15
Kuybyshevskoye	Russia	S	0.0001*	1.24	0.69
L223	Canada	I	>0.1	1.80	1.00
L224	Canada	I	>0.1	0.76	0.42
L227	Canada	I	0.02*	1.55	0.86
L239	Canada	I	0.02*	1.30	0.72
L240	Canada	I	0.02*	1.46	0.81
L302s	Canada	I	>0.1	0.79	0.44
Ladoga	Russia	S	0.01*	1.17	0.65
Lake of the Woods	USA, Canada	S	>0.1	0.25	0.14
Lappajärvi	Finland	I	0.04*	1.60	0.89
Lianquihui	Chile	S	>0.1	0.04	0.02
Limfjorden	Denmark	S	>0.1	-0.85	-0.47
Little Para Reservoir	Australia	I	0.04*	1.30	0.72
Loch Leven	Scotland	I	0.10*	1.35	0.75
Lohi	Canada	I	0.07*	0.81	0.45
Lower Zurich	Switzerland	I	0.01*	1.35	0.75
Maggiore	Italy	I	>0.1	0.56	0.31
Malären	Sweden	I	0.0001*	1.57	0.87
Malawi	Malawi, Tanzania Mozambique,	S	0.06*	0.20	0.11
Managua	Nicaragua	S	0.09*	0.45	0.25
Manitoba	Canada	S	0.04*	0.70	0.39
Maroondah	Australia	I	>0.1	-0.29	-0.16
Martre	Canada	S	>0.1	1.01	0.56
McConaughy	USA-Nebraska	I	>0.1	0.56	0.31
Mendota	USA-Wisconsin	I	>0.1	0.68	0.38
Michigan	USA, Canada	I	>0.1	0.76	0.42
Michigan	USA, Canada	S	>0.1	0.36	0.20
Middle	Canada	I	0.05*	0.86	0.48
Millbrook Reservoir	Australia	I	>0.1	0.58	0.32
Mondsee	Austria	I	0.10*	0.56	0.31

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				(°F per decade)	(°C per decade)
Monona	USA-Wisconsin	I	>0.1	0.85	0.47
Mount Bold Reservoir	Australia	I	>0.1	0.27	0.15
Müggelsee	Germany	I	0.01*	1.53	0.85
Mweru	Zambia, DRC	S	0.09*	0.36	0.20
Myponga Reservoir	Australia	I	>0.1	0.45	0.25
Na Mu/ Nam Co	China	S	>0.1	0.11	0.06
Nasser	Egypt, Sudan	S	>0.1	0.47	0.26
Neusiedler See/ Ferto	Austria, Hungary	I	0.08*	0.81	0.45
Neversink	USA-New York	I	>0.1	0.81	0.45
Newnans	USA-Florida	I	>0.1	0.02	0.01
Ngoring/ Eling	China	S	>0.1	0.25	0.14
Nicaragua	Nicaragua	S	>0.1	0.13	0.07
Nipigon	Canada	S	>0.1	1.30	0.72
Okeechobee	USA-Florida	S	>0.1	0.13	0.07
Onegh/ Onega	Russia	S	>0.1	1.30	0.72
Oneida	USA-New York	I	0.0001*	0.86	0.48
Ontario	Canada	S	>0.1	0.59	0.33
Övre Skärsjön	Sweden	I	0.09*	1.19	0.66
Päijänne/ Murtoselka	Finland	I	0.05*	1.49	0.83
Peipsi	Russia, Estonia	I	0.01*	1.24	0.69
Peipsi	Russia, Estonia	S	0.003*	1.37	0.76
Pepacton	USA-New York	I	>0.1	0.97	0.54
PeterPond	Canada	S	>0.1	0.38	0.21
Pielinen	Finland	I	0.06*	1.53	0.85
Plastic	Canada	I	>0.1	0.23	0.13
Plussee	Germany	I	0.05*	1.40	0.78
Poinsett	USA-Florida	I	>0.1	0.65	0.36
Pyhäselkä	Finland	I	0.10*	1.55	0.86
Pyramid Lake	USA-Nevada	S	0.0001*	0.92	0.51
Qinghai	China	S	0.05*	0.65	0.36
Razelm/ Razim	Romania	S	0.03*	0.85	0.47
Red Chalk	Canada	I	>0.1	0.38	0.21
Reindeer	Canada	S	>0.1	0.86	0.48
Remmarsjön	Sweden	I	0.10*	1.21	0.67
Rondout	USA-New York	I	0.01*	1.42	0.79
Rotehogstjärnen	Sweden	I	>0.1	0.72	0.40
Rotorua	New Zealand	I	>0.1	-0.43	-0.24

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Rukwa	Tanzania	S	0.05*	0.36	0.20
Rybinkskoye	Russia	S	0.0001*	1.60	0.89
Saimaa	Finland	I	0.0001*	1.15	0.64
Saint Clair	USA, Canada	S	0.03*	0.88	0.49
Salton Sea	USA-California	S	0.003*	1.31	0.73
Samsonvale/North Pine Dam	Australia	I	>0.1	0.97	0.54
Sans Chambre	Canada	I	>0.1	0.68	0.38
Sarykamyshskoye	Turkmenistan	S	0.01*	0.76	0.42
Sasykkol	Kazakhstan	S	0.03*	1.12	0.62
Schoharie	USA-New York	I	>0.1	0.00	0.00
Se lin/ Siling Go	China	S	>0.1	-0.20	-0.11
Segozero	Russia	S	0.08*	1.66	0.92
Selawik Lake	USA-Alaska	S	0.01*	1.24	0.69
Sevan	Armenia	S	>0.1	0.18	>0.1
Silvan	Australia	I	>0.1	-0.23	-0.13
Simcoe	Canada	S	>0.1	0.52	0.29
Sparkling	USA-Wisconsin	I	0.01*	1.46	0.81
St. Jean	Canada	S	0.06*	0.72	0.40
St. Skarsjon	Sweden	I	0.09*	1.53	0.85
Stechlinsee	Germany	I	>0.1	0.72	0.40
Stensjön	Sweden	I	0.06*	1.71	0.95
Stora Envättern	Sweden	I	0.06*	1.13	0.63
Sugarloaf	Australia	I	>0.1	-0.14	-0.08
Superior	USA, Canada	I	0.07*	2.09	1.16
Superior	USA, Canada	S	>0.1	1.44	0.80
Swan	Canada	I	0.0001*	1.19	0.66
Tahoe	USA-California, Nevada	I	0.01*	0.97	0.54
Tahoe	USA-California, Nevada	S	0.0001*	1.28	0.71
Taihu	China	I	>0.1	0.00	0.00
Taihu	China	S	>0.1	-0.04	-0.02
Tana	Ethiopia	S	>0.1	0.29	0.16
Tanganyika	Tanzania, Zambia, Burundi, DRC	S	0.06*	0.34	0.19
The Loch	USA Colorado	I	>0.1	0.95	0.53
Titicaca	Peru, Bolivia	S	0.01*	0.27	0.15

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				(°F per decade)	(°C per decade)
Toolik	USA-Alaska	I	>0.1	-0.18	-0.10
Trout Lake	USA-Wisconsin	I	0.02*	1.39	0.77
Tsimlyanskoye	Russia	S	0.01*	0.72	0.40
Tulemalu	Canada	S	>0.1	0.74	0.41
Turkana	Kenya, Ethiopia	S	0.04*	0.40	0.22
U Yarra	Australia	I	>0.1	0.18	0.10
Ulungar/ Wu Lun Gu Hu	China	S	0.01*	1.22	0.68
Upemba	DRC	S	0.0001*	0.77	0.43
Upper Zurich	Switzerland	I	>0.1	0.74	0.41
Urmia	Iran	S	0.003*	1.17	0.65
Uvs	Mongolia, Russia	S	0.04*	0.70	0.39
Valkea Kotinen	Finland	I	>0.1	0.90	0.50
Van	Turkey	S	0.09*	0.50	0.28
Vänern	Sweden	S	>0.1	1.12	0.62
Vattern	Sweden	S	0.04*	1.13	0.63
Victoria	Tanzania, Uganda, Kenya	S	0.09*	0.54	0.30
Võrtsjärv	Estonia	I	0.09*	0.72	0.40
Walenstadt	Switzerland	I	>0.1	-0.59	-0.33
Warren Reservoir	Australia	I	0.04*	0.92	0.51
Washington (Washington)	USA- Washington	I	0.01*	0.49	0.27
Washington (Florida)	USA-Florida	I	>0.1	-0.11	-0.06
Whitepine	Canada	I	>0.1	0.49	0.27
Winnebago	USA-Wisconsin	S	0.06*	1.33	0.74
Winnipeg	Canada	S	>0.1	0.41	0.23
Winnipegosis	Canada	S	0.04*	0.99	0.55
Woerther See	Austria	I	0.01*	0.85	0.47
Yan Yean	Australia	I	>0.1	0.18	0.10
Zaysan	Kazakhstan	S	>0.1	0.45	0.25
Zeyskoye	Russia	S	0.06*	0.74	0.41