

Table S1. List of Landsat Images (Surface reflectance level-2 science product).

SN	Image	Date	Path	Row	Resolution
1	LT05_L1TP_140041_19891109_20170201_01_T1	11/9/1989	140	41	30 m
2	LT05_L1TP_140041_19900112_20170201_01_T1	1/12/1990	140	41	30 m
3	LT05_L1TP_140041_19921101_20170121_01_T1	11/1/1992	140	41	30 m
4	LT05_L1TP_140041_19931120_20170116_01_T1	11/20/1993	140	41	30 m
5	LT05_L1TP_140041_19941022_20170111_01_T1	10/22/1994	140	41	30 m
6	LT05_L1TP_140041_19951009_20170106_01_T1	10/9/1995	140	41	30 m
7	LT05_L1TP_140041_19961128_20170101_01_T1	11/28/1996	140	41	30 m
8	LT05_L1TP_140041_19981102_20161220_01_T1	11/2/1998	140	41	30 m
9	LT05_L1TP_140041_20001107_20161213_01_T1	11/7/2000	140	41	30 m
10	LE07_L1TP_140041_20011220_20170201_01_T1	12/20/2001	140	41	30 m
11	LE07_L1TP_140041_20021223_20170128_01_T1	12/23/2002	140	41	30 m
12	LT05_L1TP_140041_20031218_20161203_01_T1	12/18/2003	140	41	30 m
13	LT05_L1TP_140041_20041204_20161129_01_T1	12/4/2004	140	41	30 m
14	LT05_L1TP_140041_20051105_20161123_01_T1	11/5/2005	140	41	30 m
15	LT05_L1TP_140041_20081012_20161029_01_T1	10/12/2008	140	41	30 m
16	LT05_L1TP_140041_20091015_20161019_01_T1	10/15/2009	140	41	30 m
17	LT05_L1TP_140041_20101205_20161011_01_T1	12/5/2010	140	41	30 m
18	LC08_L1TP_140041_20131010_20170429_01_T1	10/10/2013	140	41	30 m
19	LC08_L1TP_140041_20140927_20170419_01_T1	9/27/2014	140	41	30 m
20	LC08_L1TP_140041_20141114_20170417_01_T1	11/14/2014	140	41	30 m
21	LC08_L1TP_140041_20150930_20170403_01_T1	9/30/2015	140	41	30 m
22	LC08_L1TP_140041_20161103_20170318_01_T1	11/3/2016	140	41	30 m
23	LC08_L1TP_140041_20171021_20171106_01_T1	10/21/2017	140	41	30 m

Table S2. List of Sentinel-2 Images (Level 1c product).

S N	Image	Date	Tile number
1	S2A_OPER_PRD_MSIL1C_PDMC_20160114T181529_R076_V20160114T050729_20160114T050729	01/14/2016	T45RVM
2	S2A_OPER_PRD_MSIL1C_PDMC_20160114T181529_R076_V20160114T050729_20160114T050729	01/14/2016	T45RVL
3	S2A_OPER_PRD_MSIL1C_PDMC_20160414T013425_R076_V20160413T045850_20160413T045850	04/14/2016	T45RVM
4	S2A_OPER_PRD_MSIL1C_PDMC_20160414T013425_R076_V20160413T045850_20160413T045850	04/14/2016	T45RVL
5	S2A_OPER_MTD_SAFL1C_PDMC_20161030T121245_R076_V20161030T044922_20161030T044922	10/30/2016	T45RVM
6	S2A_OPER_MTD_SAFL1C_PDMC_20161030T121245_R076_V20161030T044922_20161030T044922	10/30/2016	T45RVL
7	S2A_MSIL1C_20161209T045202_N0204_R076_T45RVM_20161209T04560	12/09/2016	T45RVM
8	S2A_MSIL1C_20161209T045202_N0204_R076_T45RVL_20161209T04560	12/09/2016	T45RVL
9	S2A_MSIL1C_20170508T044701_N0205_R076_T45RVM_20170508T045856	05/08/2017	T45RVM
10	S2A_MSIL1C_20170508T044701_N0205_R076_T45RVL_20170508T045856	05/08/2017	T45RVL
11	S2A_MSIL1C_20171015T044751_N0205_R076_T45RVM_20171015T045632	10/15/2017	T45RVM
12	S2A_MSIL1C_20171015T044751_N0205_R076_T45RVL_20171015T045632	10/15/2017	T45RVL
13	S2B_MSIL1C_20171209T045149_N0206_R076_T45RVM_20171209T082401	12/09/2017	T45RVM
14	S2B_MSIL1C_20171209T045149_N0206_R076_T45RVL_20171209T082401	12/09/2017	T45RVL
15	S2B_MSIL1C_20180508T044659_N0206_R076_T45RVM_20180508T083014	05/08/2018	T45RVM
16	S2B_MSIL1C_20180508T044659_N0206_R076_T45RVL_20180508T083014	05/08/2018	T45RVL
17	S2A_MSIL1C_20180513T044701_N0206_R076_T45RVM_20180513T075139	05/13/2018	T45RVM
18	S2A_MSIL1C_20180513T044701_N0206_R076_T45RVL_20180513T075139	05/13/2018	T45RVL

The relative orbit for each image was 076

Table S3. List of WorldView and GeoEye basic level images.

SN		Date	Satellite	Coverage
1	103001004B849300	11/17/2015	WV-02	Landak, Chhule, Melung, Bhote Koshi
2	10300100553C3D00	04/16/2016	WV-02	Lumsamba
3	1050010007140900	11/05/2016	GE01	Ngozompa
4	104001002469AD00	10/25/2016	WV-03	Nuptse, Lhotse Nup, Changri Nup, Khumbu, Nareyargaip, Cholo, Nare, Lobuche
5	1040010019841600	04/27/2016	WV-03	Ngozompa
6	103001005E3EFF00	10/29/2016	WV-02	Lhotse, Imja & Lhotse Shar
7	10300100531C0A00	04/3/2016	WV-02	Amphu, Tingbo
8	103001005496C400	04/03/2016	WV-02	Amadablam, Duwo, Nareyargaip
9	10300100553C3D00	04/03/2016	WV-03	Cholotse, Tweche

Table S4. Supraglacial ponded area (km<sup>2</sup>) in 16 glaciers in different years from 1989–2017 mapped using Landsat images.

Year	Nareyargaip	Duwo	Ama Dablam	Amphu	Imja	Lhotse	Nuptse	Khumbu	Changri Nup	Lobuche	Ngozompa	Lumsamba	Bhote Koshi	Melung	Chhule	Thyanbo	Total area
1989	0.005					0.016		0.142		0.024	0.063	0.011	0.099	0.007	0.011		0.378
1990	0.008					0.018		0.143		0.015	0.057	0.007	0.094	0.018	0.022		0.382
1992	0.009		0.015		0.018	0.008		0.156	0.016	0.026	0.193	0.014	0.057		0.020		0.531
1993	0.010		0.015			0.034		0.147			0.211	0.037	0.053		0.016		0.524
1994	0.013		0.008		0.007	0.011	0.007	0.146			0.119	0.055	0.053	0.017	0.025		0.462
1995	0.015				0.013	0.014	0.008	0.184	0.005		0.108	0.091	0.062		0.016		0.516
1996	0.013				0.006	0.010		0.130	0.010		0.092	0.032	0.051	0.007	0.037		0.388
1998	0.017				0.013	0.014		0.172	0.005		0.126	0.031	0.061		0.030		0.469
2000	0.018					0.012	0.010	0.146		0.026	0.175	0.020	0.064		0.019		0.489
2001	0.013				0.005	0.013	0.010	0.142	0.006	0.021	0.199	0.009	0.049	0.006	0.019		0.493
2002	0.013		0.012		0.029	0.027	0.012	0.183	0.006	0.006	0.170	0.007	0.071	0.020	0.023		0.580
2003	0.012		0.006		0.012		0.017	0.143	0.006		0.163	0.006	0.045	0.010	0.010		0.430
2004	0.011		0.016		0.019		0.024	0.140	0.006	0.008	0.201	0.007	0.055	0.005	0.038		0.528
2005	0.014		0.007		0.008		0.015	0.144	0.005	0.026	0.186		0.092	0.005	0.031		0.532
2008	0.048		0.009		0.012	0.011	0.008	0.176		0.007	0.275	0.015	0.113	0.019	0.044		0.735
2009	0.049		0.012		0.030	0.012	0.011	0.186			0.332	0.029	0.132	0.013	0.029		0.835
2010	0.045		0.016		0.023	0.020	0.010	0.216	0.020		0.278	0.024	0.119	0.030	0.049	0.011	0.860
2013	0.055	0.006	0.005		0.026	0.020	0.016	0.206		0.009	0.290	0.054	0.141	0.015	0.034	0.015	0.893
2014	0.053	0.008	0.020	0.016	0.023	0.049	0.025	0.262	0.014	0.011	0.376	0.057	0.177	0.007	0.029	0.021	1.146
2015	0.067	0.008	0.024	0.013	0.006	0.034	0.022	0.242	0.024	0.020	0.419	0.110	0.204	0.008	0.036	0.030	1.266
2016	0.054	0.000	0.015	0.009	0.007	0.052	0.017	0.206	0.023	0.011	0.379	0.108	0.222	0.012	0.043	0.040	1.198
2017	0.059	0.018	0.023	0.009		0.047	0.020	0.250	0.039	0.012	0.423	0.087	0.208	0.012	0.051	0.065	1.324

Table S5. Supraglacial pond number in 16 glaciers in different years from 1989–2017 mapped using Landsat images.

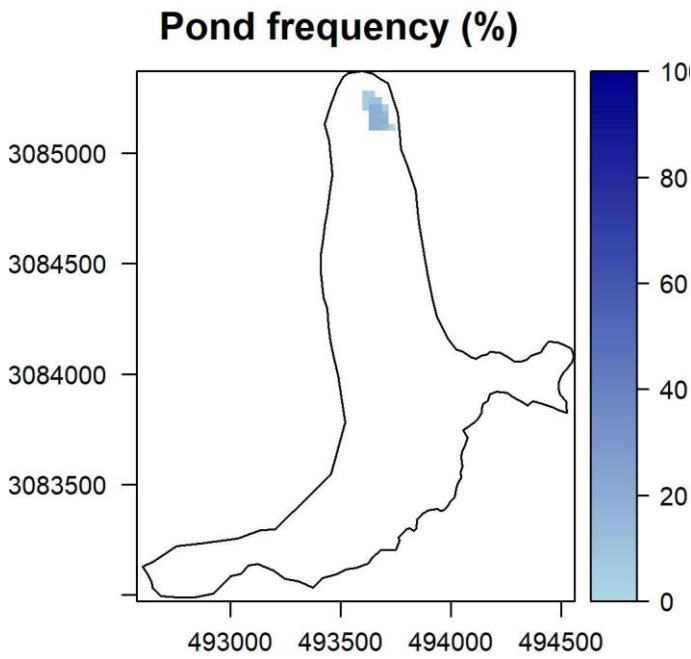
Year	Nareyargaip	Duwo	Ama Dablam	Amphu	Imja	Lhotse	Nuptse	Khumbu	Changri Nup	Lobuche	Ngozumpa	Lumsamba	Bhote Koshi	Melung	Chhule	Thyanbo	Total
1989	1					2		4	0	2	8	2	4	1	1		25
1990	1					2		3		1	7	1	3	2	2		22
1992	1		2		1	1		4	2	2	11	2	7	1			34
1993	1		2		0	3		5			13	6	8		1		39
1994	1		1		1	1	1	3			12	5	7	3	2		37
1995	1				2	1	1	7	1		9	6	7		1		36
1996	1				1	1		3	1		10	4	6	1	4		32
1998	1				1	2		5	1		11	4	5		2		32
2000	1				0	2	1	4		1	15	2	7		1		34
2001	1				1	2	1	5	1	2	14	1	6	1	1		36
2002	1		2		3	3	1	6	1	1	15	1	7	3	2		46
2003	1		1		2		2	4	1		14	1	4	1	1		32
2004	1		2		2		2	4	1	1	17	1	6	1	2		40
2005	1		1		1		2	3	1	3	13		12	1	2		40
2008	2		1		2	1	1	8	0	1	14	2	10	2	4		48
2009	2		2		4	2	2	10	0		19	3	13	1	2		60
2010	2		2		4	3	1	6	3		15	3	10	4	3	1	57
2013	2	1	1		2	2	2	10	0	1	14	5	12	2	2	1	57
2014	2	1	2	1	2	5	3	12	2	1	18	4	13	1	2	1	70
2015	3	1	3	1	1	5	2	9	2	2	28	9	18	1	2	1	88
2016	2		2	1	1	7	2	8	2	1	21	7	17	1	2	2	76
2017	2	2	3	1	0	5	2	11	4	1	27	6	17	1	1	2	85
Total	31	5	27	4	31	50	26	134	23	20	325	75	199	28	40	8	1026

Table S6. Pond cover percentage with the debris-covered area in 16 glaciers in respect to the area of debris portion of the glacier from 1989–2017.

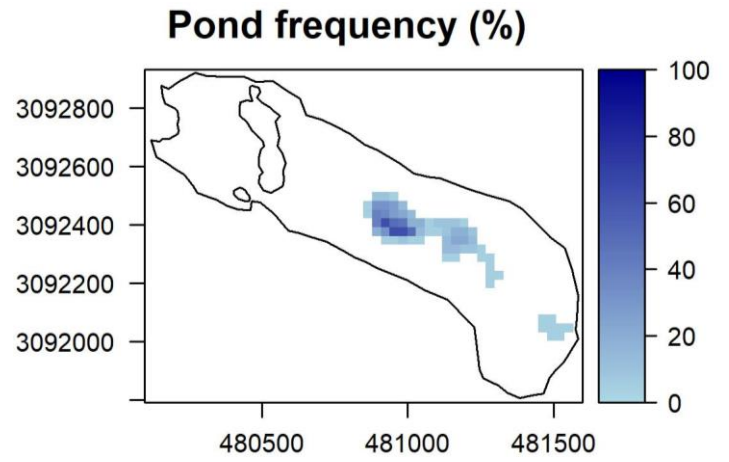
Year	Nareyargaip	Duwo	Ama Dablam	Amphu	Imja	Lhotse	Nuptse	Khumbu	Changri Nup	Lobuche	Ngozumpa	Lumsamba	Bhote Koshi	Melung	Chhule	Thyanbo
1989	0.3					0.3		2.0		5.3	0.3	0.2	0.7	0.1	0.3	
1990	0.4					0.3		2.0		3.3	0.2	0.2	0.7	0.4	0.6	
1992	0.5		0.6		0.3	0.1		2.1	0.2	5.8	0.8	0.3	0.4		0.6	
1993	0.6		0.7			0.6		2.0			0.9	0.8	0.4		0.5	
1994	0.7		0.3		0.1	0.2	0.3	2.0			0.5	1.1	0.4	0.4	0.7	
1995	0.8				0.2	0.3	0.4	2.5	0.1		0.5	1.9	0.5		0.5	
1996	0.7				0.1	0.2	0.0	1.8	0.1		0.4	0.7	0.4	0.2	1.1	
1998	0.9				0.2	0.3	0.0	2.4	0.1		0.5	0.6	0.5		0.9	
2000	0.9					0.2	0.5	2.0		5.7	0.8	0.4	0.5		0.6	
2001	0.7				0.1	0.3	0.5	2.0	0.1	4.6	0.9	0.2	0.4	0.1	0.6	
2002	0.7		0.5		0.5	0.5	0.6	2.5	0.1	1.4	0.7	0.1	0.5	0.5	0.7	
2003	0.6		0.2		0.2		0.8	2.0	0.1		0.7	0.1	0.3	0.2	0.3	
2004	0.6		0.7		0.3		1.1	1.9	0.1	1.7	0.9	0.1	0.4	0.1	1.1	
2005	0.8		0.3		0.1		0.7	2.0	0.1	5.8	0.8		0.7	0.1	0.9	
2008	2.5		0.4		0.2	0.2	0.4	2.4		1.5	1.2	0.3	0.8	0.4	1.3	
2009	2.6		0.5		0.5	0.2	0.5	2.6			1.4	0.6	1.0	0.3	0.9	
2010	2.4		0.7		0.4	0.4	0.5	3.0	0.3		1.2	0.5	0.9	0.7	1.4	0.8
2013	2.9	0.5	0.2		0.5	0.4	0.8	2.8		2.0	1.3	1.1	1.1	0.3	1.0	1.1
2014	2.8	0.6	0.8	1.6	0.4	0.9	1.2	3.6	0.2	2.5	1.6	1.2	1.3	0.2	0.9	1.5
2015	3.6	0.6	1.0	1.3	0.1	0.6	1.0	3.3	0.4	4.5	1.8	2.3	1.5	0.2	1.1	2.2
2016	2.9		0.6	0.9	0.1	1.0	0.8	2.8	0.3	2.4	1.6	2.3	1.7	0.3	1.3	2.8
2017	3.1	1.4	1.0	0.9		0.9	0.9	3.4	0.6	2.7	1.8	1.8	1.5	0.3	1.5	4.6
Average	1.5	0.8	0.6	1.2	0.3	0.4	0.6	2.4	0.2	3.5	1.0	0.8	0.8	0.3	0.9	2.2

Figure S1. Distribution of supraglacial ponds in different glaciers in between from 1989 and 2017, highlighting the persistence of individual ponds.

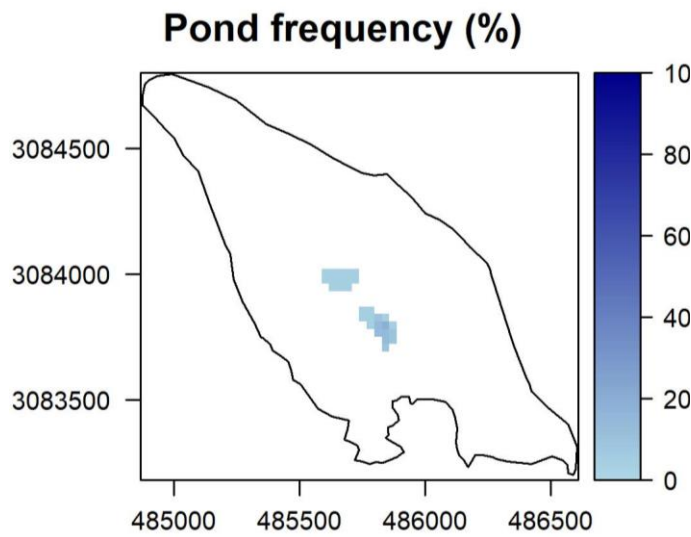
Amphu Glacier



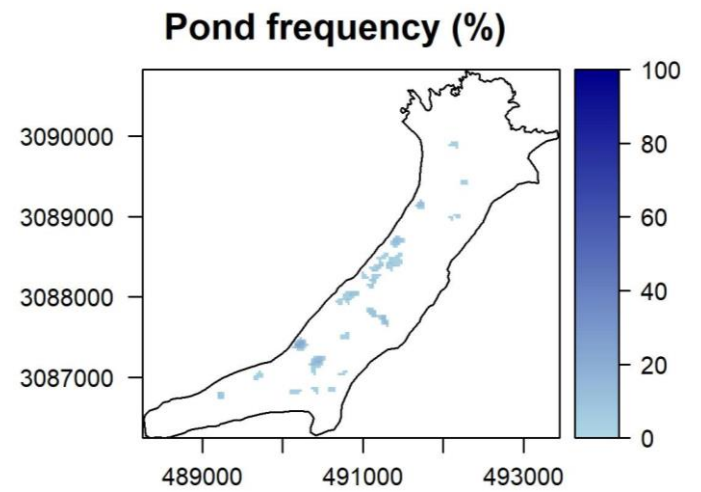
Lobuche Glacier



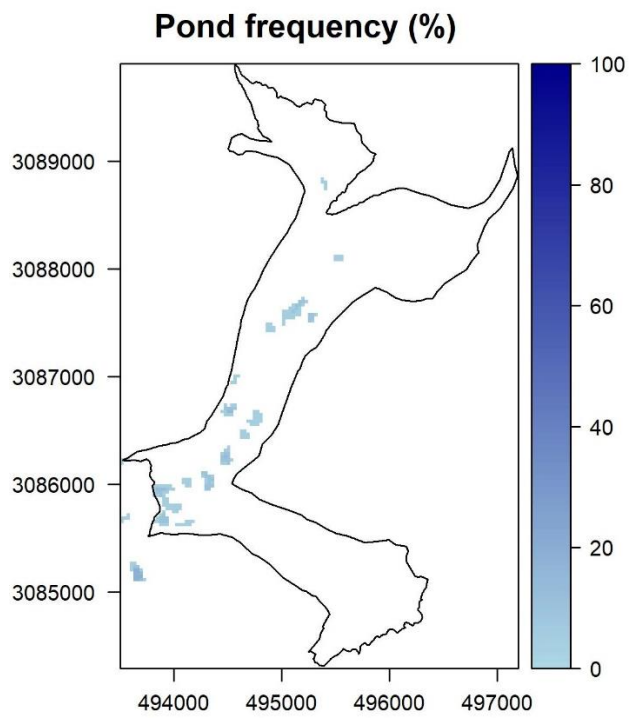
Duwo Glacier



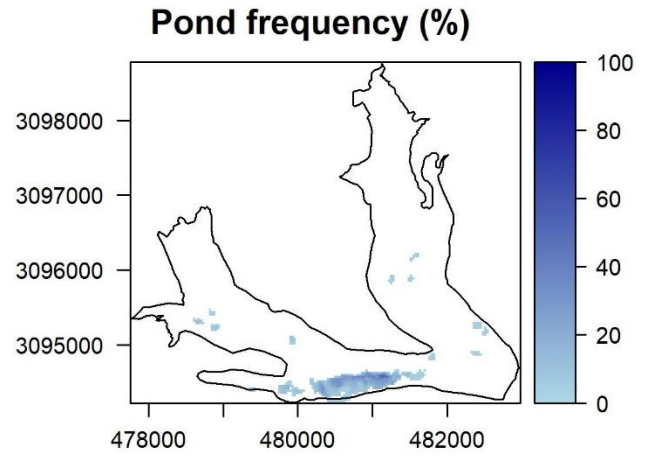
Lhotse Glacier



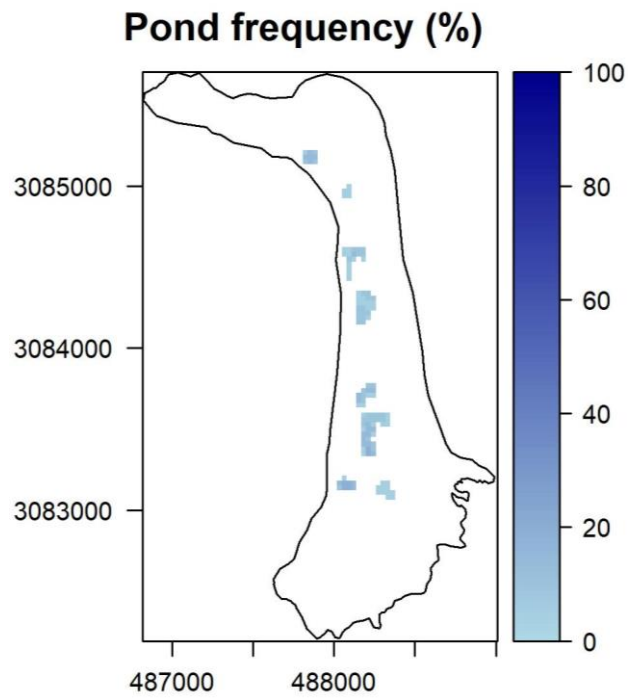
Imja Glacier



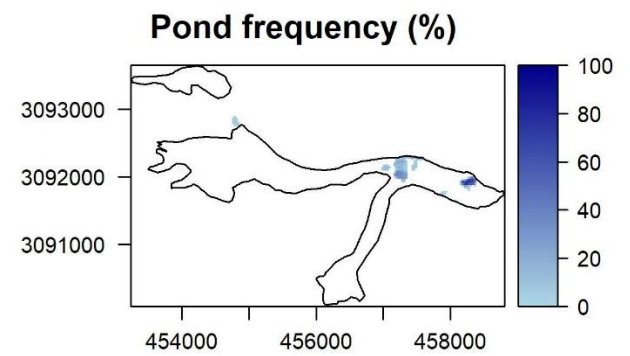
Changri Nup Glacier



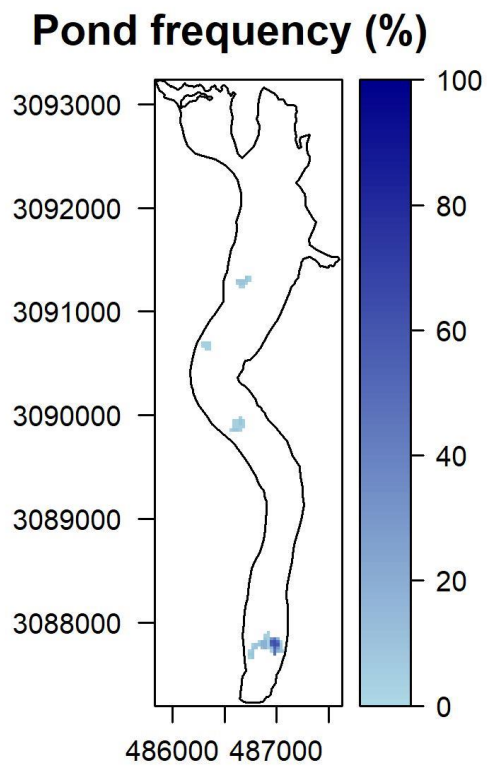
Amadablam Glacier



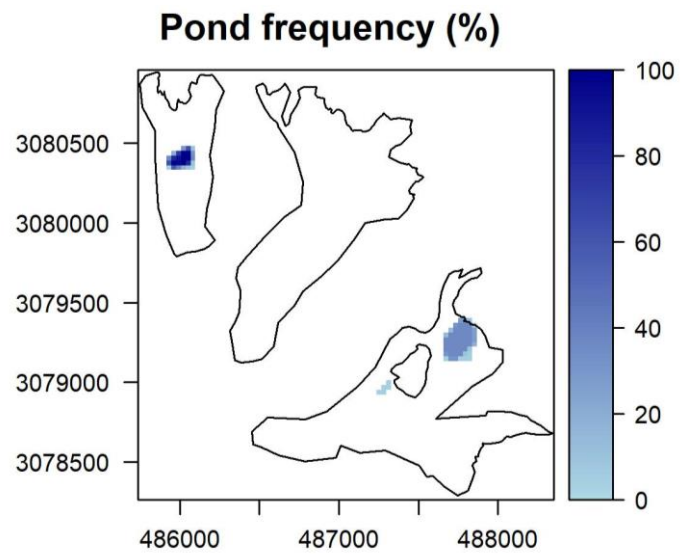
Chhule Glacier



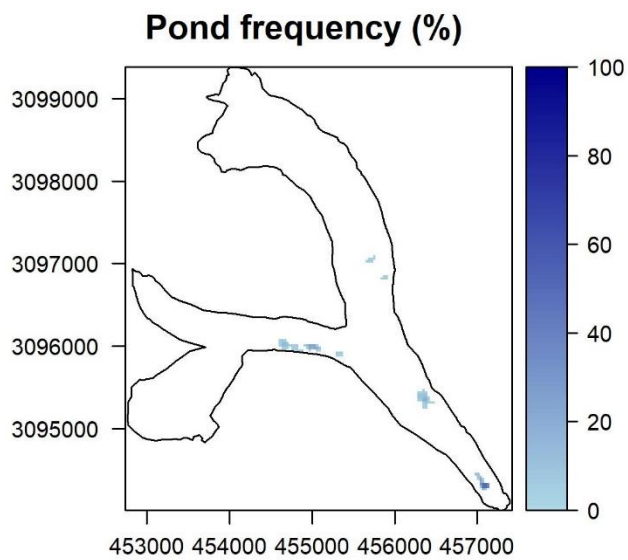
Nuptse Glacier



Nare Glacier



Melung Glacier



Thyanbo Glacier

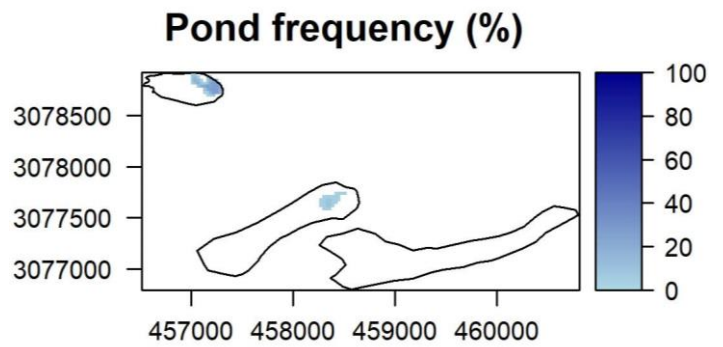


Figure S2. Examples of ponds obtained with the Landsat (a, d, & g), Sentinel-2 (b, e, & h), WorldView-2 (c & i), and GeoEye-1 (f) at the surface of the selected glaciers i.e. terminuses of Nuptse Glacier (a, b, & c), near terminus of the Ngozumpa Glacier (d, e, & f), and terminus of the Melung Glacier (g, h, & i).

