

## Investigating the impact of wildfires on lake water quality using Earth observation satellites

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### Supplementary Materials

#### Tables

**Table S1.** Indicator values for cluster analysis carried out on 2011 burned vegetation types (100% = perfect indicator i.e. Land Cover (LC) burn occurs in only that cluster).

Cluster		1	2	3	4	5	6
Cluster ID		1	883	1059	1348	1457	1648
n		1281	145	152	95	180	171
LC code	Land cover summary						
LC01	Crop/Herb/shrub	0	0	2	0	<b>46</b>	<b>49</b>
LC02	Cropland	0	0	0	0	<b>21</b>	<b>23</b>
LC03	Crop/Natural	0	0	1	0	<b>22</b>	<b>71</b>
LC04	Crop/Natural	0	0	1	0	12	<b>81</b>
LC05	broadleaf, evergreen	0	0	0	0	1	<b>52</b>
LC06	broadleaf, deciduous	0	0	0	0	1	<b>84</b>
LC07	needleleaf, evergreen	0	2	0	<b>95</b>	1	0
LC08	needleleaf, deciduous	3	0	0	4	0	1
LC09	mixed leaf trees	0	0	1	<b>29</b>	3	5
LC10	tree/shrub	0	0	0	3	4	<b>81</b>
LC11	Herbs/trees/shrub	1	0	0	0	1	<b>60</b>
LC12	Shrubland	0	0	0	2	1	<b>81</b>
LC13	Grassland	0	0	0	0	6	<b>79</b>
LC14	Lichen/moss	0	0	0	<b>28</b>	0	0
LC15	Sparse veg	0	0	0	13	1	<b>22</b>
LC16	Trees flooded	0	0	0	<b>31</b>	0	12
LC17	Trees flooded	0	0	0	0	2	16
LC18	Shrubs/herbs flooded	0	0	0	0	4	<b>66</b>

**Table S2.** List of 106 selected lakes (list and maps at this link: [https://gws-access.jasmin.ac.uk/public/cds\\_c3s\\_lakes/CCI\\_LAKES/CCI\\_LAKE\\_LIST\\_v2/LAKE\\_LIST\\_MASK\\_CCI\\_v2\\_UoR\\_fv\\_1.0.html](https://gws-access.jasmin.ac.uk/public/cds_c3s_lakes/CCI_LAKES/CCI_LAKE_LIST_v2/LAKE_LIST_MASK_CCI_v2_UoR_fv_1.0.html)). AF = Africa, AS = Asia, EU = Europe, NA = North America, OC = Oceania, SA = South America. Lat = latitude; Lon = longitude; Catch area/lake area = ratio catchment area /lake area; 95ile SPI = 95<sup>th</sup> percentile of Standardized Precipitation Index; Cluster on total burned area: III = limited regular annual fires and medium burned area (BA); IV = significant regular annual fires and high BA; V = limited fire peaks and medium BA.

N.	id	Name	Countries	Continent	Lat	Lon	Lake area (km <sup>2</sup> )	Catch area / lake area	95ile SPI	Cluster
1	GLBL00000013	Kyoga	Uganda	AF	1.58403	32.45693	2788	114	1.55	IV
2	GLWD00000011	Great Slave	Canada	NA	61.99792	-112.38889	26734	37	1.55	V
3	GLWD00000014	Chad	Chad;Niger;Nigeria	AF	13.47500	14.12500	18752	52	1.67	III
4	GLWD00000024	Volta	Ghana	AF	7.48403	0.09791	6045	67	1.53	IV
5	GLWD00000030	Albert	The Democratic Republic of the Congo;Uganda	AF	1.87709	31.13818	5527	75	1.60	IV
6	GLWD00000036	Mweru	The Democratic Republic of the Congo;Zambia	AF	-9.02430	28.70068	5043	43	1.66	IV
7	GLWD00000040	Zaysan	Kazakhstan	AS	48.71667	83.43193	4194	34	1.56	III
8	GLWD00000075	Hulun	China	AS	48.94931	117.39929	2121	63	1.57	III
9	GLWD00000079	Kakhovskoye (Kakhovka Reservoir)	Ukraine	EU	47.26459	33.95485	2092	233	1.50	III
10	GLWD00000087	Kremenshugskoye (Kremenchuk Reservoir)	Ukraine	EU	49.38125	32.37776	1849	210	1.73	III
11	GLWD00000093	Krasnoyarskoye (Krasnoyarsk Reservoir)	Russian Federation	EU	54.85000	90.95623	1630	179	1.66	III
12	GLWD00000098	Argyle Reservoir	Australia	OC	-16.36041	128.67151	829	55	1.69	IV
13	GLWD00000108	Kossour Reservoir	Côte d'Ivoire	AF	7.32431	-5.71112	500	66	1.67	IV
14	GLWD00000109	Hungtze	China	AS	33.32709	118.72984	1374	120	1.57	III
15	GLWD00000113	Saratov Reservoir	Russian Federation	EU	52.48820	48.16110	1073	1201	1.63	III
16	GLWD00000116	Kainji Reservoir	Nigeria	AF	10.55903	4.54791	1035	1518	1.70	IV
17	GLWD00000129	represa de Ilha Solteira	Brazil	SA	-19.79791	-50.51459	1077	346	1.56	III
18	GLWD00000153	Chapala	Mexico	NA	20.24445	-103.10001	1052	42	1.71	III
19	GLWD00000190	Novosibirskoye	Russian Federation	EU	54.30348	81.78332	1024	223	1.55	III
20	GLWD00000199	Iepe	Brazil	SA	-22.82847	-50.99445	407	208	1.53	III
21	GLWD00000217	Grande	Brazil	SA	-20.25902	-48.87431	349	339	1.56	III
22	GLWD00000238	das Brisas	Brazil	SA	-18.30763	-48.93543	333	285	1.51	III
23	GLWD00000249	Hirakud Reservoir	India	AS	21.65764	83.73401	501	145	1.86	III
24	GLWD00000266	Inhernillo	Mexico	NA	18.55348	-101.86737	288	381	1.82	III

25	GLWD00000274	Roseires Reservoir	Sudan	AF	11.55209	34.45624	225	839	1.56	IV
26	GLWD00000279	Assad	Syrian Arab Republic	AS	36.07987	38.07013	637	175	1.64	III
27	GLWD00000287	Gaoyou (Kaoyu)	China	AS	32.78472	119.22083	703	244	1.64	III
28	GLWD00000291	Buir	China;Mongolia	AS	47.80625	117.70345	598	36	1.70	III
29	GLWD00000296	Chardarinskoye	Kazakhstan;Uzbekistan	AS	41.13820	68.12151	745	268	1.53	III
30	GLWD00000306	Lagdo Reservoir	Cameroon	AF	8.88403	13.95415	623	50	1.54	IV
31	GLWD00000314	Upemba	The Democratic Republic of the Congo	AF	-8.62291	26.38679	608	118	1.62	IV
32	GLWD00000328	Mingechaurskoye	Azerbaijan	AS	40.92153	46.75485	416	148	1.54	III
33	GLWD00000330	Sinakharin	Thailand	AS	14.72292	99.04443	346	32	1.70	III
34	GLWD00000337	Stephens	Canada	NA	56.42153	-95.08681	317	3129	1.89	V
35	GLWD00000347	Gandhisagar Reservoir	India	AS	24.44098	75.50901	524	44	1.84	III
36	GLWD00000386	Manantali	Mali	AF	13.06598	-10.37223	438	64	1.57	IV
37	GLWD00000436	Kyivs'Ke-Reservoir (Kiev Reservoir)	Ukraine	EU	50.91598	30.50346	636	386	1.60	III
38	GLWD00000460	Hendrik Verwoerd	South Africa	AF	-30.62847	25.79027	294	239	1.57	III
39	GLWD00000462	Itezhi-Tezhi-Dam	Zambia	AF	-15.69374	25.97846	329	326	1.65	IV
40	GLWD00000471	Kanivs'Ke	Ukraine	EU	50.11736	30.89860	470	729	1.57	III
41	GLWD00000475	Tiga	Nigeria	AF	11.39098	8.43957	108	61	1.72	III
42	GLWD00000477	Malpaso	Mexico	NA	17.11598	-93.48889	292	118	1.70	III
43	GLWD00000485	Lagos	Nigeria	AF	6.52987	3.54443	630	76	1.68	III
44	GLWD00000494	Agua-Vermelha Reservoir	Brazil	SA	-19.94652	-49.88265	507	275	1.53	III
45	GLWD00000498	Nagarjuna	India	AS	16.22848	79.06873	196	1124	1.68	III
46	GLWD00000502	Jebba	Nigeria	AF	49.84236	136.37359	324	40	1.54	III
47	GLWD00000506	Dniester-Estuary (Dnestrovskiy)	Republic of Moldova;Ukraine	EU	9.44237	4.60971	275	5862	1.77	IV
48	GLWD00000509	Grajau	Brazil	SA	46.23125	30.34026	370	197	1.58	III
49	GLWD00000510	Tungabhadra	India	AS	-6.92291	-44.17501	311	274	1.55	IV
50	GLWD00000528	Karakaya	Turkey	AS	15.17153	76.23471	353	82	1.75	III
51	GLWD00000542	Pend-Oreille	United States	NA	38.48820	38.46318	195	409	1.51	III
52	GLWD00000546	Jupia	Brazil	SA	48.13403	-116.37500	360	174	1.63	III
53	GLWD00000553	Marion	United States	NA	-20.58402	-51.52293	289	1563	1.53	III
54	GLWD00000556	Malombe	Malawi	AF	33.53125	-80.45903	62	604	1.69	III
55	GLWD00000586	Malombe	Malawi	AF	-14.67777	35.25068	310	422	1.58	IV
56	GLWD00000601	Krasnodarskoye Vodokhranilishche	Russian Federation	EU	44.98959	39.25554	269	167	1.54	III
57	GLWD00000603	Ubol Ratana	Thailand	AS	16.70209	102.59998	313	39	1.56	III

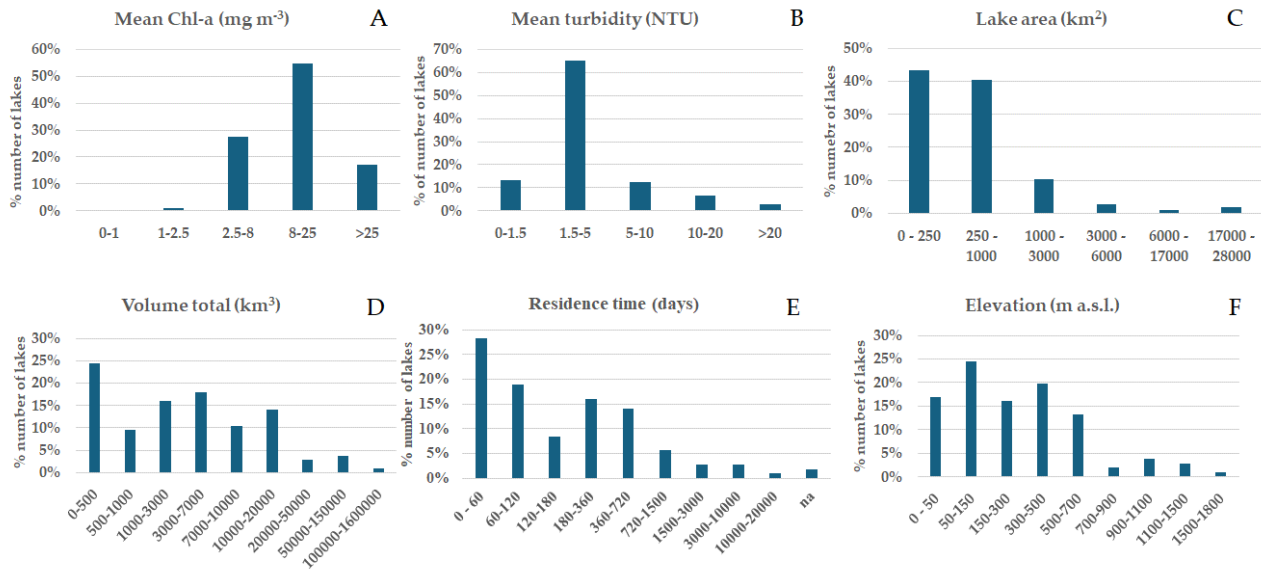
58	GLWD00000613	Tshangalele	The Democratic Republic of the Congo	AF	-10.92430	27.04652	180	70	1.84	IV
59	GLWD00000674	Kisale	The Democratic Republic of the Congo	AF	-8.27430	26.51249	298	425	1.62	IV
60	GLWD00000746	Lake Maurepas	United States	NA	30.26320	-90.50070	237	33	1.69	V
61	GLWD00000851	ozero Saltaim-Tenis	Russian Federation	EU	56.13125	71.93679	252	46	1.56	IV
62	GLWD00000937	Rana Pratap	India	AS	24.82917	75.60068	171	146	1.82	III
63	GLWD00000960	Malye Chany	Russian Federation	EU	54.56875	77.95971	204	104	1.62	III
64	GLWD00001007	Guarico	Bolivarian Republic of Venezuela	SA	9.03681	-67.38820	188	43	1.57	III
65	GLWD00001046	Kabamba	The Democratic Republic of the Congo	AF	-7.89444	27.04027	109	1442	1.53	IV
66	GLWD00001058	Mamawi	Canada	NA	58.61875	-111.45973	146	151	1.62	V
67	GLWD00001059	Ukal	India	AS	21.34792	73.77776	370	168	1.83	III
68	GLWD00001076	Dukan	Iraq	AS	36.10348	44.92499	120	95	1.52	III
69	GLWD00001286	Karasor	Kazakhstan	AS	49.86875	75.55693	147	54	1.62	III
70	GLWD00001344	Oologah	United States	NA	36.54792	-95.60626	115	97	1.57	III
71	GLWD00001368	Kissimmee	United States	NA	27.89723	-81.26598	121	33	1.67	III
72	GLWD00001430	Luoma	China	AS	34.11042	118.20970	248	192	1.53	III
73	GLWD00001501	Matatila-Dam	India	AS	25.05348	78.32360	66	311	1.96	III
74	GLWD00001609	Uyaly	Kazakhstan	AS	46.43264	81.28054	123	167	1.59	III
75	GLWD00001616	Poelela	Mozambique	AF	-24.54235	35.05138	88	165	1.62	III
76	GLWD00001640	Davy	Canada	NA	58.86736	-108.29445	111	78	1.56	III
77	GLWD00002018	Yueliang Pao	China	AS	45.70903	123.87081	99	428	1.61	III
78	GLWD00002239	Uryum	Russian Federation	EU	54.54792	78.49096	77	148	1.61	III
79	GLWD00002285	Ebeyty	Russian Federation	EU	54.64659	71.73557	83	94	1.55	III
80	GLWD00003500	Maraldy	Kazakhstan	AS	52.31598	77.77151	54	33	1.71	III
81	HYLA00000946	Promissao	Brazil	SA	-21.45624	-49.49793	511	110	1.51	III
82	HYLA00001257	Huoshaohei-Talahong	China	AS	46.75209	124.18540	430	64	1.63	III
83	HYLA00001496	Bargi Dam	India	AS	22.79514	80.03054	153	98	1.78	III
84	HYLA00001503	Rengali	India	AS	21.47292	84.95971	311	82	1.77	III
85	HYLA00001509	Sriram Sagar	India	AS	18.95209	78.28610	336	269	1.78	IV
86	HYLA00001612	Mtera	United Republic of Tanzania	AF	-7.02430	35.83749	444	157	1.82	IV
87	HYLA000010381	Iago Vera	Paraguay	SA	-26.17291	-57.47709	44	40	1.59	III
88	HYLA000013471	Ozero Khorosheye	Russian Federation	EU	53.52848	78.55623	41	194	1.57	III
89	HYLA000013521	Surskoye Vodokhranilishche	Russian Federation	EU	53.00209	45.33193	86	160	1.58	III
90	HYLA000013715	None	Kazakhstan	AS	50.90348	74.01318	59	76	1.58	III

91	HYLA00013995	Zelenodilske	Ukraine	EU	47.53889	33.63193	15	30	1.56	III
92	HYLA00014041	Daqing	China	AS	46.82431	125.13679	50	37	1.66	III
93	HYLA00014153	Nanyin	China	AS	45.92014	124.45206	74	404	1.62	III
94	HYLA00014305	Oltina	Romania	EU	44.16042	27.63749	20	134	1.65	III
95	HYLA00014360	Tasytkolskoye Water reservoir	Kazakhstan	AS	43.36042	73.96526	47	567	1.54	III
96	HYLA00015220	Al Manzalah	Egypt	AF	31.28959	32.14513	78	148	1.94	III
97	HYLA00015361	Ramganga reservoir	India	AS	29.58264	78.78262	47	68	1.59	III
98	HYLA00015626	Inle lake	Myanmar	AS	20.54167	96.91734	48	57	1.74	III
99	HYLA00015638	Isapur	India	AS	19.79375	77.32360	82	54	1.71	III
100	HYLA00015805	Challawa Gorge	Nigeria	AF	11.69792	8.00693	65	59	1.79	III
101	HYLA00015875	Noung Jur	Sudan	AF	7.43264	30.58124	35	14510	1.54	IV
102	HYLA00015901	lac Togo	Togo	AF	6.25417	1.41388	50	132	1.57	IV
103	HYLA00016110	Mweru Wantipa	Zambia	AF	-8.91180	29.77915	38	39	1.77	IV
104	HYLA00016120	None	The Democratic Republic of the Congo	AF	-10.03124	27.25415	42	37	1.65	IV
105	HYLA00016223	Manyame	Zimbabwe	AF	-17.80485	30.53263	75	53	1.64	IV
106	HYLA00016311	lagoa Bambene	Mozambique	AF	-24.46458	33.26249	54	69	1.57	III

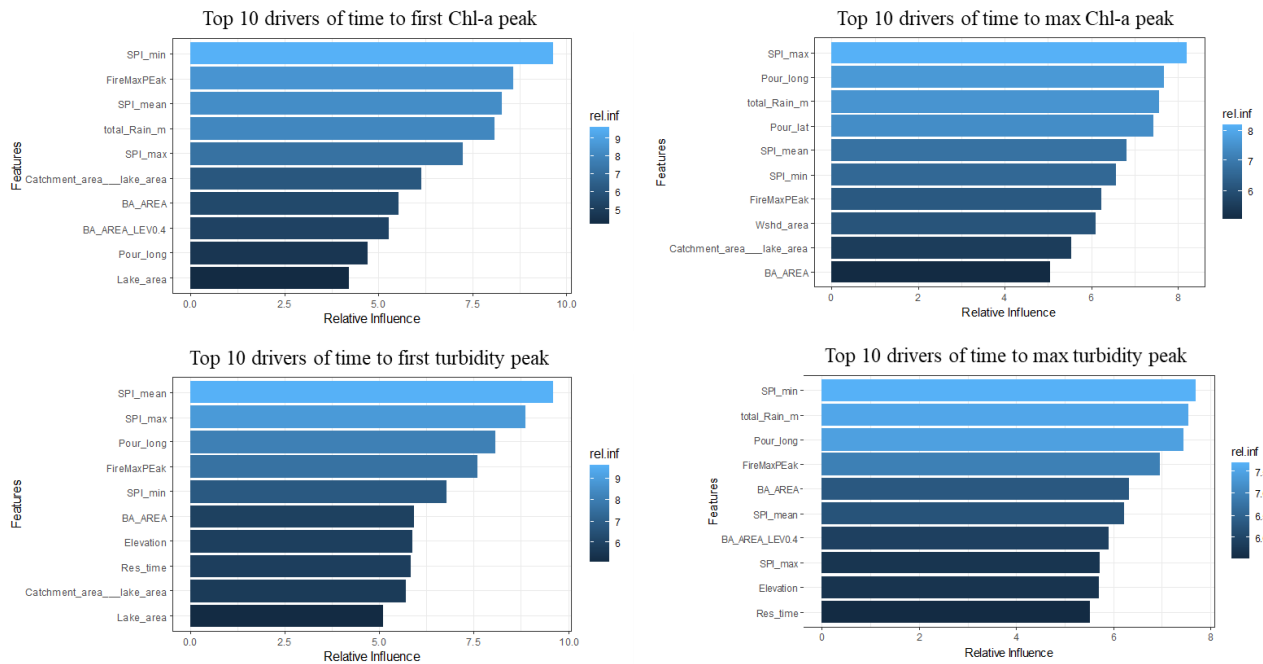
**Table S3.** Results of the multinomial logistic regression analysis between category changes (increase, decrease) in chlorophyll-a (Chl-a) or turbidity and geographical factors, land cover, fire extension and rainfall. “All” explanatory group includes altitude, latitude, land cover types (agriculture, forest, grassland, other – sparse vegetation, settlement, wetland), maximum burned area (BA) and total annual rainfall. Results are expressed as p-values.

Parameter	Change tested	Explanatory group	Intercept	Altitude	Latitude	Agriculture	Forest	Grassland	Other	Settlement	Wetland	Maximum BA	Total rainfall
Chl-a	Decrease	All	0.84	0.71	0.65	0.84	0.84	0.71	0.84	0.36	0.90	0.32	0.54
Chl-a	Increase	All	0.44	0.50	0.58	0.09	0.65	0.50	0.19	0.07	0.27	0.79	0.58
Chl-a	Decrease	Altitude, Latitude, Land cover	0.92	0.92	0.83	0.78	0.59	0.11	0.83	0.26	0.88		
Chl-a	Increase	Altitude, Latitude, Land cover	0.59	0.35	0.76	0.11	0.63	0.48	0.23	0.09	0.37		
Chl-a	Decrease	Altitude, Latitude	0.66	0.76	0.51								
Chl-a	Increase	Altitude, Latitude	0.27	0.27	0.49								
Turbidity	Decrease	All	0.93	0.25	0.58	0.94	0.94	0.94	0.91	0.95	0.93	0.59	0.76
Turbidity	Increase	All	0.85	0.11	0.40	0.82	0.84	0.32	0.28	0.08	0.65	0.50	0.96
Turbidity	Decrease	Altitude, Latitude, Land cover	0.34	0.23	0.29	0.61	0.55	0.91	0.02	0.98	0.64		
Turbidity	Increase	Altitude, Latitude, Land cover	0.86	0.15	0.33	0.87	0.85	0.33	0.22	0.12	0.56		
Turbidity	Decrease	Altitude, Latitude	0.85	0.20	0.81								
Turbidity	Increase	Altitude, Latitude	0.24	0.18	0.37								

## Figures



**Figure S1.** Graphs of the percentage of the 106 lakes in each class of the following lake characteristics: mean chlorophyll-a (Chl-a) concentration for the period 2017-2020 (A), mean turbidity concentration for the period 2017-2020 (B), lake area (C), lake total volume (D), residence time (E), elevation (F).



**Figure S2.** Result graphs of the boosted regression analysis to investigate the drivers of timing of first and maximum peaks of chlorophyll-a (Chl-a; upper graphs) and turbidity (lower graphs) after a fire occurrence. Features reported in the graphs are: lake area (Lake\_area), residence time (Res\_time), elevation, watershed area (Wshd\_area), longitude (Pour\_long), latitude (Pour\_lat), ratio catchment area/lake area, ratio burned area(BA)/burnable area (A) level 0-4 (BA\_AREA\_LEV0.4), ratio total BA/A (BA\_AREA), maximum BA (FireMaxPeak), annual SPI mean (SPI\_mean), annual SPI min (SPI\_min), annual SPI maximum (SPI\_max), total annual rainfall (total\_Rain\_m).