How to identify groundwater caused thermal anomalies in lakes based on multi-temporal satellite data in semi-arid regions

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Supplement:

Table S1: Recording and atmospheric parameter for applied data (Trans = Transmissivity, Up = Upwelling Radiances [$W \cdot m^{-2} \cdot sr^{-1} \cdot \mu m^{-1}$], Down = Downwelling Radiances [$W \cdot m^{-2} \cdot sr^{-1} \cdot \mu m^{-1}$])

No	Date of Recording	Time (GMT)	Season	Lat	Lon	Trans	Up	Down
1	15.02.2000	08:04	Winter	31.8	35.4	0.83	1.12	1.84
2	03.04.2000	08:03	Winter	31.8	35.4	0.87	0.99	1.64
3	21.05.2000	08:03	Summer	31.8	35.4	0.89	0.88	1.47
4	22.06.2000	08:03	Summer	31.8	35.4	0.81	1.54	2.52
5	25.08.2000	08:02	Summer	31.8	35.4	0.66	2.84	4.41
6	28.10.2000	08:01	Summer	31.8	35.4	0.79	1.52	2.47
7	31.12.2000	08:01	Winter	31.8	35.4	0.88	0.78	1.30
8	21.03.2001	08:01	Winter	31.8	35.4	0.85	1.08	1.81
9	24.05.2001	08:01	Summer	31.8	35.4	0.86	1.08	1.85
10	25.06.2001	08:00	Summer	31.8	35.4	0.79	1.74	2.78
11	11.07.2001	08:00	Summer	31.8	35.4	0.78	1.84	2.97
12	13.09.2001	07:59	Summer	31.8	35.4	0.72	2.26	3.55
13	19.01.2002	08:00	Winter	31.8	35.4	0.92	0.53	0.89
14	08.03.2002	08:00	Winter	31.8	35.4	0.93	0.53	0.90
15	24.03.2002	08:00	Winter	31.8	35.4	0.86	1.04	1.73
16	09.04.2002	08:00	Winter	31.8	35.4	0.86	0.99	1.63
17	14.07.2002	08:00	Summer	31.8	35.4	0.69	2.56	4.01
18	18.10.2002	07:59	Summer	31.8	35.4	0.68	2.39	3.76
19	19.11.2002	07:59	Winter	31.8	35.4	0.94	0.46	0.78

Table S2: Comparison of Recording Dates, Rainfall Events and minimum values of SRT-CAT – grey-shaded are all images that are indicated as surface discharge influenced by exhibiting at least one value below the threshold of -0.053 - Abbreviations: TD – Time difference [days], TR – Total amount of rain per event [mm], ED – Event duration [days], MI – Maximum intensity [mm], Min IF – Minimum value after SRT-CAT

No	Date of recording	Date of last rain	TD	TR	ED	MI	Min IF
1	15.02.00	14.02.00	1	47.5	3	41.1	-0.104
2	03.04.00	30.03.00	4	-*	-*	12	0.020
3	21.05.00	21.03.00	17	0.8	1	0.8	0.006
4	22.06.00	21.03.00	49	0.8	1	0.8	0.018
5	25.08.00	21.03.00	31	39.9	1	39.9	-0.021
6	28.10.00	26.10.00	2	7.2	4	4.1	-0.135
7	31.12.00	30.12.00	1	-*	-*	3	-0.318
8	21.03.01	16.03.01	5	-*	-*	1	0.019
9	24.05.01	17.05.01	7	-*	-*	1	-0.019
10	25.06.01	03.05.01	29	50	1	50	-0.076
11	11.07.01	03.05.01	45	50	1	50	0.007
12	13.09.01	03.05.01	109	50	1	50	-0.040
13	19.01.02	18.01.02	1	-*	-*	1	-0.149
14	08.03.02	07.03.02	1	-*	-*	5	0.020
15	24.03.02	22.03.02	2	-*	-*	2	-0.013
16	09.04.02	06.04.02	3	-*	-*	2	-0.020
17	14.07.02	15.05.02	60	2	1	2	0.012
18	18.10.02	16.10.02	2	-*	-*	10	-0.062
19	19.11.02	18.11.02	1	-*	-*	2	-0.136

* Information derived from TRMM data where total amount per event and event duration are inappropriate to infer

Table S3: Recording dates vs. rain occurrence and intensity for all rain stations and TRMM_34B2 data – Abbreviations: RD – Recording date of image, TD - Time difference between RD and the respective station/TRMM [days], MI - maximum intensity of the rain event [mm]

	Gilgal		Jerusalem		Amman		TRMM_3B42	
RD	TD	MI	TD	MI	TD	MI	TD	MI
15.02.00	1	10	1	41.1	1	8.9	1	2
03.04.00	13	3	10	21.1	10	7.9	4	12
21.05.00	61	3	58	21.1	17	0.8	-*	-*
22.06.00	93	3	90	21.1	49	0.8	-*	-*
25.08.00	157	3	154	21.1	31	39.9	-*	-*
28.10.00	3	4	n/a	n/a	2	4.1	2	6
31.12.00	7	4	6	24.1	6	7.6	1	3
21.03.01	12	4	12	3	25	0.8	5	1
24.05.01	21	9	22	0.8	22	5.1	7	1
25.06.01	53	9	43	0.8	29	50	-*	-*
11.07.01	69	9	59	0.8	45	50	-*	-*
13.09.01	133	9	123	0.8	109	50	-*	-*
19.01.02	9	23	9	64	7	23.1	1	13
08.03.02	11	1	10	1.3	10	0.8	1	5
24.03.02	3	6	2	6.1	3	17	2	2
09.04.02	6	4	5	33.8	4	70.1	3	2
14.07.02	60	2	101	33.8	100	70.1	-*	-*
18.10.02	2	3.5	4	0.8	54	50	2	10
19.11.02	14	15	29	0.5	15	3	1	2

* Information derived from TRMM data where total amount per event and event duration are inappropriate to infer

Fig. S1: Last rain occurrence according to TRMM prior to Landsat data recording

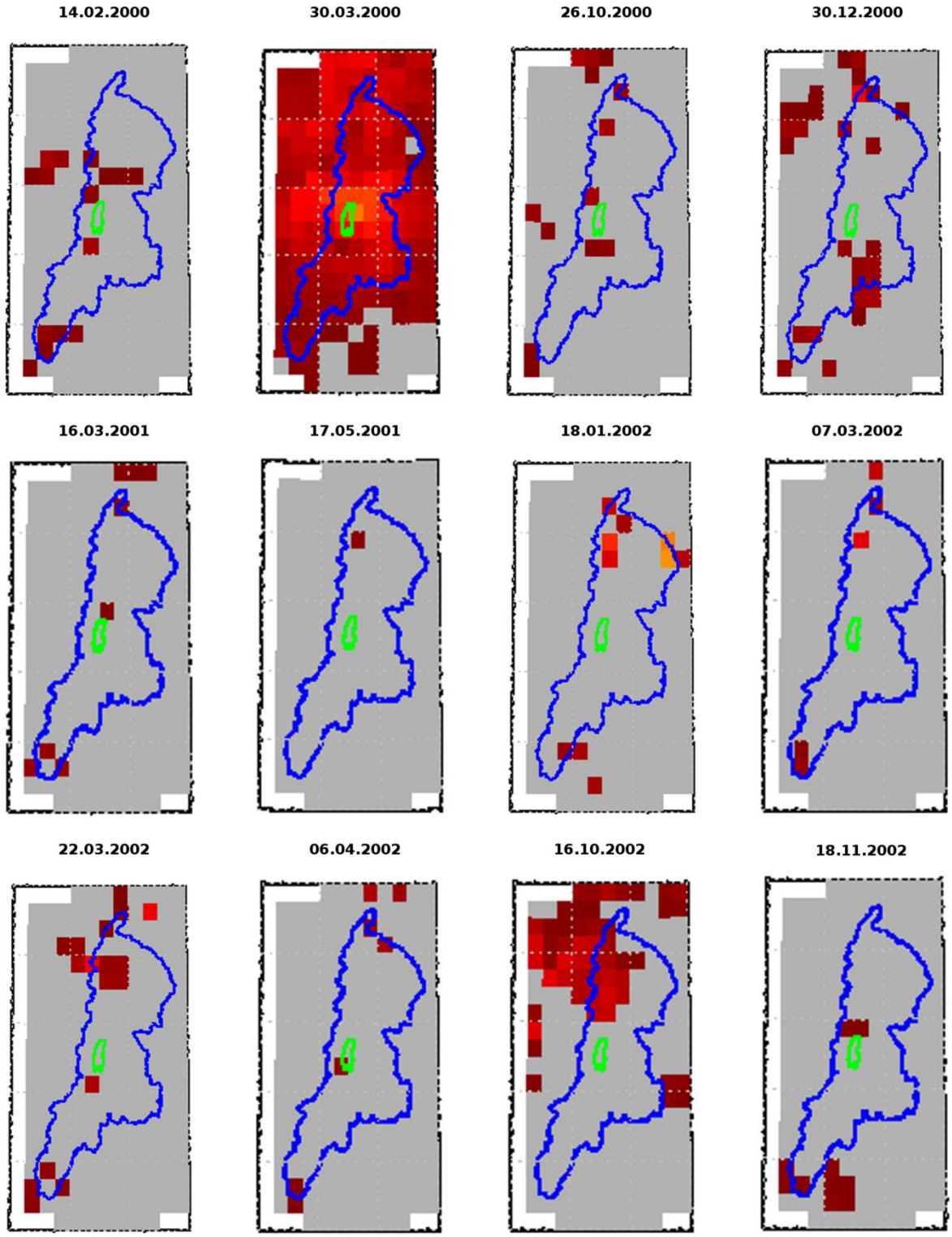

Table S4: Explanation of Volume calculation

Processing steps	Description
Data basis:	geo-referenced aerial photographs (2007) – GSD: 1 m
Determination of fan area:	manual digitalisation using the cliff as western boundary and the DS as eastern boundary
Volume calculation:	1. creating an upper plane representing the current topographical surface by extracting the before determined fan area from the ASTER GDEM 2. creating a tilted lower plane by applying the calculation: $X_iY_i – (X_iY_i – Min)$ on the upper plane 3. calculating the volume using the "Cut Fill" function of ArcGIS. using upper and lower plane as input parameter

Table S5: Parameter used for pore runoff calculation

Parameter	Value	Parameter	Value
V_{total}	$14.07 \cdot 10^6$	h_a	-384
n_{pores}	30% *	h_b	-420
Material	Gravel	L	1000
Kf	10^{-2} *	A	$33 \cdot 10^3$

*Values after Hölting and Coldewey 2005