Monitoring of changes in the water surface and wetland area of the Aral Sea and the Aral Region

SIC ICWC made monitoring of changes in the Aral Sea and the Aral Region by using the Landsat 8 OLI images. The images got on 31 July 2021 on the Western and Eastern parts of the Aral Sea allowed having wetland and open water surface areas.

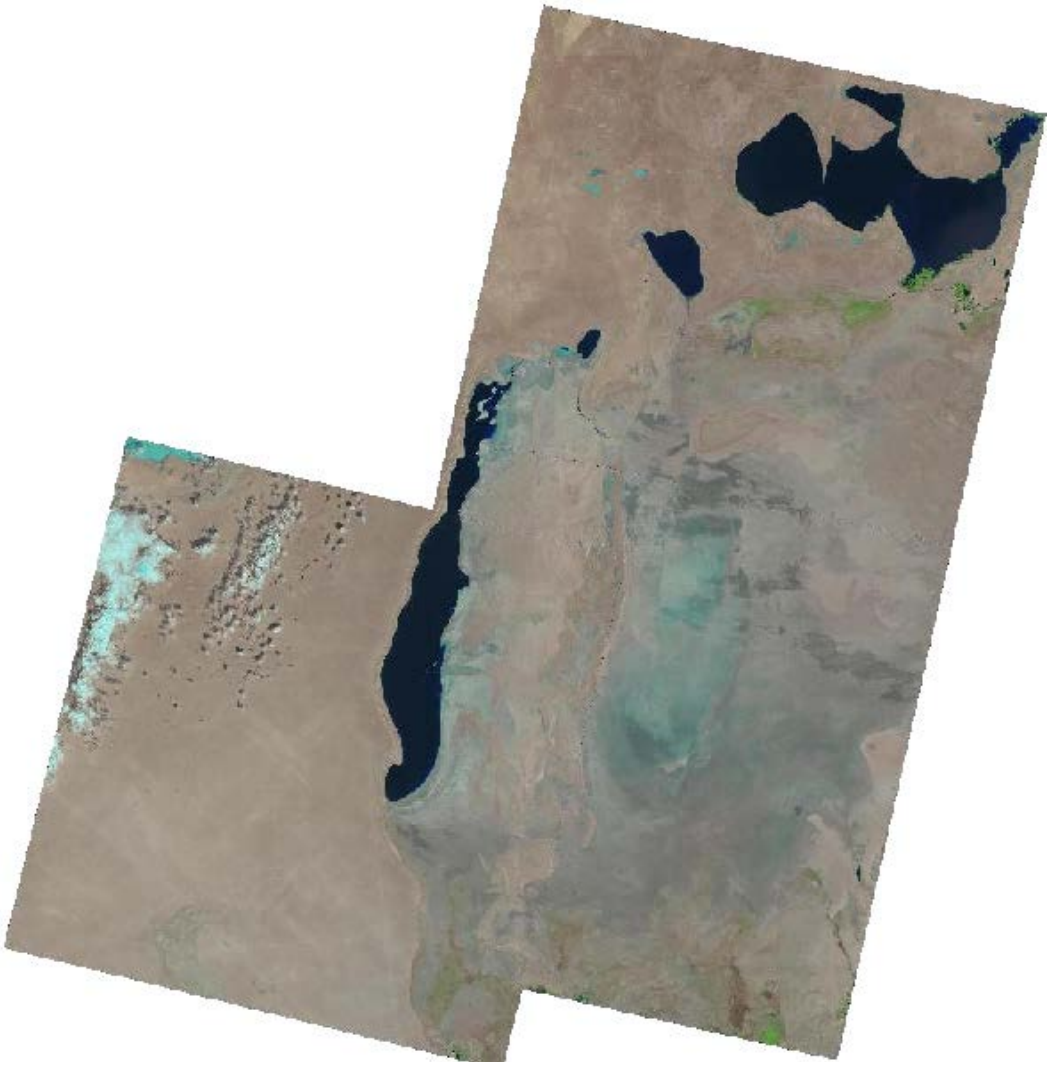

Figure 1. Western and Eastern parts of the Aral Sea.
Landsat 8, 21 July 2021.

Table 1

The area of wetlands, open water surfaces and dried ground* in the Western and Eastern parts of the Aral Sea

	21.02.2021	**10.04.2021**	**12.05.2021**	**29.06.2021**	**31.07.2021**
	Western part of the Aral Sea, ha				
Wetland	Clouds	60 683	6 754,32	3 220,92	2 960
Water surface		231 073	231147,7	231182,7	226 671,66
Dried ground*		269 593,4	323 448,2	326946,6	331 718
	Eastern part of the Aral Sea, ha				
Wetland	Clouds	Clouds	5 778,63	Clouds	11 966
Water surface			17,01		668,88
Dried ground *			1 491 028		1 484 189
	February	March	April	May	June
Water quota	167	185	180	336	391
Inflow to the Aral Region, Mm^3/month	192	143	119	110	116

* bare soil, dense or rare vegetation

Table 2

Areas of wetlands in the Aral Region, ha

Water body	21.02.2021	10.04.2021	12.05.2021	13.06.2021	31.07.2021
Sudoche	465	474,03	337,77	19,62	464
Mejdureche	156,78	129,78	101,52	4,41	27,72
Rybache	204,12	28,98	405,27	3,42	1,35
Muynak	1085,76	320,22	50,67	0,9	4,05
Djiltyrbas dam-terminated	689,76	820,17	295,65	24,39	277,2
Djiltyrbas (together with former right and left streams)	1177,92	697,86	32,67	0,63	5,49
Dumalak	32,94	19,17	2,34	0	0
Makpalkul	213,57	286,11	92,52	2,7	0,9
Mashan Karadjar	82,26	124,65	32,49	1,44	15,12
Water surface southward of Muynak	32,31	0	0	0	0
Water surface along Kazakhdarya river channel	0	0,63	0	0	0
Zakirkol	13,32	9	2.43		0
Total:	**4 153,7**	**2 910,6**	**1 353,33**	**57,51**	**796,1**

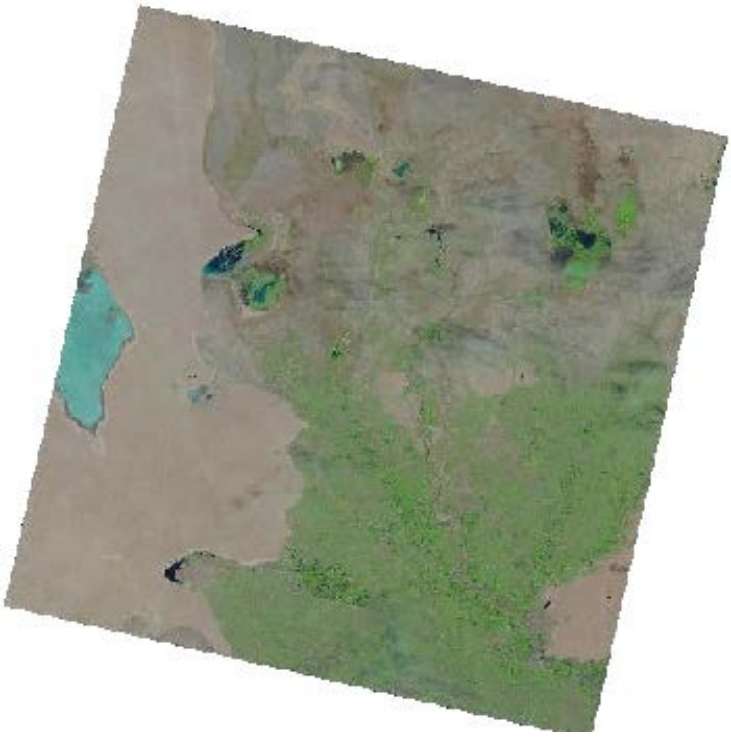

Figure 2 The Aral Region. Landsat 8, 31 July 2021.

Table 3

The area of open water surface in the Aral region, ha

Water body	21.02.2021	10.04.2021	12.05.2021	13.06.2021	31.07.2021
Sudoche	13 346,1	12 963,8	11 984,76	10 223,28	5 756,13
Mejdureche	6946,92	5945,31	2890,71	954,81	395,28
Rybache	2106,99	2348,1	1411,74	172,26	1,26
Muynak	946,08	765,45	179,46	15,12	21,96
Djiltyrbas dam-terminated	7608,06	6806,43	5401,08	4605,21	2840,58
Djiltyrbas (together with former right and left streams)	442,53	1017,72	133,47	54,36	17,64
Dumalak	283,5	233,19	10,08	0	0
Makpalkul	2495,52	1730,52	678,6	239,67	0,9
Mashan Karadjar	499,86	547,11	363,42	97,47	60,93
Water surface southward of Muynak	48,78	0	0	0	0
Water surface along Kazakhdarya river channel	0	0,27	0	0	0
Zakirkol	226,53	160,11	17,73	0	0
Total	**34 950,87**	**32 517,99**	**23 071,05**	**16 362,18**	**9094,68**

Table 4

Dried ground area* in the Aral Region, ha

Water body	**21.02.2021**	**10.04.2021**	**12.05.2021**	**13.06.2021**	**31.07.2021**
Sudoche	58 886	59 259	60 374	62 454	66 477
Mejdureche	30 680	31 709	34 792	36 825	37 361
Rybache	9 182	9 116	9 676	11 317	11 490
Muynak	14 132	15 078	15 934	16 148	16 138
Djiltyrbas dam-terminated	39 175	39 846	41 776	42 843	44 355
Djiltyrbas (together with former right and left streams)	97 331	97 235	98 785	98 896	98 928
Dumalak	15 734	15 798	16 038	16 050	16 050
Makpalkul	5 975	6 667	7 913	8 442	8 682
Mashan Karadjar	26 619	26 529	26 805	27 102	27 125
Water surface southward of Muynak	9 524	9 605	9 605	9 605	9 605
Water surface along Kazakhdarya river channel	4 752	4 751	4 752	4 752	4 752
Zakirkol	2 551	2 622	2 771	2 791	2 791
Total	**314 539,6**	**318 216**	**329 219,8**	**337224,5**	**343 753,5**

* bare soil, dense or rare vegetation

Since 2019, SIC ICWC has been using a new methodology for detection of water surfaces and wetlands through the controlled classification (Automated Water Extraction Index, AWEI).

The boundaries of water bodies and wetlands (i.e. Sudoche lake system, Mejdureche reservoir, Makpalkul, Djiltyrbas reservoirs, etc.) digitized manually in 2016 were used as a 'conditional design' boundaries for statistics on the total open water surface and wetland area of these water bodies (i.e. total water body area = open water area + wetland area).

Such a method minimizes erroneous interpretation/digitization of an area under consideration as the water or land surface (e.g. if plants cover the water's surface). However, the problem of detecting wetlands, i.e. the possibility to distinguish them from land (dry, degraded land) remained open. Moreover, the wetland areas within the 2016 boundaries have changed considerably over the last years, mainly, towards shrinkage/drying (dry, degraded land replaced wetlands).

Therefore, in early 2022, we undertook a research to improve the 2019 methodology. To this end, we determined the threshold values of open water surface (water depth of 5-25 cm, de-

pending on the rise or fall of water), wetlands (water depth of up to 5 cm, wet and moist soil), and non-water sites (all other land surfaces, except for open water and wetlands) for 10 spectral indices (including NDVI and AWEI).

Based on the research results, we selected the threshold values for NDVI (< -0.001 for open water, -0.001÷0.05 for wetland, and > 0.05 for other land surfaces) for further classification of water sites.

By present, the information for 2020 and 2021 have been updated on the base of the improved methodology. In this context, differences can be found when making comparison with the data for the past years.

References.

(*) Remote Sensing Based Water Surface Extraction and Change Detection in the Central Rift Valley Region of Ethiopia (doi:10.5923/j.ajgis.20160502.01**).**

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