

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 16 August 2021 on the Western part of the Aral Sea allowed having wetland and open water surface areas.



**Figure 1. Western and Eastern parts of the Aral Sea.
Landsat 8, 16 August 2021.**

Table 1

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

	10.04.2021	12.05.2021	29.06.2021	31.07.2021	16.08.2021
	<i>Western part of the Aral Sea, ha</i>				
Wetland	60 683	6 754.32	3 220.92	2 960	200.07
Water surface	231 073	231147.7	231182.7	226 671.66	224 157.6
Dried ground*	269 593.4	323 448.2	326 946.6	331 718	336 992.6
	<i>Eastern part of the Aral Sea, ha</i>				
Wetland	Clouds	5 778.63	Clouds	11 966	144.81
Water surface		17.01		668.88	141.39
Dried ground *		1 491 028		1 484 189	1 496 538
	March	April	May	June	July
Water quota	185	180	336	391	480
Inflow to the Aral Region, Mm ³ /month	143	119	110	116	100

* bare soil, dense or rare vegetation

Table 2**Areas of wetlands in the Aral Region, ha**

Water body	10.04.2021	12.05.2021	13.06.2021	31.07.2021	16.08.2021
Sudoche	474,03	337,77	19,62	464	38,97
Mejdureche	129,78	101,52	4,41	27,72	1,26
Rybatche	28,98	405,27	3,42	1,35	0,09
Muynak	320,22	50,67	0,9	4,05	0,54
Djiltyrbas dam-terminated	820,17	295,65	24,39	277,2	21,42
Djiltyrbas (together with former right and left streams)	697,86	32,67	0,63	5,49	0,18
Dumalak	19,17	2,34	0	0	0
Makpalkul	286,11	92,52	2,7	0,9	0
Mashan Karadjar	124,65	32,49	1,44	15,12	1,26
Water surface southward of Muynak	0	0	0	0	0
Water surface along Kazakhdarya river channel	0,63	0	0	0	0
Zakirkol	9	2,43	0	0	0
Total:	2 910,6	1 353,33	57,51	796,1	63,72

**Figure 2 The Aral Region. Landsat 8, 03 October 2021.**

Table 3

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

Water body	10.04.2021	12.05.2021	13.06.2021	31.07.2021	16.08.2021
Sudoche	12 963,8	11 984,76	10 223,28	5 756,13	4941,18
Mejdureche	5945,31	2890,71	954,81	395,28	338,13
Rybatche	2348,1	1411,74	172,26	1,26	2,07
Muynak	765,45	179,46	15,12	21,96	20,61
Djiltyrbas dam-terminated	6806,43	5401,08	4605,21	2840,58	2841,48
Djiltyrbas (together with former right and left streams)	1017,72	133,47	54,36	17,64	13,68
Dumalak	233,19	10,08	0	0	0
Makpalkul	1730,52	678,6	239,67	0,9	0
Mashan Karadjar	547,11	363,42	97,47	60,93	38,79
Water surface southward of Muynak	0	0	0	0	0
Water surface along Kazakhdarya river channel	0,27	0	0	0	0
Zakirkol	160,11	17,73	0	0	0
Total	32 517,99	23 071,05	16 362,18	9 094,68	8 195,94

Table 4**Dried ground area* in the Aral Region, ha**

Water body	10.04.2021	12.05.2021	13.06.2021	31.07.2021	16.08.2021
Sudoche	59 259	60 374	62 454	66 477	67 717
Mejdureche	31 709	34 792	36 825	37 361	37 445
Rybatche	9 116	9 676	11 317	11 490	11 491
Muynak	15 078	15 934	16 148	16 138	16 143
Djiltyrbas dam-terminated	39 846	41 776	42 843	44 355	44 609
Djiltyrbas (together with former right and left streams)	97 235	98 785	98 896	98 928	98 937
Dumalak	15 798	16 038	16 050	16 050	16 050
Makpalkul	6 667	7 913	8 442	8 682	8 684
Mashan Karadjar	26 529	26 805	27 102	27 125	27 161
Water surface southward of Muynak	9 605	9 605	9 605	9 605	9 605
Water surface along Kazakhdyra river channel	4 751	4 752	4 752	4 752	4 752
Zakirkol	2 622	2 771	2 791	2 791	2 791
Total	318 216	329 219	337 224	343 753	345 384

* 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, depending 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, $-0.001 \div 0.05$ 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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