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 10 April 2021 allowed having wetland and open water surface areas within the boundaries of the Aral Region and the Aral Sea.

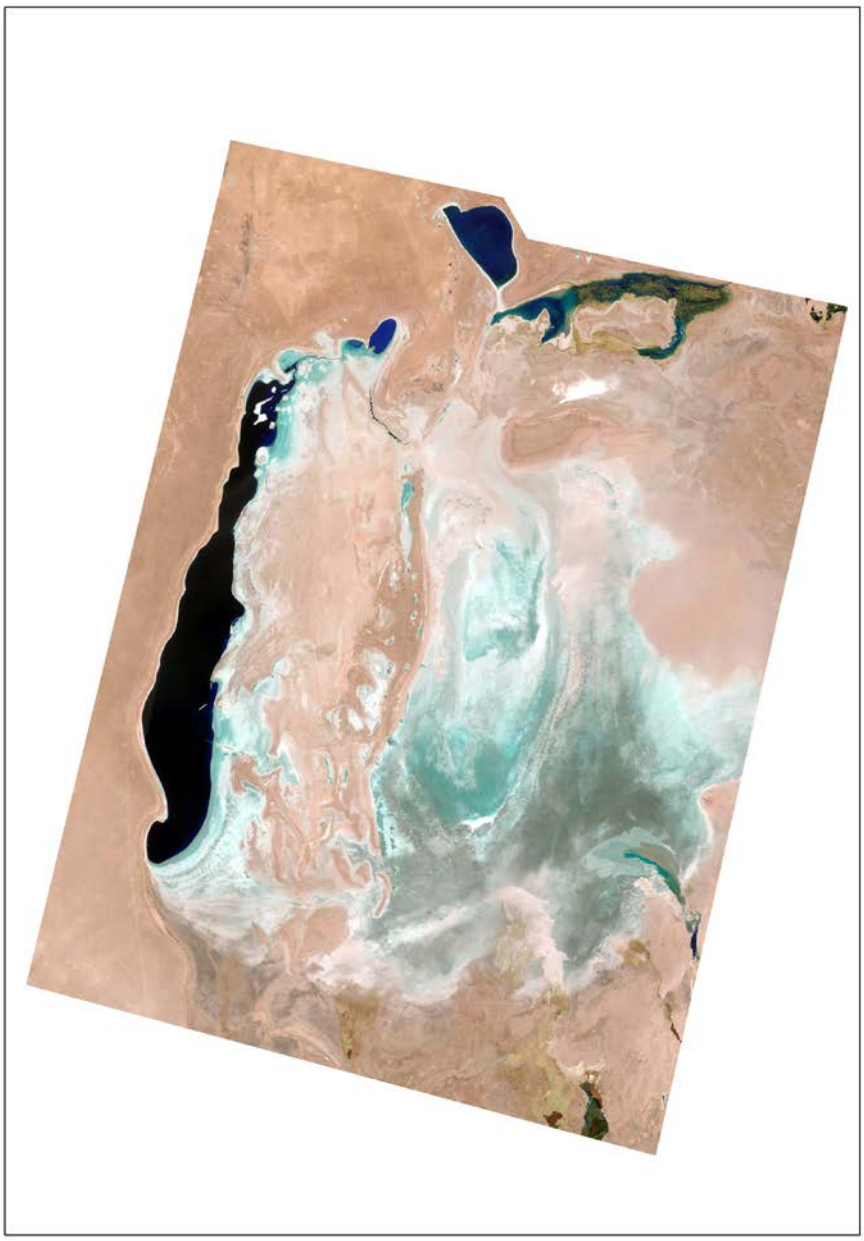

Figure 1. Western and Eastern parts of the Aral Sea.
Landsat 8, 10 April 2020

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**
	Western part of the Aral Sea, ha	
Wetland	Clouds	60 683
Water surface		231 073
Dried ground*		269 593.4
	Eastern part of the Aral Sea, ha	
Wetland	Clouds	Clouds
Water surface		
Dried ground *		
	February	March
Water quota	167	185
Inflow to the Aral Region, Mm^3/month	192	143

* *bare soil, dense or rare vegetation

Table 2

Areas of wetlands in the Aral Region, ha

Water body	**21.02.2021**	**10.04.2021**
Sudoche	465	474,03
Mejdureche	156,78	129,78
Rybache	204,12	28,98
Muynak	1085,76	320,22
Djiltyrbas dam-terminated	689,76	820,17
Djiltyrbas (together with former right and left streams)	1177,92	697,86
Dumalak	32,94	19,17
Makpalkul	213,57	286,11
Mashan Karadjar	82,26	124,65
Water surface southward of Muynak	32,31	0
Water surface along Kazakhdarya river channel	0	0.63
Zakirkol	13.32	9
Total:	**4 153,7**	**2 910,6**

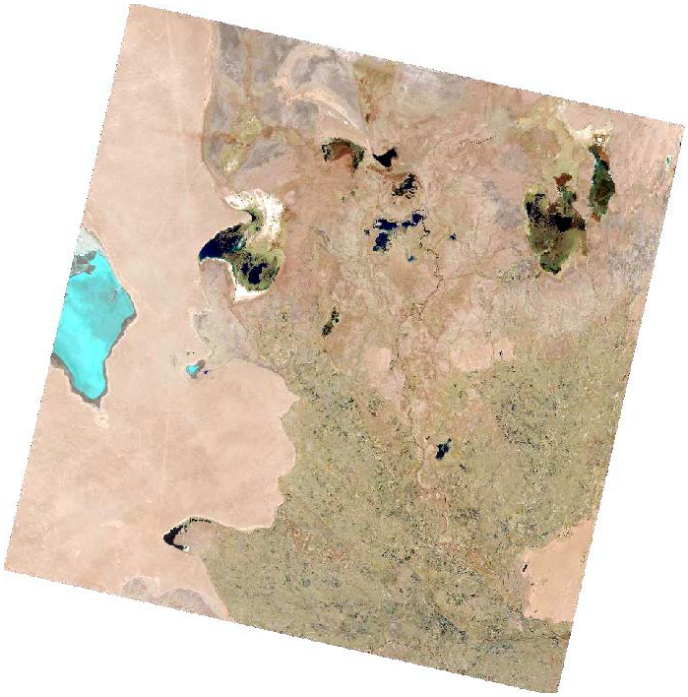

Figure 2 The Aral Region. Landsat 8, 10 April 2021.

Table 3

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

Water body	21.02.2021	10.04.2021
Sudoche	13346,1	12963,8
Mejdureche	6946,92	5945,31
Rybache	2106,99	2348,1
Muynak	946,08	765,45
Djiltyrbas dam-terminated	7608,06	6806,43
Djiltyrbas (together with former right and left streams)	442,53	1017,72
Dumalak	283,5	23319
Makpalkul	2495,52	1730,52
Mashan Karadjar	499,86	547,11
Water surface southward of Muynak	48,78	0
Water surface along Kazakhdarya river channel	0	0,27
Zakirkol	226,53	160,11
Total	**34 950,87**	**32 517,99**

Table 4

Dried ground area* in the Aral Region, ha

Water body	21.02.2021	10.04.2021
Sudoche	58 886	59 259
Mejdureche	30 680	31 709
Rybache	9 182	9 116
Muynak	14 132	15 078
Djiltyrbas dam-terminated	39 175	39 846
Djiltyrbas (together with former right and left streams)	97 331	97 235
Dumalak	15 734	15 798
Makpalkul	5 975	6 667
Mashan Karadjar	26 619	26 529
Water surface southward of Muynak	9 524	9 605
Water surface along Kazakhdarya river channel	4 752	4 751
Zakirkol	2 551	2 622
Total	**314 539,6**	**318 216**

* bare soil, dense or rare vegetation

Notes: Sentinel 2, from April 06-16, 2021 was used to determine the water surface of the western part of the Aral Sea. And Landsat 8 images from April 10, 2021 were used to determine the water surface of the Aral Sea region.

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÷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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