A.1. Climatic characteristics of the basin

Aral sea basin located in the center of Euroasia encompasses sub-tropic and temperate zone. Climate is continental because of region location within deserts and its remoteness from seas and oceans. Main climatic features-heat, humidity deficit, long hot summer and short warm winter.

Central Asia territory is divided into natural belts, zones and province. According to soil-geographic zoning two climatic belts are distinguished:

sub-boreal and sub-tropic (fig. A.1.1.)

Border between these belts is 43^0 of northern latitude (south coast of Aral sea). This border can be called conditional, i.e. climatic. There are sub-boreal and sub-tropic desert landscapes, in pre-mountain plains sub-boreal desert steppe and sub-tropical semi-desert landscapes.

A.1.1. Peculiarities of air temperatures in the region. Air temperature peculiarities in the region within the Central Asia deserts average temperatures and duration of frost free period increase from the North to the South. Number of months with positive temperatures is 11-12 in the South and 7-8 in the North. Duration of frost free period in Kzyl Atrek is 271 days, in Karakala - 236, in Termez and in Bairam Ali - 212 days while in northen deserts its duration is 150-190 days. Within growing period (with average temperatures more than 10^0C) sum temperatures is 4500-5600^{0}C in the South and only 3200-4000 in the North. Maximum high temperatures areobserved in the South (48-49^{0}C, Karakum and Kzylkum and minimum ones - 36^{0}C in the North. Average air temperature is shown in table A.1.1. and A.1.2. as well as maximum ones - in table A.1.3.

A.1.2. Rain fall occurs mostly in winter-spring period, its value is 90-450 mm/years on plains and 1000-1500 m/years in the mountains.

Relative air humidity in summer is 27-35 %, in Karakum desert sometimes it is 4-5 % and near the Kaspian sea - 50 %. Maximum air humidity is observed in December-January, minimum - in June (fig. A.1.2).

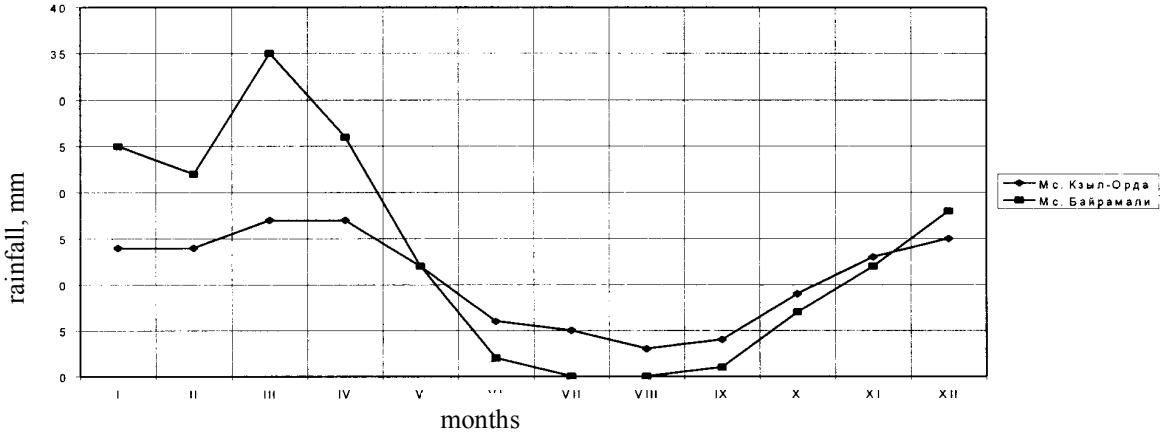

Fig.A.1.2. Season changes of rainfall for south and north zones of the region according to multi-year data

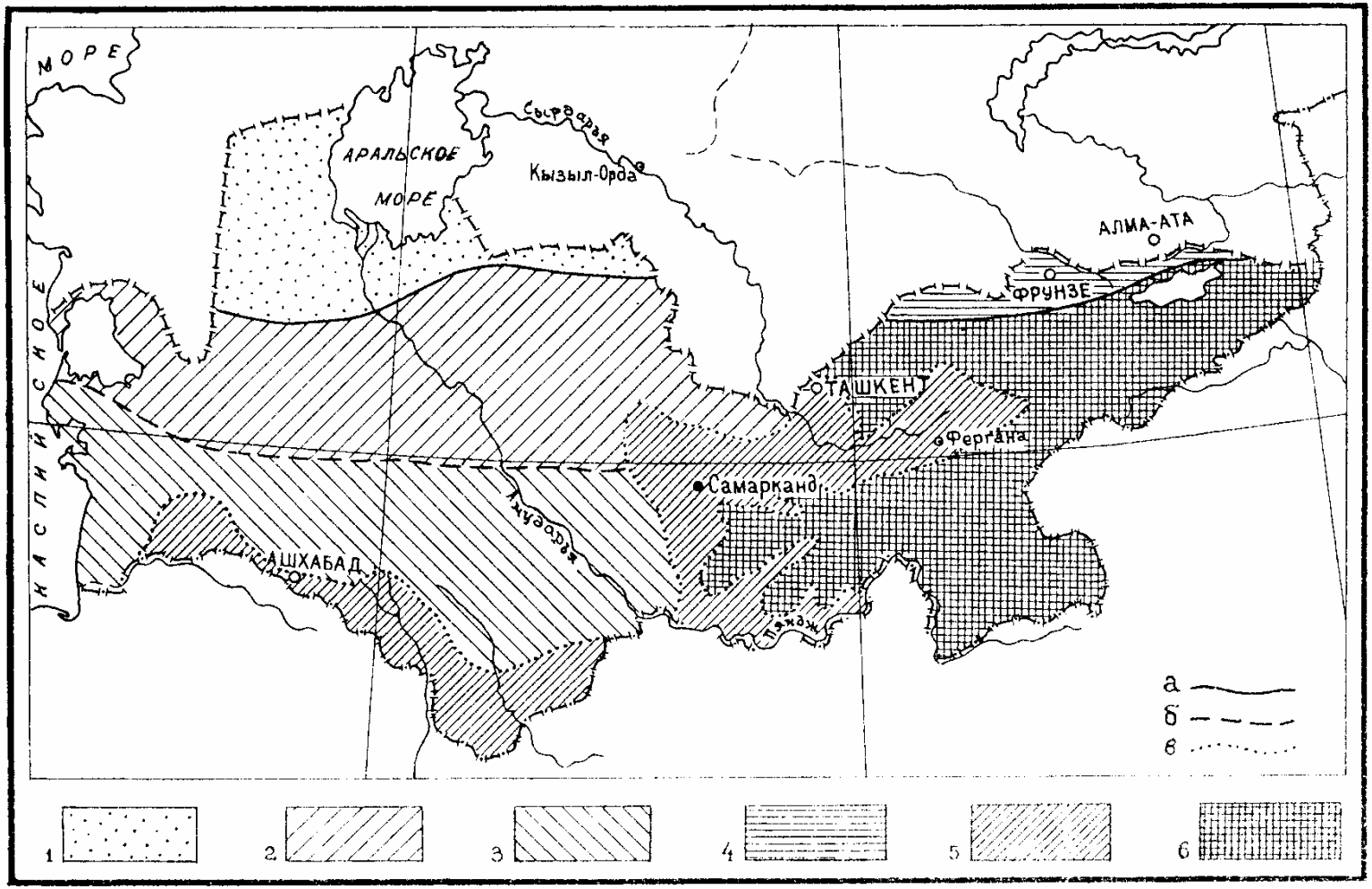

Fig. A.1.1. Natural-climatic zoning of the Aral sea basin
1-sub-boreal deserts; 2 - sub-tropic northern deserts; 3-sub-tropic southern deserts; Pre-mountain plains;
4-subboreal semi-deserts; 5-sub-tropical semi-deserts. Mountains: 6-mountaineous area; Boundaries: a) sub-boreal and sub-boreal and sub-tropical best; b) northern and southern sub-tropic deserts; c) mountainous areas

Table 1.1

Average air temperatures and average precipitation for the Central Asian plains*

Points	Northen latitude, ^{0}	Mean temperature, ^{0}C			Average annual amplitude	Sum of precipitation, мм				
		January	July	annual		year	winter	spring	summer	autumn
Kazalinsk	46	-11.0	26.6	8.4	37.6	112	32	36	19	31
Akkuduk	42	-5.3	28.5	11.5	33.8	122	29	41	24	28
Chimbaj	43	-7.6	25.9	10.0	33.5	71	23	29	7	12
Kzil-Orda	45	-9.8	25.9	10.0	35.7	93	35	31	14	12
Krasnovodsk	40	2.7	28.4	15.9	25.7	109	38	42	11	18
Tashauz	42	-6.7	28.3	11.4	35.0	83	22	40	11	10
Tamdy	42	-4.1	30.0	13.4	34.1	108	42	52	3	11
Tashkent	41	-1.1	26.7	13.3	27.8	359	134	141	17	67
Ashkhabad	38	0.9	29.9	15.7	29.0	231	67	112	18	34
Bairam-Ali	37	0.6	30.0	15.8	28.9	127	53	58	1	15
Chardjoy	39	0.4	29.3	15.3	28.9	120	47	58	1	14
Shirabad	37	3.6	32.1	18.0	28.5	154	72	67	1	14
Termez	37	2.8	31.4	17.4	28.6	133	61	59	1	12
Kushka	35	1.5	28.1	15.0	26.6	250	114	111	1	24

* Geomorphological review of Central Asia western regions, 1964.

Table A.1.2

Climatic Characteristic of the Aral Sea basin determining thermal conditions and humidity of the territory

Belt	Zone and province	Sum of temperatures, ^{0}C	Precipitation, mm	K_{moist}	Evaporability, mm/year	Dryness index	Average monthly temperature, ^{0}C		Duration of frost-free period days	Major crops	Soils
							coldest	hottest			
Moderate sub-boreal	Plain, desert, heat availability is higher than average not supplied by water	3000 - 4200	80-200	0.12-0.22	750-1050	3.5-11.2	-5, -15	22.5-26.5	163-204	Rice, vegetables ,melons, cotton of fast ripening	Grey-brown, gypsum bearing, desert, sandy-taker salts
	Pre-mountain desert-steppe, supplied by heat, not supplied by water (Northen Pre-Tyanshang)	2800-3600	150-300	0.20-0.30	700-900	2.2-4.4	-9, -11	22-25	150-170	Cereals, melons, gardens, vineyards	North grey soils, brown, hydromorphous
Warm sub-tropical	Desert plain supplied by head, not supplied by water, very dry (North Turan)	4000-5000	75-150	0.12	1000-1250	5.7-13.7	-2, -5	26.5-30	195-220	Cotton, melons	Grey-brown, gypsum bearing, taker, desert-sandy, hydromorphous including salt
	South-Turan	5000-5500	100-200	0.12	1250-1400	5.1-11.1	-1, +2	30-32	223-248	Long-fiber cotton, melons	
	Pre-mountain semi-desert supplied by water,									Cotton, gardens, vinyards	Grey soils, brown carbonate, hydro-

Belt	Zone and province	Sum of temperatures, ^{0}C	Precipitation, mm	K_{moist}	Evaporability, mm/year	Dryness index	Average monthly temperature, ^{0}C		Duration of frost-free period days	Major crops	Soils
							coldest	hottest			
	dry and semi-dry, Western-Pre-Tyanshang, Pre-Gissar	4000-4600	100-400	0.12-0.22	1000-1150	2-8.5	0, -5	25-27	205-225		morphous.
		4000-5400	100-300	0.12-0.20	1000-1350	2.9-10.9	-1, +2	25-30	200-245		

Table A.1.3.

Major climatic indicators of agroclimatic areas of Turan province

Area	Average temperature ,^{0}C				Annual amplitude, ^{0}C	Vegetation winters, %	Minimum temperature, ^{0}C				Maximum temperature, ^{0} C		Duration of period with temperature <0 and > 5^{0}C, days				Precipitation, mm				14-relative humidity in 1 a.m. in August, %	
	January		July				average from absolute minimum		absolute minimum				<0		>5°		per year		VI—VIII			
Nizhneamudarinsky	—3,0	—5,5	27,0	28,0	31—33	8—26	—19	—22	— 29	—32	43	44	64	85	237	253	79	97	3	12	24	28
Kzylkumsky	—4,0	—	30,0	—	34	17	—20	—	— 31	—	44	—	67	—	247	—	108	—	6	—	19	—
Karataussky	—5,7	—7,2	27,5	28,6	35	0—5	—26	—28	— 34	—36	44	46	82	104	226	240	176	215	12	36	18	—
Srednesyrdarinsky	—0,8	—4,1	26,6	30,0	28—32	16—48	—19	—24	— 28	—35	41	47	38	72	245	272	175	425	17	35	26	32
Fergansky	—2,2	—3,5	26,5	—	30	23—34	—15	—18	— 23	—27	40	42	51	61	254	259	98	226	13	27	32	39
Zeravshansky	—0,2	—1,5	26,0	29,6	26—31	40—61	—16	—18	— 24	—29	41	45	0	38	266	278	111	328	2	11	20	27
Kashkadarinsky	1,9	—0,2	28,0	32,3	27—31	54—80	—15	—22	— 22	—29	43	47	0	24	284	305	107	545	2	15	14	33
Juzhnotadzhiksky	3,6	1,1	28,0	32,1	27—28	70—100	—14	—18	— 20	—28	42	48	0	—	290	306	133	615	1	21	18	26
Karakumsky	—0,2	—2,7	31,0	32,0	32—34	29—54	—19	—20	— 28	—30	45	—	39	51	265	274	97	105	6	7	15	19
Murgabsky	2,2	0,6	28,0	31,0	27—30	63—84	—16	—20	— 24	—33	43	48	0	—	288	296	127	246	1	3	17	22
Prikopetdagsky	0,8	—0,7	30,0	31,0	29—32	49—66	—15	—17	— 24	—26	45	46	0	26	277	292	137	244	2	19	18	25
Zakopetdagsky	4,8	1,4	27,6	31,1	23—29	73—100	— 8	—16	— 15	—24	42	47	0	—	291	344	103	229	11	23	24	68
Karabogazsky	—0,2	—	28,7	—	29	55	—16	—	— 25	—	43	—	26	—	275	—	90	—	12	—	—	41

- В таблице проведены пределы изменений климатических элементов на территории каждого округа.
- In the table the limits of changes of climatic elements in territory of each district are carried out(spent).

Under hydromorphous regime evaporation value (Er) significantly exceeds total precipitation (by 1,26-4,55 times) due to ground water evaporation. Water regime of hydromorphous soil intensity varies under ground water <3,5 m from 0,35 to 3,55 of total rainfall.

Low precipitation rate and high evaporability lead to small and shallow soil moistening and preservation of salt stock within upper 1 m layer. Higher moistening is typical for premountain plains.

On hydromorphous landscapes differences between sub-boreal and sub-tropical deserts are very evident. Ground water critical depth varies from 250 cm in the north to 300 cm in the south, evaporation rise, in sub-tropic desert evaporation from ground water table depth of 1 m is 1,7 times higher compared with sub-boreal. This facilitate perspirative regime of salt accumulation.

Thus climatic peculiarities of plains in the Aral sea basin are high heat availability and low natural humidity (aridity coefficient K_a<0,12-0,30; continentality coefficient K_k=220-290; dryness index R=2,5-12).

Climatic indicators of the Central Asian plains are favorable for salt stock preservation in automorphous soils on depth of 0,5-1,5 m (due to low air humidity) and lead to salt accumulation in hydromorphous soils under ground water depth less than 3-3,5 due to high evaporability.

Therefore, Central Asia and South Kazakhstan climatic factors predetermine development of harmful ecological-meliorative processes during land development and reclamation when violating meliorative regime parameters.

A.1.3. Wind regime

Specific feature of arid climate is wind regime. Wind often forms surface of arid landscapes, especially in sand deserts, strengthens evaporation, promotes eolic salt removal. Average wind speed in coastal zone of Kaspiy and Aral sea is 6 m/c. In the South it fluctuates around 2 m/s, in pre-mountain plains it can reach 34-36 m/s (Golodnaya Steppe). Fig. A.1.3. shows that the calmest are September-October, most windy period is Yanyary-May.

The region as a whole is zone of moderate winds, last years due to Aral sea desiccation wind significance sharply increased. According to assessment of Borovsky (1978) and Orlova (1983) salt removal from dry sea bed can reach 3-5 t/ha per year.

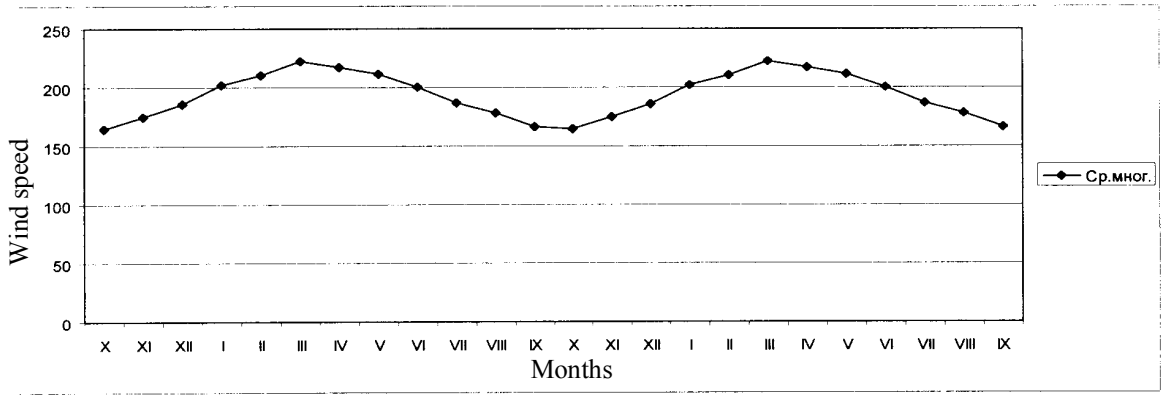

Fig. A.1.3. Seasonal changes of wind speed according to multi-year data (average from 11 weather stations)

Thus climatic factors of Central Asia and South Kazakhstan predetermine development of unfavorable ecological-meliorative processes under land development and irrigation and meliorative regime violation.