4. CLIMATE DATA

4.1 Introduction

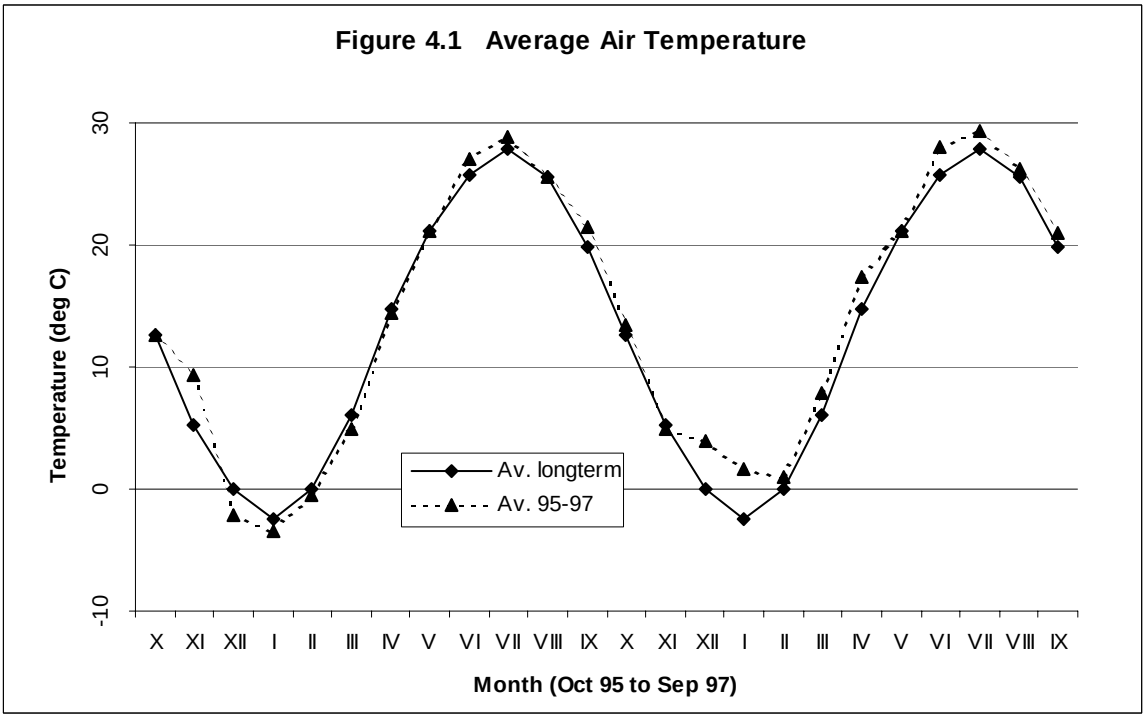
The Aral Sea basin, located in the centre of Eurasia, covers the zone of subtropical latitudes and the southern limit of temperate latitudes. Location of the area in the zone of intra-continental deserts, long distances from seas and oceans create a clearly expressed continental climate.

Measurements and assessments within WUFMAS-97 covered about 80,000 ha of irrigated land in the Central Asian region in characteristic climatic zones. In the north from N44°53´ (farm 01, Kazakhstan) to N37°34´ in the south (farms 17 and 18, Turkmenistan), and in the west from E62°11´ (farms 16 and17, Turkmenistan) to E74°33´ in the east (farm 08 (Kyrgyzstan). The range in altitude was from 75 mamsl (farm 28 (Uzbekistan)) to 958 mamsl (farm 08(Kyrgyzstan)) (Table 1). Out of the 22 farms surveyed, 12 are located in the Syrdariya river basin and 10 in the Amudariya river basin. Mean monthly climatic data during the survey period 1995-1997, are calculated as averages of data from meteorological stations that are closest to the survey farms for comparison with the equivalent long-term mean.

4.2 Air temperature

The air temperature regime in the region is illustrated in Figure 4.1. The coldest month generally is January, ranging from -9.4°C (farms 01 and 02, Kazakhstan) to 3.7°C (farms 21 and 22, Uzbekistan). The 1997 winter was warmer than average, particularly during December and January. The lowest recorded monthly air temperature in 1997 was in February, ranging from -7.6°C (farms 01 and 02, Kazakhstan) to 7.4°C (farms 21 and 22, Uzbekistan).

Figure 4.1 Average Air Temperature



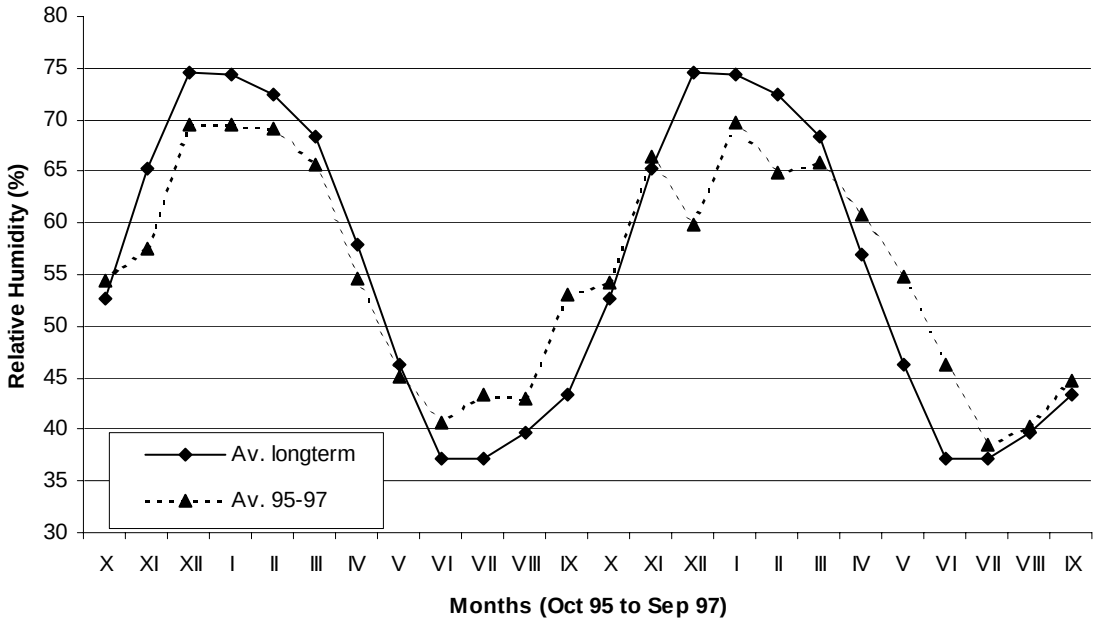
The long-term average mean monthly air temperature for July ranges from 24.4°C (farms 07 and 08, Kyrgyzstan) to 31.9°C (farms 21 and 22, Uzbekistan). The summers of 1996 and 1997 were hotter than average, the highest temperatures occurring in July as expected. The

highest recorded average monthly air temperature was observed in July 1997, ranging from 26.7°C (farms 07 and 08, Kyrgyzstan) to 32.4°C (farms 21 and 22, Uzbekistan).

4.3 Relative air humidity

Seasonal change in relative air humidity from average long-term data and for the period from October 1995 to September 1997 is shown in Figure 4.2. The pattern of seasonal change inversely reflects change in air temperature, being high in winter months and low in summer months.

Figure 4.2 Average Relative Humidity of Air

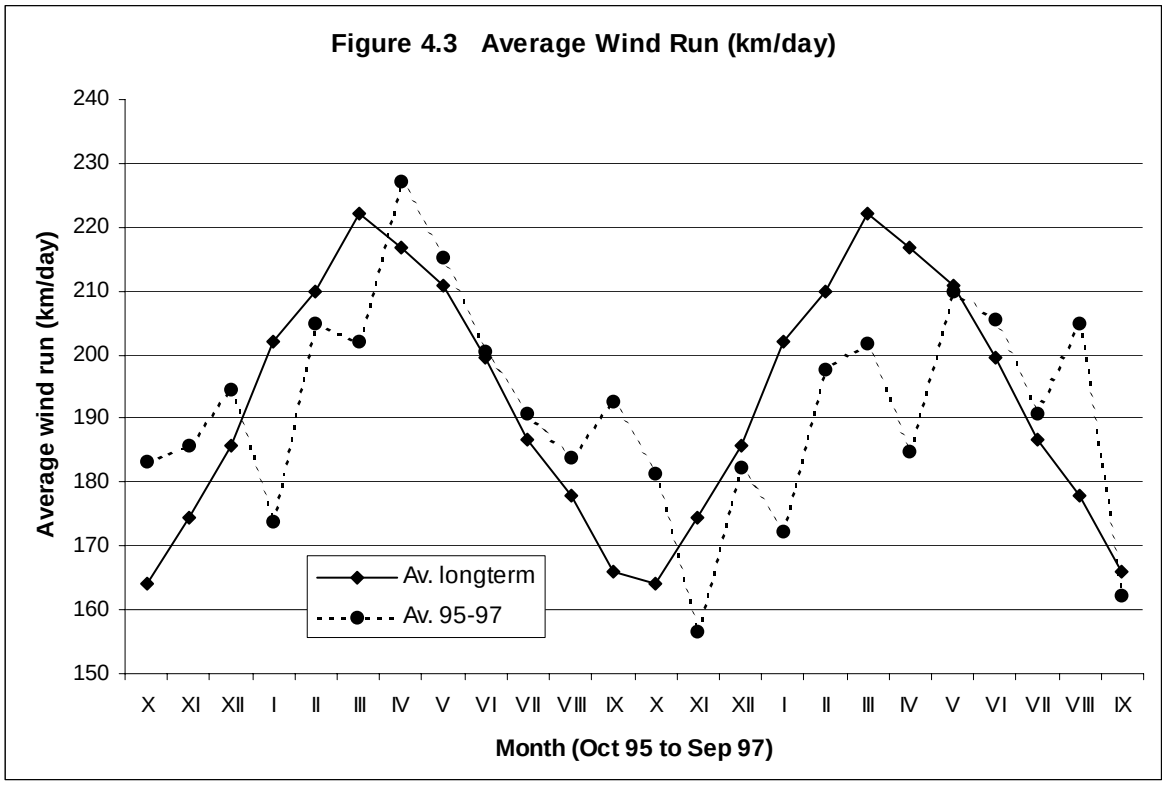


Comparison of means of values measured during the period from October 1995 to September 1997 with long-term data shows that recent years have been more humid during summer and drier during winter. From long-term data the highest humidity occurs in December and January, ranging from 81-82 percent (farms 03 and 04, Kazakhstan) to 64-68 percent (farms 21 and 22, Uzbekistan). During the survey period, the highest humidity was observed in January 1997, ranging from 83 percent (farms 03 and 04, Kazakhstan) to 59 percent (farms 21 and 22, Uzbekistan).

The lowest humidity generally occurs in July, ranging from 22 percent (farms 21 and 22, Uzbekistan) to 49 percent (farms 03 and 04, Kazakhstan). During the survey period, the lowest humidity was observed in June - July 1997, ranging from 26 percent (farms 01 and 02, Kazakhstan) to 48 percent (farms 27 and 28, Uzbekistan).

4.4 Wind speed

According to the values of average monthly wind speed the region is classified as a zone of moderate winds with between 175 and 425 km/day, as shown in Figure 4.3. However, some farms fall in the zone of light winds (farms 03 and 04 in Kazakhstan, and 07 - 10 in Kyrgyzstan), with generally less than 175 km/day.



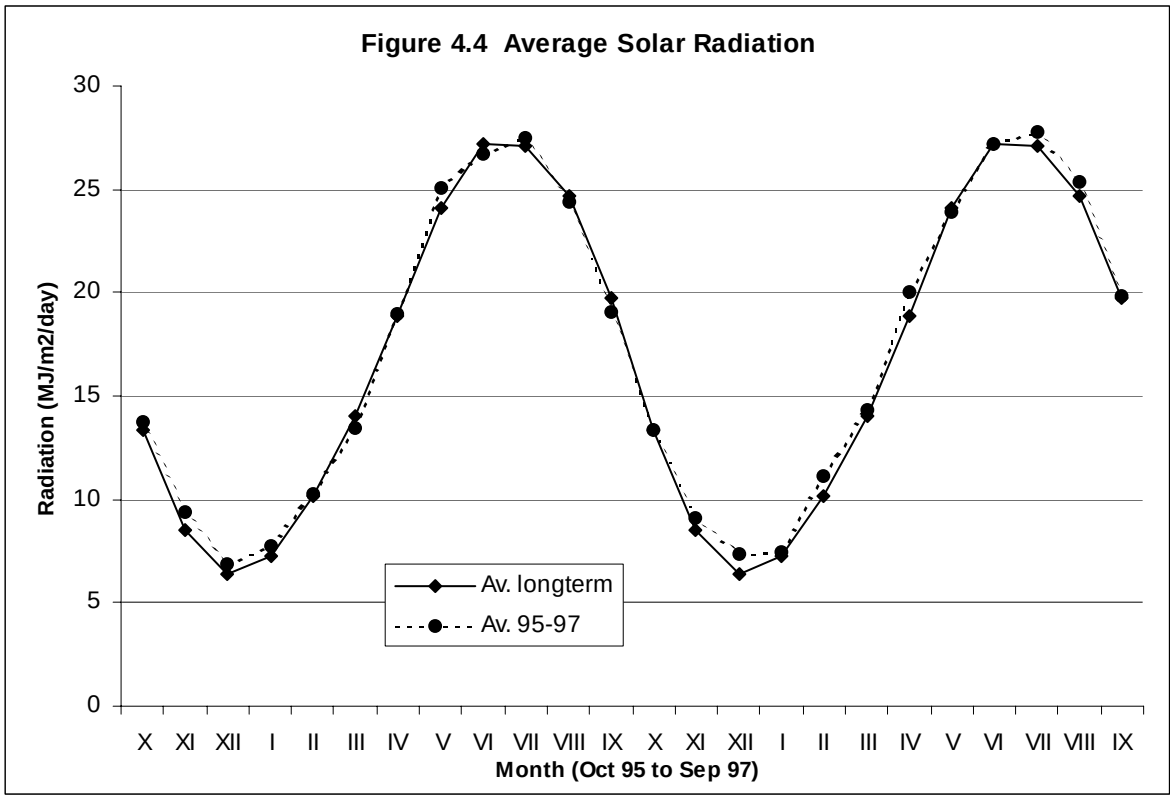
The long-term averages show that the quietest period is September-October, with winds varying from 86-95 km/day (farms 03 and 04, Kazakhstan) to 242-251 km/day (farms 01 and 02, Kazakhstan). During the survey period, the least wind occurred in November 1996, ranging from 52 km/day (farms 03 and 04, Kazakhstan) to 302 km/day (farms 01and 02, Kazakhstan).

The windiest period generally is from January to May, with wind speed ranging from 112-139 km/day (farms 07 and 08, Kyrgyzstan) to 311-346 km/day (farms 01 and 02, Kazakhstan). May 1997 was the windiest month during the survey, when the range of wind speed varied from 95 km/day (farms 03 and 04, Kazakhstan) to 458 km/day (farms 01 and 02, Kazakhstan).

4.5 Solar radiation

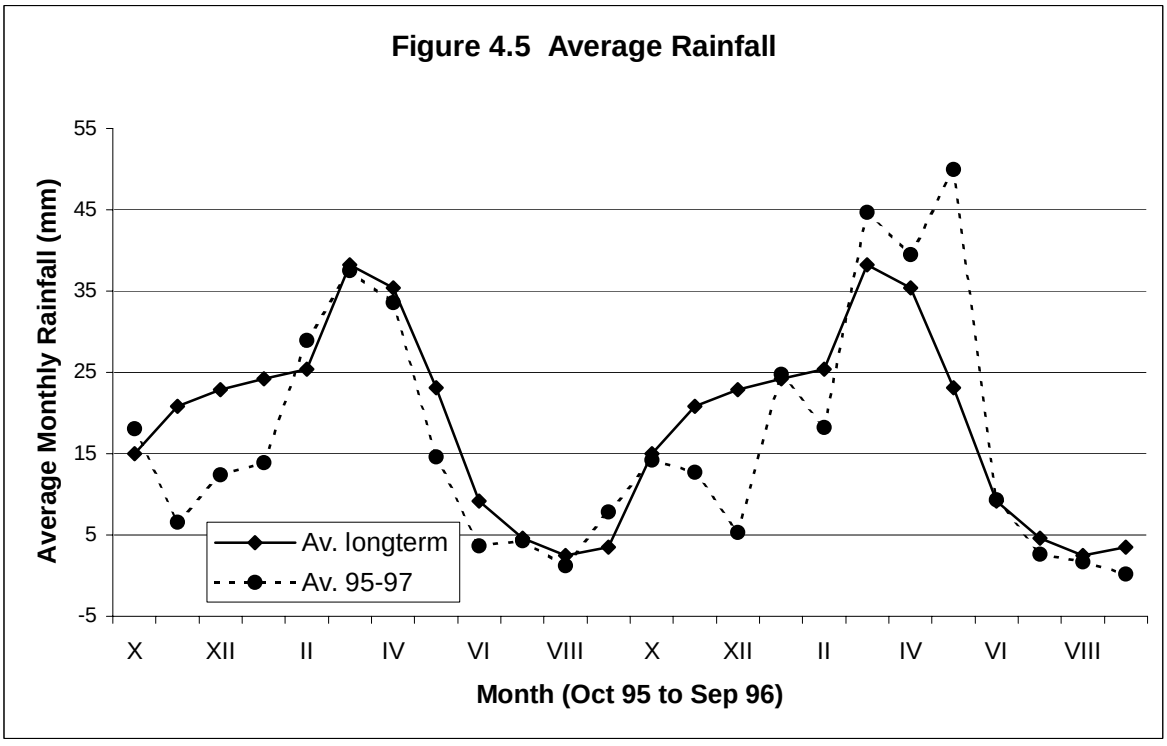
Change in solar radiation is determined by seasonal variation in day length, which is greatest in June-July (Figure 4.4). Meteorological stations record sunshine hours, and long-term means enable solar radiation to be calculated. Radiation values during mid-summer range from 24.7-25.0 MJ/m^2/day (farms 07 and 08, Kyrgyzstan) to 27.9-28.3 MJ/m^2/day (farms 21 and 22, Uzbekistan). Solar radiation values are minimal in December - from 5.2 MJ/m^2/day (farms 27 and 28, Uzbekistan) to 8.2 MJ/m^2/day (farms 21 and 22, Uzbekistan).

The values of average daily solar radiation from measured sunshine hours in the period from October 1996 to September 1997 were marginally higher than the long-term averages. The maximum was observed in June-July 1997, ranging from 24.4-26.7 MJ/m^2/day (farms 07 and 08, Kyrgyzstan; 27 and 28, Uzbekistan) to 28.6-30.2 MJ/m^2/day (farms 23 and 24, Uzbekistan; farms 01 and 02, Kazakhstan). Minimal values were observed in December 1996 in the range from 5.8 MJ/m^2/day (farms 07 to 10, Kyrgyzstan) to 9.2 MJ/m^2/day (farms 21 and 22, Uzbekistan).



4.6 Rainfall

Most rain falls in the months of March and April as shown in Figure 4.5. Maximum monthly rainfall varies from 16-17 mm/month (farms 25 and 26, Uzbekistan; farms 01 and 02, Kazakhstan) to 63-72 mm/months (farms 23 and 24, Uzbekistan; 07 and 08, Kyrgyzstan). The driest month is August, with no rain falling on farms 17 and 18 (Turkmenistan) and farms 21, 22, 35 and 36 (Uzbekistan), rising to a long-term average of 13 mm in Kyrgyzstan (farms 07 and 08).



During the survey period maximum precipitation was observed in May 1997 within the range from 11.9 mm (farms 25 and 26 (Uzbekistan) to 89.6 mm (farms 07 and 08, Kyrgyzstan). The driest month was September 1997 with no rainfall on any farms except farms 27 and 28 (Uzbekistan) which received 1.7 mm.

4.7 Crop Evapotranspiration (ETo)

Crop evapotranspiration was calculated on the basis of latitude and altitude, and average monthly values of air temperature, relative humidity, wind speed, and sunshine hours using the Penman-Montieth method, available in the CROPWAT program (FAO, 1997).

As shown in Figure 4.6, evapotranspiration is greatest in July, values calculated from long-term data averages ranging from 5.8 mm/day (farms 03 and 04, Kazakhstan) to 7.9 mm/day (farms 17 and 18, Turkmenistan). Values are least in December-January, ranging from 0.4 mm/day (farms 01 and 02, Kazakhstan) to 1.0-1.1 mm/day (farms 21 and 22, Uzbekistan).

Values calculated from measured climate data during the survey period were mostly higher than the corresponding long-term values. Maximal values were observed in June-July 1997 in the range from 4.7-5.7 mm/day (farms 07 and 08, Kyrgyzstan) to 9.3-9.4 mm/day (farms 21 and 22, Uzbekistan). Minimal evapotranspiration was observed in January 1997 in the range from 0.5 mm/day (farms 07 and 08, Kyrgyzstan) to 1.8 mm/day (farms 21 and 22, Uzbekistan).

Figure 4.6 Reference Crop Evapotranspiration (ETo)