ADAPTATION TO CLIMATE CHANGE

Shukhrat Mukhamedjanov, Rustam Sagdullaev,
Azamat Mukhomedjanov, SIC ICWC, Tashkent, Uzbekistan

Adaptation to climate change in irrigated agriculture

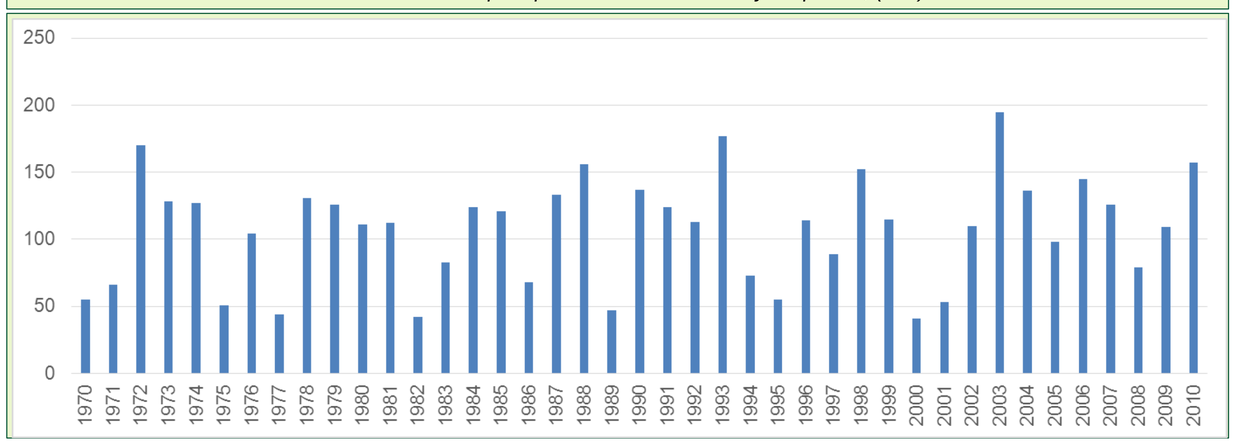
Introduction

Over the last ten years, the agricultural activity with its own specific problems has become more complicated due to climate change within year and the alternation of wet and dry years. Huge swings in air temperature and precipitation have a significant influence over the planned agronomic and irrigation activities approved according to state recommendations related to the crop husbandry and irrigation schedules. Currently, every farmer as well as water supply agency is trying to address these issues according to their knowledge and experience. Today, none of the countries in the region has any specific recommendations on preventive measures that allow adapting to huge swings in climate change, especially in the course of a year. The given program is aimed at the development of tools and approaches to maximize the adaptation of such process operations as agronomic and irrigation activities to various kinds of weather changes and its negative consequences.

Based on collection and evaluation of long-term climatic data, we have analyzed the frequency of occurrence of climatic conditions. From the long-term data, a selection of years on winter and spring precipitation similar to the climatic conditions of the current year has been done. Analysis of climatic data on precipitation for the period from 1970 to 2014 showed that within forty years the occurrence of high-water and low-water years has shown no consistent pattern. According to the amount of annual precipitation, 11 years can be highlighted with the amount of annual rainfall above 200 mm.

Periodicity of recurrence of high-water and low-water years is different for different periods. However, there were two highly wet years, when precipitation had exceeded 300 mm - 1993 and 2003 respectively. The average amount of annual precipitation for all the years is 120mm per year.

Amount of annual precipitation values for multiyear period, (mm)



However, the analysis of the intra-annual distribution of precipitation showed that the amount of annual rainfall is not entirely determines the availability of moisture and favorable conditions for crops growing. For agricultural production, the most suitable years are those with adequate rainfall from November to March, with little rainfall and sufficient temperatures during the growing season and plant development period. Such years were 1976, 1989.1994 and 2012. Difficult years in terms of water scarcity during the whole growing season were 1975, 1982 and 2000; these years were different from the others due to acute shortage of irrigation water and lack of moisture because of lack of rainfall.

According to the assessment of long-term dynamics of rainfall and air temperature, it can be seen that the most common years are those with very high rainfall in spring and even in summer. High humidity and low temperatures during these periods cause problems for agricultural production. In such years, it is complicated to plant crops in March and April and in May due to abundant precipitation, low air temperatures and lack of solar power many plants suffer from various diseases and some types could be even lost. Irrigation modes and agro-technological maps designed for average climatic conditions become outdated and not suitable for the current conditions.

Challenges and Risks Associated with the Climate Change

The main risks and measures to identify and eliminate them are the following:

- A sharp rise in temperature and the necessity of irrigation in the conditions of unstable water supply;

- Abundant rainfall in the height of vegetation period and the necessity of special treatment of the fields;

- Pests and diseases outbreaks caused by low temperatures require the development of preventive measures and measures to combat pests and diseases;

- Lack of irrigation water and prolonged irrigation intervals assume maximum mobilization and use of water-holding activities as well as the effective irrigation schemes during the dry periods of the year.

It is quite possible to control and prevent all of these risks upon availability of certain information and necessary tools and technological approaches.

With this purpose, we need to develop and propose a general program that could be adapted to the conditions of the irrigated agriculture as an example of the Fergana Valley, and served as a tool in the agricultural production and irrigation planning and management for the whole region of Central Asia based on the principle: Field - Farm - WUA.

Necessary Actions

To adapt the existing system of agricultural production and irrigation to climate change, it is important to have:

1. Detailed information with regard to all major climatic parameters of the considered region;

2. Assessment of the dynamics of climatic parameters over many years and in the context of one year;

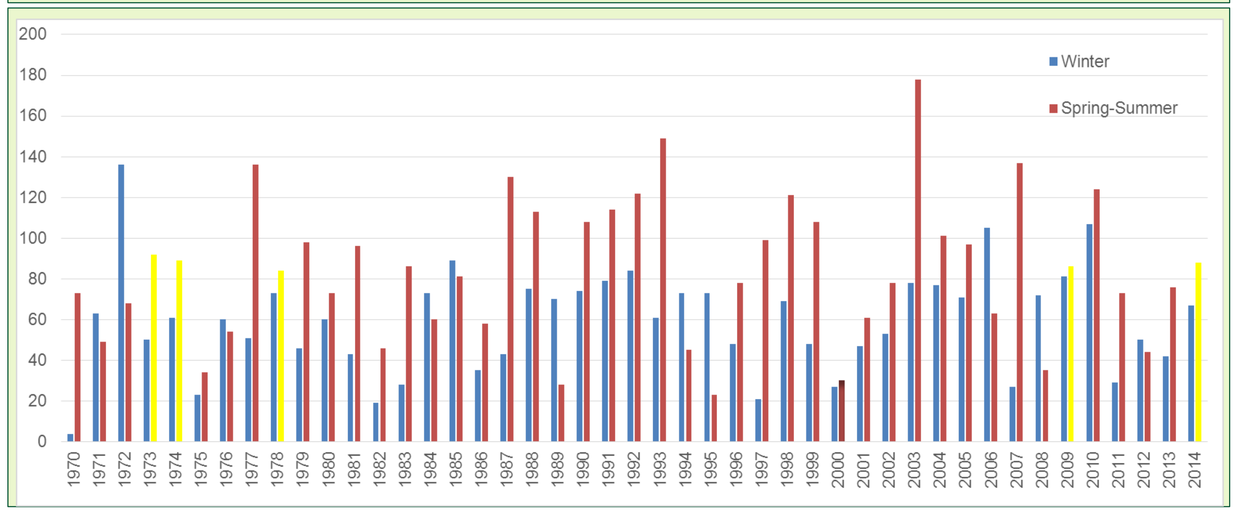
3. Assessment of the risks of agricultural production and irrigation caused by various weather parameters;

4. System of continuous monitoring of climatic parameters and indicators of growth and development of crops and changes in soil moisture;

5. Tools, mechanisms and technological solutions to adapt to the rapid changes of climatic parameters;

There is neither need nor possibility to anticipate the change of climatic parameters for decades to come. It is quite obvious that this kind of climate change of one region is the result of global climate change, the causes of which can lie far beyond that region. However, the study of climate change at the regional level, both for the multiyear period and intra-annual distribution of precipitation and air temperature should be carried out. Precisely that type of study could provide the possibilities to adapt both agricultural and irrigation activities to the strange (for the given region) climatic conditions.

Sum of precipitation in mm. for Dec-Feb and for March-Aug



Methods to Address the Issue

Assessment of the climatic parameters is based on the climatic information including the decade or better daily data on precipitation and air temperature over the last 50 years minimum or more. First, the following should be established:

- Are there any deviations from those climatic parameters which we have seen throughout the past in our region?

- Whether the existing climate changes are not standard deviations;

- To what extent the climate change influences the agricultural production;

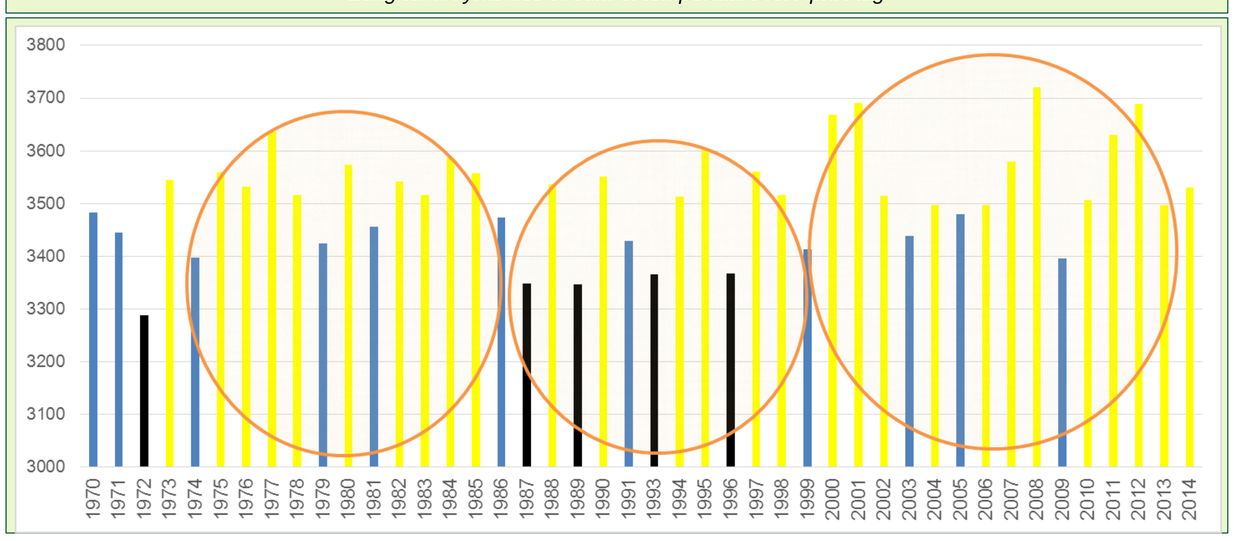
- Specific risks caused by various climatic conditions in various combinations of climatic parameters in the context of the year (draught and high temperatures, abundant rainfall and low temperatures);

- Degree of resistance of the existing approaches in agricultural production and irrigation to the climate change;

It is important to determine the most important period for the analysis and assessment. When considering the growth and development of plants, it is important to determine the dynamics of changes in climatic parameters during the vegetation period and during the preceding period. It is necessary to determine the regularity of change of climatic parameters in different years depending on the time of year, as well as to determine their frequency in the multiyear cycle, which is important for the forecast of climatic parameters within the current year. Based on the charts, the cyclical recurrence of climatic parameters in a multi-year cycle could be determined. Consequently, these years could be taken as an analogue for the forecast of climatic parameters for the coming months.

Based on the assessment of climatic parameters, it becomes possible to develop an approach that allows forecasting the weather conditions for the coming vegetation period and for each subsequent month, particularly precipitation and temperature conditions, as well as developing necessary tools to manage agronomic and irrigation activities effectively, taking into account the sharp intra-annual fluctuations of precipitation, evaporation, air and soil temperatures.

Long term dynamics of sum of temperature for April-Aug



Summary

A study of current practices in agricultural production revealed that: - the climatic conditions, and its sharp fluctuations have a major negative impact on the development of plants;

- It is important to develop risk management tools in agriculture negative impact of sharp fluctuations of climatic conditions;

- It is important to create a network of small agro-meteorological stations for continuous monitoring of climatic parameters.

Conclusions

According to the assessment of long-term dynamics of rainfall and air temperature, it can be seen that the most common years are those with very high rainfall in spring and even in summer. High humidity and low temperatures during these periods cause problems for agricultural production. In such years, it is complicated to plant crops in March and April and in May due to abundant precipitation, low air temperatures and lack of solar power many plants suffer from various diseases and some types could be even lost. Irrigation modes and agro-technological maps designed for average climatic conditions become outdated and not suitable for the current conditions.