Water-use in the context of the approaching climate change

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Abstract. Optimal use of surface and groundwater will be a decisive factor in maintaining the lives of people on the Earth and the functioning of infrastructure. A climate change calls for a new way of the management and use of water. What means and methods are used to achieve the required balanced state is presented in the basic scope by the following article.

1. Introduction
Water is essential for life on the Earth. Everyone knows this fact, but not everyone treats water with sufficient respect when using it. Very often, especially in the second half of the last century, water was treated with certain contempt in all countries of the world. Although it was perceived as a significant natural factor, water sources and in particular their long-term renewability, were not adequately protected. The broader spectrum of surface and groundwater use did not comply with the natural laws of their renewability, which is why the overall balance of these waters in the nature gradually deteriorated. Nowadays, a number of states have already reached a deficit in terms of water management due to the coming climate change. Lack of water is one of the main causes of extensive human migration, changes in the type of flora, and a negative impact on the species represented in the fauna as well. It can be assumed that the current situation will be significantly more strained at least in the medium term horizon. The current analyses already indicate that the global reserves of water that can be used for water supply needs as well as to maintain agricultural production has been decreasing [1]. In many countries in Africa and the Middle East, the scarcity of fresh water has been the cause of migration of people to places with a relatively sufficient amount of water. However, these places will quickly become overloaded and will make people move to new locations again.

The countries of the European Union must also be prepared for this situation. Even the current migration events clearly indicate the development in the future. A preventive adoption of the technical and operational measures in the area of surface and groundwater use can significantly reduce the future negative impact in each region of the world.

2. Climate change and its impact on water ecosystems
A climate change is not a modern phenomenon. Written history of mankind and scientific research have documented with sufficient accuracy that this phenomenon is repeated in certain periods. The only difference is represented by the accompanying negative impacts on the flora, fauna and, during the last millennium, on the human population as well [2]. It is necessary to realize that the increasing cultural development of the human society goes hand in hand with rapidly growing consumption of drinking and process water for this group of inhabitants of the world. At the same time, fresh water
consumption in agriculture and in infrastructure of countries increases as well, and these facts are associated with the growing risk of a global lack of water. Whether and to what extent this threat becomes reality will result from the current climate change during this century. The effects of the climate change will most likely become visible in the sphere of aquatic ecosystems in the following areas:

- long-term, further decrease of the reserves of shallow, but also deep groundwater,
- significantly fluctuating capacity of flowing and accumulated surface water in different basins,
- fundamental change of the quality of surface and groundwater due to inorganic and organic material load,
- fluctuating lack of raw water suitable for treatment into drinking water in large regions of the world,
- secondary induced change of cultivation of agricultural crops depending on the intensity of the effect of hydrological drought in the region,
- extinction of indigenous flora species in the areas critically affected by droughts accompanied by significant change of fauna.

The above presented and other impacts show that the long-term decrease of groundwater in various water-bearing beds will be the greatest threat to the existing natural environment and aquatic ecosystems, see figure 1.

Figure 1. Scheme of groundwater levels in the original environment.
The lack or a significant reduction in the volume of water in the water-bearing beds shown in the picture will certainly be the biggest threat to the natural environment. It will gradually disrupt the current concept of balance in the landscape and it will subsequently lead to an overall change in the existing natural environment of large regions of the world. Apart from this, the negative changes will probably also be reflected in the water-supply environment of the use of water for drinking purposes by the human population.

3. Water-supply use of surface and groundwater in critical situations

The existence of the majority of human population depends on sufficient amount of water to be used, especially for its treatment into drinking water. At present, more than a third of the people are threatened by the lack of drinking water. This deficit will increase with the rapidly growing number of people in the world and the declining reserves of this raw material. Various countries of the world are and will be affected with different intensity. Most notably, it will affect the countries of Asia and Africa. However, the countries of Europe or the European Union will not be spared either. It will always depend on how the state operates its water-supply systems and how it is able to use the strengths and weaknesses of the aquatic ecosystems for the water-supply purposes.

For example, in the Czech Republic, surface water and groundwater are used for the treatment into drinking water at a ratio of about 50/50 % [3]. Large cities and industrial densely populated areas in the Czech Republic are supplied from surface water sources; see the model diagram in Figure 1. The advantage of this method of the supply of drinking water to the consumer system is the relative sufficiency and rapid renewability of the source of water during the season. Medium-sized towns and smaller municipalities, if they are not connected to water-supply systems, use treated or at least hygienically safe groundwater to supply the inhabitants with drinking water.

![Figure 1. Water-supply system with one source of drinking and fire water.](image)

The overall trend of ensuring the supply of drinking water for its consumers, with significant signs of a climate change in the Czech Republic as well as in other countries of the world, will probably be
based on a substantial expansion of the water-supply systems to provide the supply of drinking water for built-up areas from surface, rapidly renewable sources of water.

4. The possible ways of how to reduce the threat of water scarcity in the 21st century
Taking into account the above-mentioned arguments in this article dealing with the issue of water-use in the context of the approaching climate change, there is an increasing need for a global approach to aquatic ecosystems with the international protection of these waters.

However, this water-use process focused on increasing its real efficiency (see figure 3) must always be complemented by a number of specific measures [4]. The basic and quickly evident measures in the field of water protection and the increase of the capacity of aquatic ecosystems in the natural environment may include especially the following steps [5]:

- speed up the process of the construction of new waste water treatment plants and increase the intensity of the treatment of waste water discharged especially into small watercourses above the current limits,
- deactivation of the original drainage systems of the so-called waterlogged lands, with a simultaneous use of these water works to increase the infiltration of rainfall in the area under consideration,
- deregulation, especially of small watercourses, to reduce the water current velocity of surface water in the recipient (creating meanders),
- execution of technical water works in places where the sources of deep water-bearing beds of soil profile are created,
- change the possibility of announcing and operating the protective zones (PZ) of underground, or even surface sources of drinking water in a legal way,
- restore the function of water managers in the legislation in order to increase the water protection and the management process of its use in the natural environment.

Their possible execution, depending on the local conditions of the individual states, has the potential not only to stabilize water in the landscape even in the new climate conditions, but also its quality and to reduce the safety anthropogenic threats of its quality change, especially in industrial densely populated areas.

Figure 3. The process of significant improvement of the protection and use of European waters [3].

5. Conclusion
The solution of the negative signs of rapid climate changes cannot be postponed. Any delay in the response to the newly created natural environment has the potential not only to cause material damage in the given state, but, in particular, to cause serious and even irreversible damage to the current living conditions of people, fauna, and flora.

This article was drawn up in order to reduce the extent of the danger through education, by highlighting the real threats and, at the same time, by indicating their elimination. Perhaps, it will trigger a discussion and a new reflection on these threats and contribute to their solution.

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