# Chapter 2
# Management of Drought and Floods in Romania

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## ABSTRACT

*This chapter presents concepts of drought and flood management, information on the steps taken and on the national policies applied in Romania in this field. The Romanian institutional framework for the management of droughts and floods is detailed, as well as the planning phase, the plans, the strategies and the programs that establish Romania's national priorities on climate change and the management of droughts and floods, in line with the EU directives and international conventions and treaties Romania is part of. Information is also given about preventive, operative measures of intervention and rehabilitation, as part of the operational and emergency situations response management, as well as the guidelines, trends and future actions of prevention and control for this category of disasters in Romania.*

## INTRODUCTION

Romania is located in the temperate zone of Europe and by placing them on the continent, through the influence of barometric centers of action, on the one side and the Carpathian mountains forming an orographic barrier, on the other side, the Romanian climate gets its own specific to the climate of neighboring countries. Climatic factors (temperature, humidity, wind speed, precipitation, etc.) have an uneven distribution during in the year due especially to the existence of the seasons and in the land, due to the diversity physico-geographical conditions.

*Average annual temperatures* recorded the highest values of over $11^0$ C in southern Romanian Plain, along the Danube river, along the Black Sea coast (*Dobrogea*) and in the south-western Banat. In other regions of the plains, the average annual temperature is maintained between $10^0$ C and $11^0$ C. In hilly and plateau regions, the average temperature drops to $6^0$ C. The lowest values of annual average temperatures in mountainous regions, where the values varies, in altitude, between $6^0$ C and $-2^0$ C.

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*Rainfall* has a significant variation over time and are due to extraterrestrial (solar activity cycle 11 years) and dynamic (the atmospheric circulation of air masses).

*Evapotranspiration* is directly related to the thermal regime, the highest values being registered in the southern and southeastern part of the country (Dobrogea). Annual hydric deficit (ETP-P) has a distribution determined by the variability of precipitation and evapotranspiration across the country, the highest values being in Dobrogea, in the Romanian Plain and southern Moldova.

Romania is located in a proportion of 97.4% (232 193 $km^2$) in the Danube hydrographic basin. Romanian hydrographical network has a length of 78905 km. Water resources of rivers are 40 billion $m^3$, which represents 20% of the water resources of the Danube River. Also in Romania there is 117 lakes with an area greater than 0.5 $km^2$ (of which approx. 54% are in the Danube Delta) and 242 reservoirs with a larger area than 0.5 $km^2$. Hydrographic Danube basin includes the Romanian coastal waters and hydrographic basins of affluent that flow into the Black Sea. Groundwater sources can supply 639 million $m^3$.

Observations and measurements made, all in the world and on Romania land, on the climatic parameters and on the effects of climate change on water resources, shows some signs which support *the hypothesis of climate change.* The extremes hydrological meteorological phenomena occurred in the last decade and have caused numerous floods, prolonged droughts and warmth waves are considered more and more specialists as the result of climate change, a potentially irreversible threat to society and to the our planet. Regional and local climate changes affects ecosystems, human settlements and infrastructure. According to the latest *IPCC Report (The Intergovernmental Panel on Climate Change Fourth Assessment Report,* IPCC, 2007), can be listed as the consequences of climate warming: decreasing productivity of all cereals in low latitudes, increased mortality due to warmth waves, increased the frequency of flooding and droughts. Changes in temperature and precipitation forecast periods may lead to changes in vegetation periods and changing boundaries between forests and pastures. Some extreme meteorological events (warmth waves, droughts, floods, etc.), with increased frequency and intensity have resulted in significant damage associated with serious risks.

Europe climate has warmed by almost 1°C over the last century, faster than the global average. Scientific results show that, in the next two decades, expected a warming of $0.1^0$C / decade even if concentrations of all gases with greenhouse effect and aerosols, generating climate change would remain constant at the 2000 year level. And on the Romanian land was highlighted global warming trend, with the highest increases of up to $0.4^0$C in industrial areas (Busuioc, A., Caian, M., Bojariu, R., Boroneanţ, C., Cheval, S., Baciu, M., Dumitrescu, A., 2012, p. 1). According to the evaluations presented in the 4th IPCC (2007), Romania expects annual average warming of $0.5^0$C and $1.5^0$C for the period 2020 to 2029 and between $2^0$C and $5^0$C for 2090-2099

*The drought and rainy periods in Romania*, without having a real cyclical characteristic, have a sequence with a period of approximately 12-15 years.

The drought affects 7.1 million ha, which represent 48% from the total agricultural land (RNIS, 2010). The South, Southeast (*Dobrogea*) and East parts of country are the the most hit areas (<600$m^3$ water / hectare – extreme and severe pedological drought) during the extremely droughty years average yields of various crops representing only 35-60% of the potential yields.

These areas are also characterized by a ratio between precipitation and potential evapotranspiration (multiannual values) below 0.65, which, according to the United Nations Convention to combat desertification, indicate their predisposition to this phenomenon, which can be aggravated by the incidence of droughts. The more gravely process, desertification, affects approximately 3 millions hectares, of which 2.8 million hectares are agricultural land.

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