

Summary

The doctorate thesis “Climate, air pollution and the influence of climatic factors in atmosphere pollution of Botosani municipality” is the result of preparing activity in the Natural Sciences doctorate field, entering in the vast field of research of physical geography, at the contact between two distinct areas: climatology and urban environment problems.

In general framework, the field of the doctorate thesis theme refers to thoroughness and particularization of new issues in fields already approached, explored and partially elucidated and grounded. General objective is the climate and air pollution study and improving the knowledge level of the role played by climatic conditions specific for Botosani town, in the evolution and manifestation way of diverse atmospheric pollution phenomena. The necessity of the present work is justified by the fact that for Botosani municipality there weren't performed complex studies from the climatic point of view, and, much less, studied concerning the relation weather – climate – pollution.

The paper is structured on five chapters. The first chapter refers to the history of researches, database, research methodology, spatial characteristics and elements specific for Botosani municipality, physical and built frame of the town, considerations over the town extension in surface and height, over the cut-off and functional areas structure. The second chapter contains the analysis of the climate genetical factors correlated with the region relief and the role of active surface in determining the area specific. The third chapter contains the analysis of the main meteorological parameters and the evolution of climatic elements and phenomena. In the fourth chapter there are analyzed the pollution sources (with accent on anthropic, industrial sources), there are classified the main pollutants types, quality evolution, level and evolution tendency of air pollution in Botosani municipality. In the fifth chapter there are presented the climatic conditions meteorological factors which have the greatest influence on temporal variation of air pollution degree. During the paper there are permanently followed reciprocal relations between climate and urban environment which registered a slow but constant degradation, not only because of anthropic activities but also due to specific climatic conditions which the towns generate on the general climatic field.

The doctorate thesis represents the result of an original study, resulted from processing data and the study of a vast bibliography, from Romanian and foreign speciality literature (263 pages, 129 bibliographical sources, 230 figures and 100 tablets).

Due to its geographical position and to the way in which the radiative, physical-geographical, dynamic and anthropic factors interact, for the analyzed interval (1961-2009), Botosani municipality presents a series of proper characteristics, which introduce modifications in the values of the main elements and climatic phenomena. The town supports the influence of the activity of the four main baric centers: azores anticyclone, Euro-Asian anticyclone, Icelandic cyclone, Mediterranean cyclones, plus the influences of the Greenland, Scandinavian anticyclone, and the reduced influence of the local baric centers. The air masses with the most significant activity for the area where Botosani municipality is situated, are of polar maritime origin, cold and humid.

The average multi-annual temperature of the air is 9,2⁰C. The coldest month is January and the warmest, July. The average multi-annual value of the atmospheric pressure in Botosani, is 997,1 hPa. The annual regime highlights the fact that there is a main annual maximum which is produced in April, and the secondary minimum in June. In annual regime, the wind dominant direction is from North-West sector, followed by the winds from South East sector. The winds

from North East have the lowest frequency. Because of Botosani town location near the valley Sitna, consequent valley oriented in the direction NW-SE and because of hilly peaks presence which give wide openings to the Eastern sector, where the altitudes are reduced, there was asserted the second predominant wind direction, SE. The annual frequency of the atmospheric calm is 29,1% and it has the highest values in autumn and summer because of the basic anticyclone formations, and the lowest values in spring, because of cyclonic activity and convective processes intensification. The dominant direction of maximum wind speed is from NW sector, and the most reduced average multi-annual speed is from NE sector. The values of atmospheric humidity in the region are influenced by the Atlantic Ocean, Mediterranean Sea and Black Sea. The values of relative moisture registered in the urban region itself are lower than those registered in the weather station of the town. During the year the total cloudiness has the highest values in December, and the lowest in August. The annual regime of sunny days varies in inverse ration with those of cloud-capped days. The average annual amount of precipitation is 560,6 mm/ a year. The most frequent annual amounts of precipitation are those included between 471-520 mm. The general tendency is of growing the precipitation amounts in summer and autumn, and of decreasing in winter and spring. The continental pluviometric regime is characterized by a single maximum in July and a single minimum registered in January and February.

In the category of stationary air pollution sources, the largest share represents the industrial units with different degrees of implication by economic agents: power industry, machines and equipment building industry, chemical industry, wood processing industry, building materials industry, textile and confections industry, food industry, fuel distribution stations, asphalt mixture stations, dust hole. In the mobile sources category of air pollution the largest share represents the existing means of transport which generate CO₂, CO, partially unburned hydrocarbons, NO_x and different sulphur compounds. In diurnal regime there are two maximum and two minimum: the main maximum is produced at around 8 a.m., (because of beginning the activity and traffic in town when thermal convection is still weak or it hasn't appeared), and the secondary one at around 6-8 p.m., when the traffic intensifies again and the convection is weak or it has already stopped. The main minimum is registered during the night, and the secondary one, at noon. In weekly regime, the pollutants concentration increases from Monday, it reaches the maximum at the middle of the week and decreases from Friday until Sunday due to activities reduction. In annual regime, in winter, the convective ascendant movements of the air are diminished, artificial heating becomes an important pollution source registering maximum concentrations. From October until February the thermal inversions frequency increases, the photosynthesis is greatly reduced, and cloudiness and fog accentuate the pollution degree.

From the variation graphics analysis of the average monthly and daily values of some climatic factors and of pollutants encountered in the atmosphere of Botosani municipality, there are highlighted a series of characteristic aspects. Temperature plays an important part in the evolution of SO₂, NO_x, C₆H₆, PM_{2,5} concentrations, and it establishes a ratio of direct proportionality with ozone immission. By the influence on reactivity, the duration of Sun shine has a secondary role in determining the SO₂, NO_x, C₆H₆, O₃ concentrations. The water vapor pressure presents a major importance only for the chemical compounds which are soluble in water in higher proportions: SO₂, PM₁₀. The relative moisture doesn't have a direct influence on the pollutant compounds immission. The rainfall has an important role on the compounds which dissolve in water or they are captured by the rain drops: SO₂, PM₁₀. In case of the other chemical

pollutants of the atmosphere, the effects of the rainfall are reduced: NO_x, C₆H₆, O₃. The wind has a role in the dispersion of atmosphere pollutants compounds. Wind speed has a role to create horizontal transport, concentrations depending by this one.

The main areas affected by atmospheric pollution in Botosani municipality are those situated near the industrial area, the South West extremity of the town (ANL Bucovina district and the vicinities of the military unit) where there are frequently depositions of particles transported by the wind on the directions NW and W and the central area (Panda – County Library), due to intense traffic and urban agglomeration itself.

In conclusion, the climatic factors influence the emission, transport, dispersion, stagnancy and reactivity processes of the atmospheric noxae closely related with the state of aggregation, mass and pollutants reactivity. From the presented evolution there can't be generalized due to reduced probability to have the same meteorological conditions in the same period of time, and for establishing a mode of action, in case of a climatic element the emission, the initial immission and climatic factors implied in pollution and de-pollution processes of atmosphere should be constant in a period in which to follow up the action of only one climatic element, which is almost impossible.

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