# THE FREQUENCY OF THE CLOUD TYPES IN THE HYDROGRAPHIC BASIN OF THE CRISUL REPEDE RIVER

**Pereş Ana Cornelia**

[*]University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: mozaani@yahoo.com

***Abstract***

*In order to emphasize the frequency of the cloud types from the hydrographic area of the Crisul Repede river we have used data from the weather stations for a period of 41 years. The highest yearly frequency is registered by the Altocumulus clouds while the Cirrocumulus ones are the rarest to be met.. In a monthly regime, during the warm season the clouds with a vertical development are predominant due to the thermo convective movements that lead to the formation of the cumuliform clouds.*

**Key words:** clouds, frequency.

## INTRODUCTION

The determination of cloud types, species and varieties is done for all the clouds that are seen on the sky even when these clouds occupy a very small part of it, starting with the clouds that occupy the largest part of the sky. Then the determinations for the other clouds are done following the order of their nebulosity decrease. If in the „observation moment" there is a transformation process of the clouds from one type to another then the observer shall take into consideration both types of clouds.

The varied aspect of the clouds isdone by the microphysical structure and by the processes which are at the basis of their apparitionand development.

The main factors that lead to the apparition of nebulosity are: the atmosphere circulation, the atmosphere humidity, the underlying surface (landscape, geological structure, vegetation), the seasons, the anthropogenic factors (pollution agents). The presence of the solid particles in the atmosphere leads to an increase of the nebulosity due to the fact that these particles form condensation nuclei. The clouds influence the evolution of the other weather elements through the degree of sky cover with clouds, through form, through the duration and through their way of being made up. Thus the nebulosity influences the regime of the radiative - calory balance of the earth and atmosphere surface and the type and the frequency of the clouds influence the quantity, the duration, the intensity and the type of rain fall.

**MATERIAL AND METHODS**

In order to realize this study we have used a series of methods as follows: the comparative method, statistics and mathematical methods and graphical methods.

The use of specific weather research means ad methods has followed a very exact processing of all the data that were at our disposal, by this we have followed the role the landscape plays as an anthropogenic factor in the evolution of the weather elements.

**RESULTS AND DISCUSSION**

The frequency of different types of clouds, their height and form differ according to the altitude, to the latitude, to the physical geographical factors, to the type of air mass or of the atmosphere front, to the dynamic or thermic convection.

*Table 1*

The yearly frequency of the cloud types (%) in the hydrographic basin of the Crişul Repede river in the period 1970 - 2010

| Station/Type of cloud | Săcueni | Oradea | Borod | Huedin | Stâna de Vale |
|---|---|---|---|---|---|
| Ci | 8.7 | 8.7 | 8.7 | 11.0 | 15.1 |
| Cc | 0.2 | 0.2 | 0.2 | 0.4 | 0.3 |
| Cs | 7.6 | 7.5 | 5.0 | 5.3 | 5.5 |
| Ac | 29.6 | 29.4 | 26.5 | 24.7 | 45.8 |
| As | 13.6 | 13.7 | 20.8 | 9.5 | 23.7 |
| Ns | 8.2 | 8.2 | 7.8 | 7.8 | 13.8 |
| Sc | 11.0 | 11.0 | 10.9 | 13.2 | 22.1 |
| St | 4.4 | 4.3 | 1.3 | 2.2 | 1.6 |
| Cu | 12.1 | 12.1 | 12.3 | 13.1 | 16.8 |
| Cb | 4.8 | 4.9 | 5.6 | 13.2 | 18.2 |

Source: data processed from the N.M.A Archive

Analyzing the yearly values of different types of clouds in the hydrographic basin of the Crişul Repede river one can notice that the *Altocumulus* clouds have got the highest frequency (see figure 1) with values between 24.7% in Huedin and 45.8% in Stâna de Vale. The clouds with the lowest frequency are the *Cirrocumulus* (see figure 1) with values between 0.2 in Oradea, Săcueni and Borod, with 0.3 in Stâna de Vale and with 0.4 % the highest percent in Huedin (see table 1, figure 1).

From the superior clouds the *Cirrus* types of clouds have got the highest frequency inthe analyzed area with a value of 8.7% in Săcueni, Oradea and Borod, with 11.0% in Huedin and with 15.1% in Stâna de Vale (see table 1, figure1).

From the clouds situated in the middle level floor the *Altocumulus* have the highest frequency, followed by the *Altostratus* with a frequency of 9.5 in Huedin, of 13.6 in Săcueni, of 13.7% in Oradea, of 20.8% in Borod and in Stâna de Vale it registers the highest value: 23.7%.

The inferior clouds with a higher frequency are the *Stratocumulus* with a frequency between 11% in Oradea and Săcueni, with 10.9% in Borod,with 13.2% in Huedin and in Stâna deVale it has the highest value of 22.1%. The rarest from this level floor are the *Stratus* clouds with values between 1.3 in Borod and 4.4% in Săcueni (see table 1, figure 1).

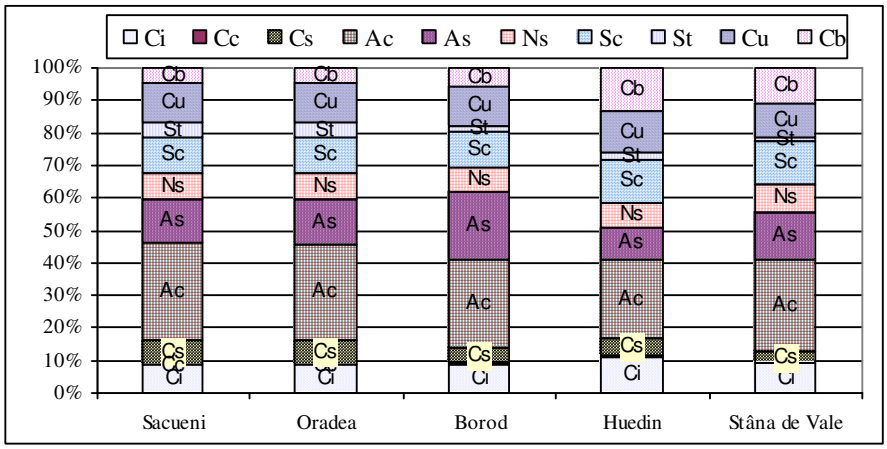



Fig. 1 The yearly frequency of the cloud types (%) in the hydrographic basin of the Crisul Repede river

From the clouds with a vertical development the most frequently met are the *Cumulus*, their frequency is between 12.1% in Oradea and in Săcueni and of 16.8% in Stâna de Vale. The *Cumulonimbus* clouds can be met in a percent of 4.8% in Săcueni, of 4.9% in Oradea, of 5.6% in Borod, of 13.2 in Huedin and of 18.2% in Stâna de Vale.

The frequency of the clouds with vertical development increases together with altitude, the maximum values being registered in the high landscape areas (see table 1).

Analyzing the monthly frequency of the cloud types it may be noticed that during the summer months the most predominant are the clouds with a vertical development, thus the *Cumulus* clouds are more frequent in July with 22.9% in Săcueni and in Oradea, with 20.9% in Borod, with 20.8% in Huedin and with 35.1% in Stâna de Vale. The *Cumulonimbus* clouds have got a high frequency in the plane areas and in hollow areas in June and in the mountain the maximum values are registered in July. Thus in June there

are 11.8% cases in Săcueni, 11.7% cases in Oradea, 13.2% in Borod, 25.3% in Huedin and 38.2% in Stâna de Vale, the latter being the maximum value in the year registered in July (see figure 2).

From the inferior cloud floor the *Stratocumulus* have got the highest values, thus the maximum values are at Stâna de Vale and they are between 28.0% in October and 18.6% in June. In the hollow areas the maximum and the minimum calue is registered in Huedin, thus there are 21.8% in December and 6.6% in June. In the field area the maximum values are registered in November with 15.8 % cases in Oradea as well as in Săcueni and the minimum values are in July with 6.6% cases. The *Stratus* clouds have got a much lower frequency in all the hydrographic basin of the Crişul Repede river and they are more often met in winter months. Their values are between 14.4% in January and 0.4% in April in Săcueni and in Oradea, between 3.3% in November and 0.1% in July in Borod and in Huedin they vary between 7.1% in January and 0.3% in May and in July and in Stâna de Vale the values are between 3.3% in November and 0.4% in June (see figure 2).

From the middle clouds the *Altocumulus* clouds have got a higher frequency. These clouds have a uniform distribution all the year round and in all the hydrographic basin of the Crişul Repede river but still in Stâna de Vale the values are even higher. In all the hydrographic basin of the Crişul Repede basin the maximum values are registered in October and the minimum values in the field area and in the mountain area are registered in January while in Huedin the minimum value is in December and in Borod in June.

Thus, in Săcueni the values are between 36.0% in October and 25.8% in January; in Oradea these values are between 36.0% in October and 25.9% in January and in Borod the maximum value is registered in October with 30.8% and the minimum value of 24.5% is registered in June; in Huedin the maximum value is in October with 27.4% and the minimum value is in December with 22.4%; in Stâna de Vale the values are higher, there are 52.0% in October and 41.3% in January (see figure 2).

From the superior clouds the *Cirrus* clouds have got the highest frequency with a higher frequency in the mountain areas. The maximum values of the *Cirrus* clouds in the hydrographic basin of the Crişul Repede river are registered in August; Huedin makes an exception from this having the maximum value in October and its minimum values are registered in December. Thus, in the mountain area the values vary between 18.5% cases in August and 10.1% in December. In Huedin there are between 14.3% cases in October and 7.7% cases in December. In Borod the cases are between 11.3% in August and and of 5.7% in December. In Oradea and in Săcueni they are between 12.6% in August and 4.2% in December. The

*Cirrocumulus* clouds are the rarest clouds from the hydrographic basin of the Crişul Repede river with a monthly frequency between 0.0% - 0.6% cases (see figure 2).

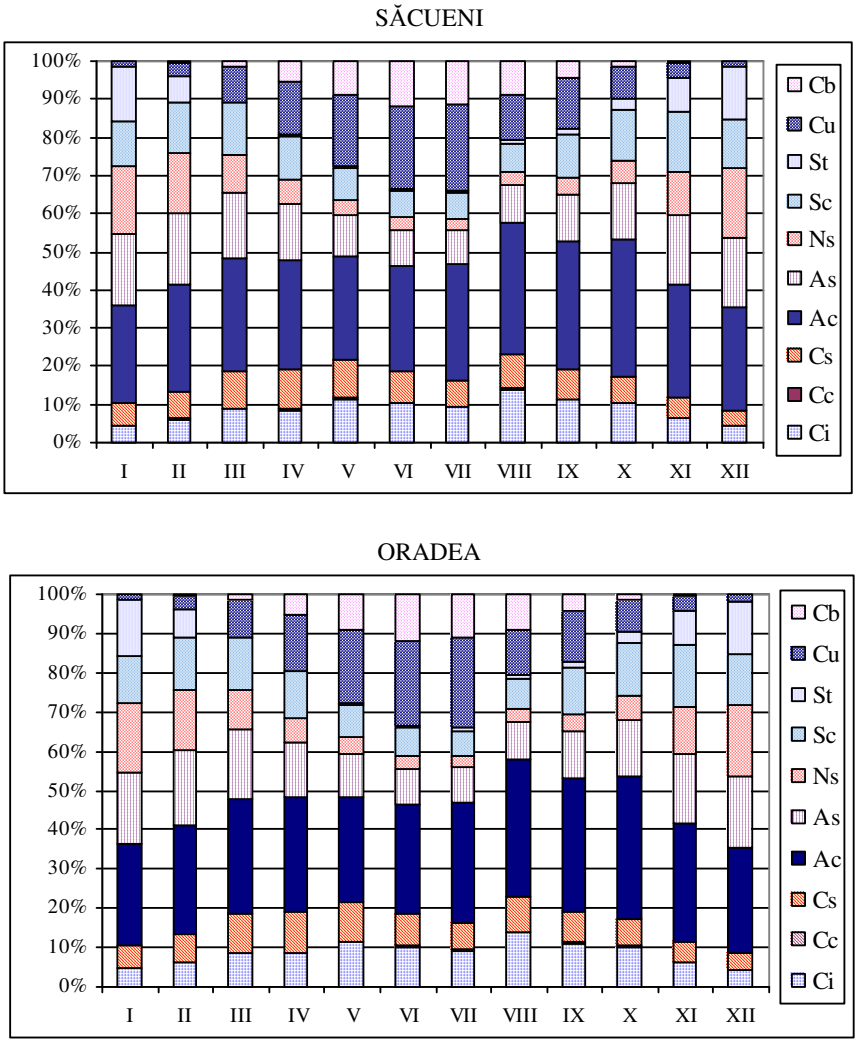
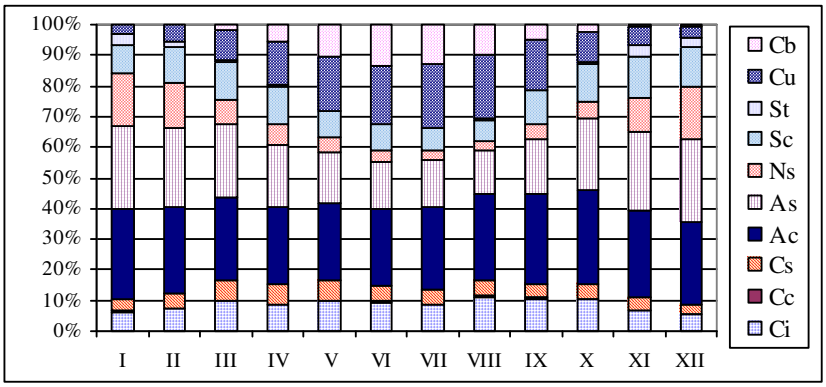
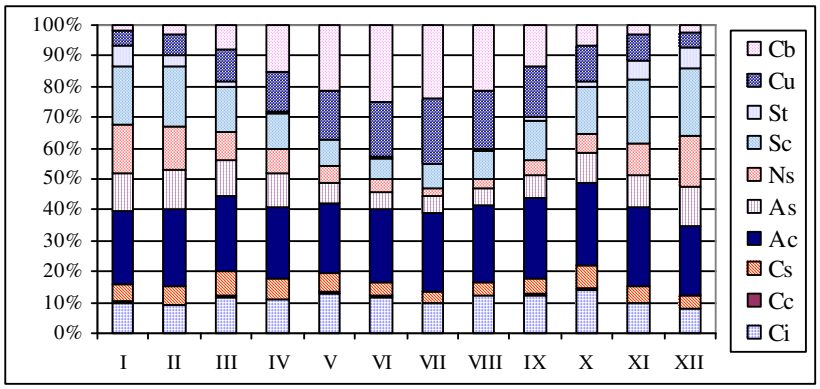



Fig. 2 The monthly frequency of cloud types (%) in the hydrographic basin of the Crisul Repede river

BOROD




HUEDIN




STÂNA DE VALE

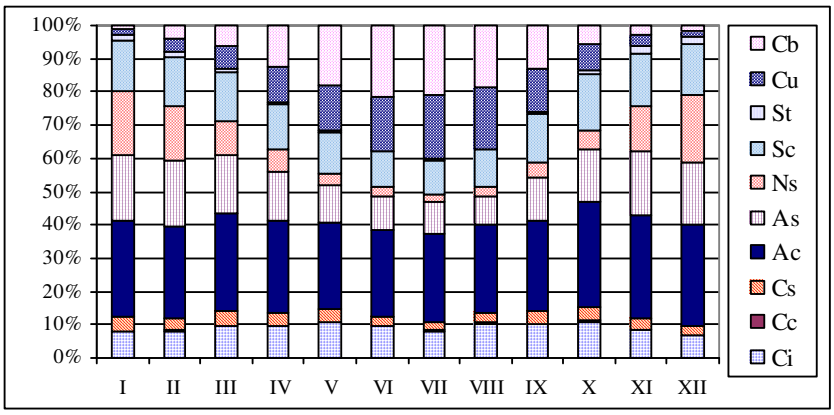



Fig. 2, sequel

**CONCLUSIONS**

The *Altocumulus* clouds have got the highest yearly frequency the values being between 24.7% in Huedin and 45.8% in Stâna de Vale. The clouds with the lowest frequency are the *Cirrocumulus* clouds.

In a monthly regime the predominant clouds are the ones with a vertical development, thus the *Cumulus* clouds are more frequent in July with a frequency between 21 – 35%.

The *Cumulonimbus* clouds have a higher frequency in the field and hollow areas in June and in the mountain areas the maximum values are registered in July.

The *Altocumulus* clouds have a uniform distribution all the year round and in all the hydrographic basin of the Crişul Repede river, with higher values in Stâna de Vale.

The *Cirrocumulus* clouds are the rarest clouds from the hydrographic basin of the Crişul Repede river with a monthly frequency between 0.0% and 0.6%.

**REFERENCES**


1. Berindei I., Gr. Pop, 1972, Judeţul Bihor, Editura Academiei R.S.R., Bucureşti.
2. Berindei O., Gr. Pop, Gh. Măhăra, Aurora Posea, 1977, Câmpia Crişurilor, Crişul Repede, Ţara Beiuşului, Cercetări în geografia României, Editura Ştiinţifică şi Enciclopedică, Bucureşti.
3. Beşleagă N., 1972, Elemente de meteorologie dinamică, I.M.H., Bucureşti.
4. Ciulache S., 2002, Meteorologie şi climatologie, Editura Universitară Bucureşti.
5. Dissescu C.A., 1933, Repartiţia şi variaţia nebulozităţii în România, Memorii şi studii, II, 1, I.M.C, Bucureşti.
6. Dumiter Aurelia Florina, 2007, Clima şi topoclimatele oraşului Oradea, Editura Universităţii din Oradea.
7. Erhan Elena, 1999, Meteorologie şi climatologie practică, Edit. Univ."AL.I.Cuza", Iaşi.
8. Fărcaş I., 1983, Probleme speciale privind climatologia României, partea I, Factorii climatogenetici, Curs litogr., UBB Cluj-Napoca.
9. Fărcaş I., 1990, Meteorologie-Climatologie (Structura şi dinamica atmosferei), Fac. de Geogr., Cluj-Napoca, pag. 165.
10. Gaceu O., 2001, Elemete de meteorologie practică, Editura Universităţii din Oradea.
11. Gaceu O., 2002, Elemete de climatologie practică, Editura Universităţii din Oradea.
12. Gaceu O., 2004, Frecvenţa genurilor de nori în Munţii Bihor şi Vladeasa, Studii şi Cercetări de Geografie, Bucureşti.
13. Gaceu O., 2005, Clima şi riscurile climatice din Munţii Bihor şi Vlădeasa, Editura Universităţii din Oradea.
14. Köteles N., Ana Cornelia Pereş, 2010, Air pollution with powders in suspension ($pm_{10}$ and $pm_{2.5}$) in Oradea city area. Analele Universităţii din Oradea, Fascicula Protecţia Mediului, Vol XIV, Anul 15, International Symposium "Risk Factors for

Environment and Food Safety", Faculty of Environmental Protection, November 5 - 6, Oradea 2010, Editura Universităţii din Oradea, 2010, ISSN 1583-4301.
15. Măhăra Gh., 1977, Nebulozitatea şi durata de strălucire a Soarelui în Câmpia Crişurilor, Lucrări Ştiinţifice, Seria A, Oradea.
16. Măhăra Gh., 1979, Circulaţia aerului pe glob, Editura Ştiinţifică şi Enciclopedică, Bucureşti.
17. Măhăra Gh., 2001, Meteorologie, Editura Universităţii din Oradea.
18. Moza Ana Cornelia, Mariana Popovici, 2006, Aspects regarding turbidity in Oradea, Natural Resources and Sustainable Development: International Symposium: ed a 4-a 10-11oct. 2006, Oradea, University of Oradea, Faculty Environmental Protection, University of Debrecen, Faculty of Agriculture, pag. 289-292.
19. Moza Ana Cornelia, 2009, Clima şi poluarea aerului în bazinul hidrografic Crişul Repede, Editura Universităţii din Oradea.
20. Posea Aurora, 1977, Crişul Repede, în vol. „Câmpia Crişurilor, Crişul Repede, Ţara Beiuşului". Cercetări în Geografia României, Editura Ştiinţifică şi Enciclopedică, Bucureşti.
21. Topor N., C. Stoica, 1965, Tipuri de circulaţie atmosferică deasupra Europei, C.S.A., I.M., Bucureşti.
22. Zăpârţan Maria, Olimpia Mintaş, Ana Moza, Eliza Agud, 2009, Biometeorologie şi Bioclimatologie, Editura Eikon, Cluj-Napoca.
23. *** 1986, Instrucţiuni pentru observarea, identificarea şi codificarea norilor şi fenomenelor meteorologice, I.M.H., Bucureşti.
24. *** 1995, Instrucţiuni pentru staţiile meteorologice, I.N.M.H., Bucureşti.