

## TEMPERATURE INVERSION IN THE CSÍK BASIN

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### Hőmérsékleti inverzió a Csíki-medencében

A Csíki-medence a Keleti-Kárpátok központi részében, Hargita megye déli részén fekszik. Nyugaton a Hargita-hegység, keleten a Csíki-havasok és a Nagyhagymás déli része határolják. Átlagos tengerszint feletti magassága 650–700m. A Csíki-medence azon medencék egyike, amelyekben az év különböző időszakaiban a hideg légtömegek sokáig stagnálhatnak. A melegebb légtömegek a medencében lévő hideg levegőréteg felett helyezkednek el és így kialakul a hőmérsékleti inverzió. A legnagyobb időtartamú és intenzitású inverziók télen, januárban fordulnak elő, amikor átlagosan 10–16 napot tesznek ki. A leghosszabb feljegyzett inverzió 22 napos volt és 1956 február 5–27. közötti észlelték. Az intenzitást, ami elérheti a 10 °C-t, elősegíti az éjszakai hőkisugárzás is. A legvastagabb inverziós réteg (100–200m) ugyancsak a januárra jellemző. Az inverzió kísérője a köd, amelyből a medence lakói következtetni tudnak az inverzió jelenlétére. A medence klímájának másik jellemzője a szélcsend, ami elősegíti a levegő stagnálását. A Csíki-medence éghajlatának ismerete nemcsak tudományos, hanem gyakorlati jelentőséggel is bír, lévén, hogy nagyban befolyásolja az alacsony hőmérsékletek megjelenését, ami a maga során meghatározó az élővilág, a gazdaság és a lakosság egészségi állapotára.

The Csík Basin is situated in the middle section of the Oriental Carpathians as well as in the south-east of Hargita County, between the Hargita Mountain in the west and the southern part of the Nagyhagymás Mountain and the Csíki Mountain, at average height of 650–700m above sea level. The Csík Depression is one of those intramontaneous basins where during particular periods of the year the cold masses of air can stagnate for long. The warmer air from the surrounding higher parts takes place above the colder and denser air of the basin and as a result a temperature inversion appears. The longest and most stable inversion can be observed during the winter months, especially in January, in average 10–16 days. In this time of the year the synoptic conditions are characterised by high pressure and cold continental air which stagnates in the basin. In winter the intensity, which can reach 10 °C, as well as the frequency are increased by the heat radiation during clear nights. The thickest layer of air (100–200m) with temperatures of inversion can also be observed in January. A characteristic phenomenon from which the inhabitants of the depression can deduct the presence of inversion is the fog that develops as a result of the condensation of the humidity of the air as it reaches the cold surface. The knowledge of this climatic peculiarity in the Csík Basin is important not only from the scientific point of view but also from the practical one as during the inversion the lowest temperatures appear which influence the living world, different branches of the economy as well as the health of the population through promoting the accumulation and stagnation of the noxes in the basin.

**Key-words:** Csík Basin, near-surface inversion, air pollution, air stagnation (calm), foggy days, air humidity, influence on the living world, economy and health

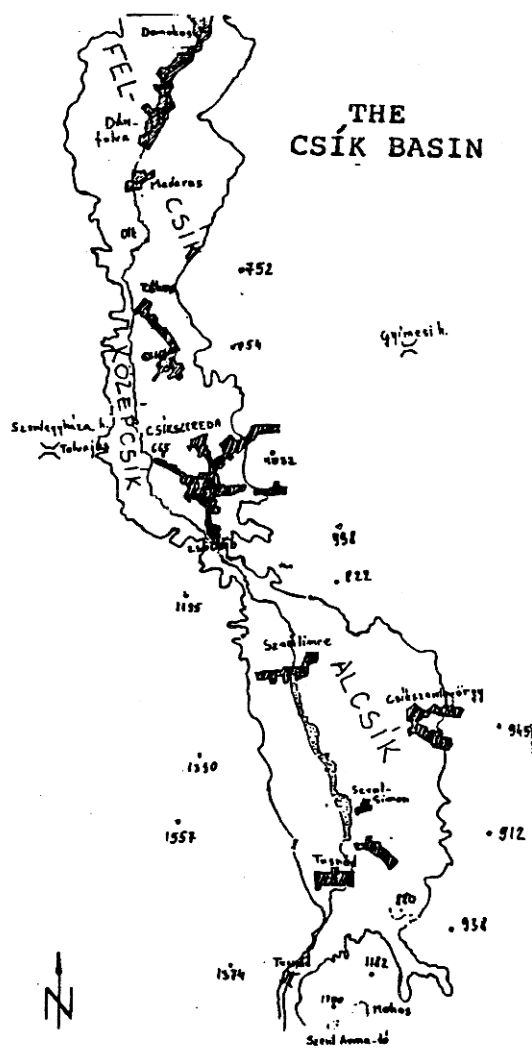


Fig. 1 The geographical situation of the Csík Basin (Romania)

Lower Csík) are clearly individualized.

The only meteorological center of the basin is functioning since 1955 in Csíkserreda. Placed in the northern part of the town on 661 m height above sea level it has the 46° 22' and 25° 44' coordinates.

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The climate of the basin is made special by the mountains situated perpendicularly to the direction of the general atmospheric circulation. The mean annual temperature is 5.8 °C, the average annual precipitation is 540 mm, which is 3 °C and 100 mm less than is Székelyudvarhely, situated in the same conditions except for it is not surrounded by mountains from west. Because of the tectonic thresholds from Csík-rákos and Csíkzsögöd, from north to south the three definite parts of the basin : Felcsík, Középcsik and Alsócsík (Upper-, Middle- and

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In the Csík Basin the temperature inversion is characteristic not only through its duration and intensity but also through its frequency, as the local conditions make possible its development in any season of the year. The inversion can be pointed out especially on the basis of air temperature. However it is very difficult to analyse such a complex natural phenomenon without stepped meteorological centers and aerological measurements. Because there is a lack of such data we can analyse the temperature inversion taking into account the practical observations, number of sunny hours and foggy days as well as the frequency of winds of different directions and the lull.

The longest and most stable inversion can be observed during the winter months, especially in January, 10–16 days on average. In this time of the year the synoptic conditions are characterized by high pressure and cold continental air from north-north-west which enter the depression and stagnate. In this season the intensity, which can reach 10 °C, as well as the frequency are increased by the heat radiation during clear nights helped by the blanket of snow which cools even more the cold and dense air which flows from the surrounding mountains. The thickest (100–200 m) layers of air with temperatures of inversion can also be observed during January.

During the summer because of the shortness of the nights, the high specific heat of soil and the high frequency of breezes the night radiations have much less effect, thus the summer layers of inversion are very thin.

In spring and autumn the rarity inversion is caused by the great instability of the masses of air. In autumn the inversion can be observed in 5–6 days on average, while in spring only in 2–3 days.

Except for the winter, when the inversion is longer, the phenomenon begins to develop in the first hours after midnight, it has the highest frequency in the morning hours and are quite rare during the midday hours when the sun warms the soil and air.

Depending on the synoptic conditions the duration of the temperature inversion can go from hours to days. When the invasion of the cold continental mass of air lasts long the inversion can last for weeks. The longest registered inversion was 22 days long between 5–27 February 1956 but inversions of such duration are fairly rare.

A characteristic phenomenon that follows and of which the inhabitants of the depression deduct the presence of inversion is the fog that develops as a result of condensation of the humidity of the air as it reaches the cold surface. The thickness of the foggy layer depends on how intense the inversion is.

The most frequent inversions can be observed in Alcsík and Középcsík because Felcsík is situated above the fog which shows the inversion.

The difference between the temperatures from above and below the inversion layer can also influence the physical condition of the precipitation. As a consequence it happens quite often that while in the depression it is snowing on the surrounding heights it is raining.

An important characteristic of the climate of the depression is the calm which has the highest extent during winter: 62.5% on average, while in January 64.2%. This is the reason why the foggy layer does not dissipate until another mass of air moves it out of the depression. This stillness is explained by the fact that the warmer layer of the inversion situated above the cold one prevents the convection.

The unfiltered smoke coming out of the chimneys of factories and plants ascend only to this limit and then it spreads horizontally as the vertical dispersion is impossible. This polluted stratum can be well observed from the adequate heights of the surrounding mountains. Just like the smoke the fog also ascends only to the lower part of the warm stratum. This is shown by the adaptation of the natural vegetation : at the height of the warm air there can be found the broad-leaved forests (beech trees), while the pine trees live in the lower, colder parts of the depression.

The knowledge of this climatic peculiarity of the Csík Basin is important not only from scientific point of view but also from the practical one as during the inversion appear the lowest temperatures which influence the living world, different branches of the economy as well as the health state of the population through promoting the accumulation and stagnation of the noxes.

Because of the inversion the sunny hours in the depression decrease very much (on average 1778 hours/year, minimum 50 in December; maximum 230 in July) but the number of foggy days is greatly increased (on average 82 days, but in 1980 there were registered 152 foggy days) as well as the relative humidity content of the air (there are many days in which it is over 74%, the maximums being registered in winter: 86–89%).

Measurements of the quality of the air are made in Csíkszereda. The SO<sub>2</sub>, NO<sub>x</sub>, and NH<sub>3</sub> content are measured in the western industrial part of the town and at the Environmental Agency. The content of ammonia in the air in the industrial district is only 1% over the allowable value. It is to be noted that the polluting enterprises do not have aerological laboratories and that their filters do not work.

Another negative phenomenon in the town is the lack of green belts which should be planted between the industrial and the housing zones because the western industrial zone is situated in the way of the movement of the air so the polluted air is directed over the town. In spite of this there cannot be noticed differences in the demographic factors between the polluted and clean zones. The required calculations at the Health Center of Csíkszereda however, show that especially the respiratory and circulatory diseases and cancerous cases are increasing: in 1985 one of 65 people, while

in 1989 one of 37 people was ill. The increase of cancerous diseases is the following: in 1985 one of 632 people, while in 1988 one of 439 people had the disease.

These facts show that preserving our relatively pure environment in its actual state and also its improvement must be considered of major importance no matter how confusing and hard our present day economical problems are.