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# OPPORTUNITIES OF CROSS-BORDER COOPERATION REGARDING ACTIVE INTERVENTIONS INTO THE ATMOSPHERE

## ABSTRACT

The out of control leaking of greenhouse gas emissions brings Terra one step closer to an imminent Armageddon scenario, in which the dramatic climate changes incurred may easily turn our planet into an inhospitable and improper place for human life.

Under the circumstances, the adjustment to the major climate changes can draw deep economic and social alterations as well as new environment protection regulations that are mainly meant to diminish and eventually stop green gas emissions, but also accommodate to the newly developed situation whose evolution cannot be precisely anticipated.

The possibility of lowering the risks in the case of certain climate vulnerabilities, such as hailfall for instance, is a fact, provided the proper technical tools are engaged. This can be achieved through local or regional internal systems, but it may register higher cumulative effects by cross-border or Euro regional actions.

The present paper reviews the current and future state of hailfall control in Romania, reconsidering the system developmental possibilities through cross-border or Euro regional projects.

**Key words:** adjusting to climate changes; hailfall control; control units for hailfall; cross-border projects.

**JEL Classification:** Q25, O13, O21.

## 1. INTRODUCTION

The contemporary world, now more than ever, is increasingly vulnerable to special natural phenomena, intensified by the undeniable climate changes that have taken place over the last few decades.

The out of control status of greenhouse gas emissions has lead our post-industrial humanity to an unforeseen paradox: it is obvious that all the human activities are generated by anthropic phenomena, by the constant decay of the environment, which is altogether at nature's will, by major cyclic modifications, more or less known and fully understood by the human civilization.

Are we indeed aware of the fact that environment is the collocation by which the frame of existence and biological life expansion is defined, the one that summons up all the elements that interact and thus create the perfect ambience for running our human life and activities?

The overwhelming generosity of our planet's natural environment has given us the false impression that we can take anything and everything, anywhere and everywhere, at any given time without giving back, without helping regeneration and further, by poisoning the natural ambience to an extent that makes us wonder if there is any way back?

## 2. STATE OF KNOWLEDGE

The international community has acknowledged by various forms these major climate changes. Therefore, the first international action committed to environment protection took place in Rio de Janeiro in 1992, where the United Nations Framework Convention on Climate Change was signed, a decree affirmed by Romania by Law no. 24/1994. Within the Convention, 194 countries agreed to take long-term measures to stabilize the greenhouse gas concentration from atmosphere at a level that could prevent the dangerous effects of air pollution on the climate system.

In 1997 in Kyoto (Japan), the developed countries of the world agreed on fighting against the climate change by assuming a series of actions for the active limitation and diminution of greenhouse gas emissions in the period 2008-2012. A series of scientific reports following the event foresaw a diminution of greenhouse gas emissions by 50% in the developing countries by the year 2050 and by 60-80% in the developed countries as compared to 1990.

The last Report of the Intergovernmental Panel on Climate Change envisaged that climate change would have a great impact upon the economies and societies of the member states of the European Union. Consequently, in 2009, following an ample consultation with the member states and the factors involved, the European Commission published the "White Paper – Adapting to climate change: Towards a European framework for action". On its basis, Romania developed the "National Strategy on Climate Change 2013-2020", taking into account two distinctive action pawns: 1) reducing the greenhouse gas emissions; 2) adapting to the impacts of climate change. Thus, it is an acknowledged fact that the diminution of greenhouse gas emissions is an arduous process, which raises serious concerns regarding the real capacity of their limitation and, most of all, concerns about providing a reversible growth course of the environment protection safety.

To that end, the strategy acknowledges the necessity of adapting to the climate change impacts. In this context, the active interventions into the atmosphere are progressively playing a greater part. Thus, on the basis of Law no. 604 of July 28, 1999 on the approval of the National Anti-Hail Program and its

financing, by Article 6 that modifies Law no. 980/1998 for founding a National Company, the "National Institute of Meteorology, Hydrology and Water Management" within the Ministry of Waters, Forests and Environment Protection, in the year 2000 the Pilot Unit for Hail Suppression was created, with civil employees under the Army Ammunition Autonomous Authority and with the obligation, as executor, to produce and homologate Prahova Pilot Unit for Hail Suppression.

In 2002, the Government's Decree no. 629/2002 modified and complemented Government's Decree no. 363/2002 on the organization and operation of the Ministry of Agriculture, Food and Forests, by which the National System for Hail-Suppression and Rainfall Enhancement (NSHSRE) was transferred from the Ministry of Waters and Environment Protection to the Ministry of Agriculture, Food and Forests, where the Department for Coordination of the NSHSRE program was created, simultaneously with the foundation of the Pilot Unit for Hail Suppression through Prahova General Direction for Agriculture and Food Industry, with the involvement of S.C. Electromecanica Ploiești S.A. as executor.

Currently, Law no. 139/2014, Article 9 and Government's Decree no. 1186/2014 on the organization and functioning of the Authority for the Management of the National System for Hail Suppression and Rainfall Enhancement specify the foundation of the Authority for the Management of the National System for Hail Suppression and Rainfall Enhancement as expert agency with legal status of the central public administration, funded by the state budget and under the Ministry of Agriculture and Rural Development.

Law no. 173/2008 on the active interventions into the atmosphere created the general legal framework where all the activities involving artificial weather modification are to be run. In agreement with Article 1, line 2 of Law 173/2008, the activities related to active interventions into the atmosphere are of national public interest and abide by the enforced law in accordance with the recommendations of the International Meteorological Organization (IMO) in conformity with the international regulations Romania is in line with. The activities are complex, have a research and operational protection profile in direct connection with the disasters caused by extreme or harmful weather phenomena as a consequence of the global climate change (Law no. 173/2008 article 1, line 3).

The objectives of the activities are mainly the following (Law 173/2008, Article 2):

a) reducing the risks of harmful weather phenomena for the population, economic areas and crops (hailstorms, thick haze, local tornadoes);

b) increasing the amount of precipitations in the country's interest areas (rainfall, snowfall);

c) actively taking part in the international and regional programs in the field.

Under the circumstances, by Government's Decree no. 256/2010, the Developing Program of the National System for Hail Suppression and Rainfall Enhancement (NSHSRE) during 2010-2024 was approved, which becomes the

scheduled document dividing the main activities regarding the NSHSRE development into annual and multi-annual components aiming at the following:

I. Scientific research, technical development and technologies of active intervention into the atmosphere;

II. Implementing the National System for Hail Suppression and Rainfall Enhancement;

III. The operational management of the system and structural units for the protection of population and economy against the risks of extreme or harmful weather phenomena;

IV. European projects in the field of active intervention into the atmosphere and international collaborations;

V. Program of professional training in the field of active intervention into the atmosphere.

It is worth mentioning that before issuing the Government's Decree no. 256/2010 on the NSHSRE development program during 2010–2024, X previous stages were completed in the period 2000-2009 and later on other VII were completed in the period 2010-2016; on the average, investments of about 2.2 million Euro/year were scheduled for the XVII annual stages.

## 3. MATERIAL AND METHOD

Overall, the NSHSRE development program – scheduled to be completed in 2024 – is based on the references provided by the scientific research in the field. Thus, the Institute of Geography of the Romanian Academy presented the synthesis *The Hail Vulnerability of the Romanian Territories* (section 7.3.5.) of the volume "The Climate Risks in Romania" (published in 1999 based on the research conducted within the Academy Grant no. 3004/1997, under the coordination of Ph.D. Octavia Bogdan, senior researcher and laboratory chief of Topo-Climatology). Based on two quantifiable indices, the medium annual number (n) and the maximum annual number (N) of hail in Romania were located in four hail vulnerability areas:

1. Low-vulnerability territories ($n < 1$ day; $N > 4$ days);
2. Intermediary-vulnerability territories ($n = 1–2$ days; $N = 4–5$ days);
3. High-vulnerability territories ($n = 2–6$ days; $N = 5–10$ days);
4. Combined vulnerability territories (depending on the exposure of versants against the advection of damp air or against the insulation degree).

The area with the highest hail vulnerability are in the central-southern part of the country, i.e. in the following plains: Gǎvanu-Burdea, Boianul, partially Burnazul, Caracal, the Getic Piedmont, the Getic and Curvature Subcarpathians, especially the interference area of the western and eastern circulation. On an isolated basis, the same vulnerabilities exist in Timiș couloir till Lugoj bay, Lipovei hills, a few aisles in the Transylvania plateau and in the Central Bărăgan Plain, at the outskirts of Brăila and Constanța cities, etc.

Medium vulnerability is a characteristic of most territories in the Western plain and hills, Transylvania plateau, Bârlad plateau, Suceava plateau, the Moldavian Subcarpathians, the south-east of Oltenia, the Danube plain of terraces and western Bărăgan.

The non-periodical wide variety of climate at global scale, which engages air masses of different origins has produced a range of high-risk and dangerous climate phenomena that could determine significant economic, social and environmental prejudices (see op.cit. of Bogdan).

This is the reason why the specialty literature from Romania and other countries involves so many publications approaching different aspects generated by hailfall. Over time, numerous studies, articles, reports, statistical series, case studies, volumes and treatises on hailfall have been published. There are countries with a special experience in the field, some of these being located in the cross-border interference area with Romania. Worth mentioning are the scientific works by a group of researchers from the Faculty of Electromechanics from Craiova University. We would like to mention here Gheorghe Manolea (professor and engineer), Laurențiu Alboteanu (assistant professor and engineer) and Constantin Șulea – Iorgulescu (Ph. D. instructor and engineer), who ran the cross-border project RO-BG MIS ETC 166 "Joint Risk Monitoring during Emergencies in the Danube Area Border" in the period 2011–2014, which is a continuation of the doctoral studies and of some projects funded by EU and generated by a collaboration started earlier in 2000 between The Centre of Innovation and Technological Transfer of Craiova University and the Technical University of Moldova from Chișinău, developed within Moldova program of Technical and Scientific Cooperation, by which researches were initiated on the modernization of complementary equipment for anti-hail systems. Another worth mentioning collaboration is between the Authority for the Management of National System for Hail Suppression and Rainfall Enhancement from Romania and the Special Service for Active Influences on the Hydro-Meteorological Processes from the Republic of Moldova, in the line of professional training in the field of active interventions into the atmosphere. By this program, the specialists of the licensed operator for Moldova, SC General Conf Grup SRL of Bucharest, succeeded to train their entire operational staff from the command units, namely, UCCG Moldova 1 Iași and UCCG Moldova 2 Vrancea in the Republic of Moldova.

## 4. RESULTS AND CONCLUSIONS

In this context, the mentioned program addresses three zonal coordination centers with the following hail-suppression units (ZCC as in Zonal Coordination Center):

– Muntenia ZCC with Prahova pilot unit for hail suppression and Oltenia hail-suppression unit;

– Moldova ZCC with Moldova 1 Iași unit for hail suppression and Moldova 2 Vrancea unit for hail suppression;

– Transilvania ZCC with Mureș unit for hail suppression, Timiș unit for hail suppression and Maramureș unit for hail suppression.

The system will insert two other units for rainfall enhancement, one in Moldova ZCC and the other one in Muntenia ZCC. Practically, the complete coverage of the high and medium-vulnerability areas against hailfall allows NSHSRE to develop some European projects in the field of active interventions into the atmosphere as well as international collaborations, such as:

1. Reducing the hailfall impact for the sustainable development in the south-east of Europe, involving the active participation of countries in the mentioned region;
2. The electrical power-supply from the photovoltaic systems of the launching units of Moldova 1 Iași, with the participation of the Republic of Moldova;
3. Preparing for emergencies so as to reduce hailfall for sustainable development in Romania-Moldova cross-border area;
4. Integrated system for disaster prevention caused by hailfall in Romania-Bulgaria cross-border area;
5. Weather modification through active interventions into the atmosphere in the context of climate change and sustainable development in Banat area (Romania-Serbia);
6. Other European collaboration projects in the field of active intervention into the atmosphere;
7. Other collaboration projects with non-EU countries in the field of active intervention into the atmosphere.

The active structures from the system formulated a series of suggestions on projects themes, such as:

1. Experimental project for late spring frost suppression in fruit-trees;
2. Integrated management of the monitoring and intervention for risk-reduction generated by extreme weather phenomena in Romania-Moldova cross- border;
3. Research on the enlargement of protected area against hail, rainfall enhancement and suppression of other extreme weather phenomena.

Therefore, the active interventions into the atmosphere are concrete adjusting actions to climate change aiming at the disempowerment of cloudy cores with high-risk of hailfall and, having the possibility of system development by adding other types of active interventions into the atmosphere, like rainfall enhancement. Since the environment protection is a prerogative of any country's national security, the active interventions into the atmosphere get a special significance in certain areas, such as: cross-border, Euro-regional, Community, continental or even global areas. In other words, adapting to climate change represents a recognition of their existence and a necessity of international collaboration at all possible levels for active interventions for risk prevention, suppression and reduction and adjustment to major climate changes on a long-term global scale.

The common strategy of mankind on adapting to climate change is concurrent with the famous phrase of William Shakespeare, when Hamlet, without any prejudice, asks himself "To be or not to be". It is the very question that makes all the difference in our case: to remain without the proper natural environment for human life or to adapt to climate change regardless of the price paid or our future alterations at economic, social and, possibly, genetic level. It is now the moment when the existential aspect of humankind gets fundamental as never before.

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