Journal of the Georgian Geophysical Society,
Issue B. Physics of Atmosphere, Ocean and Space Plasma, v.19B, 2016, pp. 73-78

On the Use of Anti-Hail Rockets "Trayal D 6- B" in the Work of Anti-Hail System in Kakheti (Georgia)

[1]Avtandil G. Amiranashvili, [1]Victor A. Chikhladze, [2]Ucha V. Dzodzuashvili, [3]Gocha A. Jincharadze, [3]Mikheil G. Pipia, [2]Ioseb P. Sauri, [2]Shmagi O. Telia

[1]M. Nodia Institute of Geophysics of I. Javakhishvili Tbilisi State University,
e-mail:avtandilamiranashvili@gmail.com
[2]Military Scientific-Technical Center "DELTA"
[3]Institute of Hydrometeorology ofGeorgian Technical University

ABSTRACT

In the Kakheti region of Georgia in the work of anti-hail system anti-hail rockets "Trayal D 6-B" of the production of Serbia from September 2016 are used. Some results of the calculations of the optimum areas of cloud seeding by the crystallizing reagent for 83 points of action located on the protected territory in Kakheti are given.

Key Words: Weather modification, anti-hail rockets.

Introduction

Georgia is one of the hail-dangerous countries of world. Large-scale work on the weather modification in the Soviet period prior to the end of the eightieth years of past century in eastern Georgia, including fight with the hail was conducted [1,2]. Taking into account importantly this problem with the support of the government of Georgia, to the active operation of Scientific-Technical center "Delta", the collaborators of institute of geophysics and institute of hydrometeorology, the work of anti-hail service in Kakheti in the end of May 2015 was restored [3-6].

At present the anti-hail service works in the test regime. From the set of anti-hail items [2,7,8] in 2015 year it was possible to acquire the anti-hail rockets SK-6 of the productions of Macedonia [2,5,9], which were used until August 2016. From September 2016 for dealing with the hail anti-hail rockets "Trayal D 6- B" of the production of Serbia are used [10].

Some results of the calculations of the optimum areas of cloud seeding by the crystallizing reagent for 83 points of action located on the protected territory in Kakheti are given below.

Material and methods

To protect the whole region of Kakheti (650 thousand hectares) in 2016 year 83 launching points were used. There is a rocket launching device, solar panel, grounding and security systems installed on the launching site. The launching device carries 26 anti-hail rockets, aims to any given direction and fires [5,6,8,9]. The launchers at the heights from 205 to 1775 m above sea level placed. In the range of heights from 205 to 500 m located 34 launchers, from 501 to 700 m - 35 launchers, from 701 to 1000 m - 12 launchers, from 1100 to 1775 m - 2 launchers (Fig. 1).

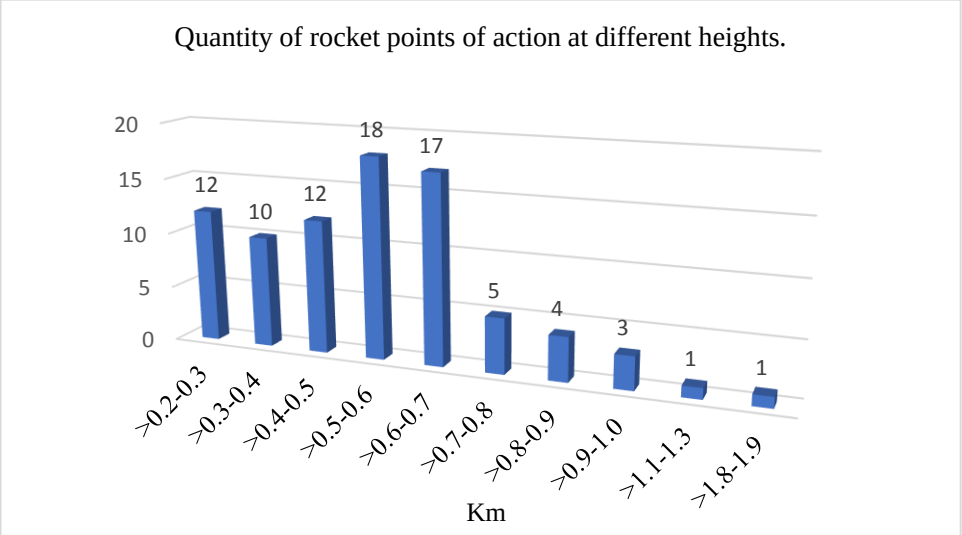

Fig. 1. Quantity of rocket points of action at different heights in Kakheti in 2016. In all - 83 points.

The anti-hail rocket „Trayal D-6B“ the production of Serbia (fig. 2) is an unguided, 55 mm rocket, which carries $4.0 \cdot 10^{15}$ particles of silver iodide reagent and disperses it for 29 seconds [10]. Some parameters of anti-hail rocket „Trayal D-6B“ represented lower. The number of rockets needed during one year estimated to be 5000-6000 units.

Fig. 2. Anti-hail Rockets „Trayal D-6B“ in the container for the transport (http://www.valjevskaposla.info/wp-content/uploads/2017/04/rakete.jpg).

Anti-hail rocket „Trayal D-6B“ parameters.

- Rocket quantity in launching device SD-26 or SD-52: 26-52 rockets
- Elevation: 55-80°
- Traverse: 360°
- Rocket diameter: 55 mm
- Rocket length: 840 mm
- Rocket weight: 3550 gram
- Rocket maximum velocity: 600 m/sec
- Shoot maximum distance (elevation 55°): 7400 meter
- The maximum from sea level (elevation 80°): 5600 meter
- The outlet of reagent from the rocket at a temperature -10°C – $4.0 \cdot 10^{15}$ particles

The calculations of the optimum areas of cloud seeding by the crystallizing reagent it was carried out taking into account level of the zero isotherm (and isotherm -6.0 °C), which as a result of the warming of climate [11-14] grew by several hundred meters [15,16], and also heights of the arrangement of launchers.

Results and discussion

The results of calculations on Fig. 3 and 4 are presented.

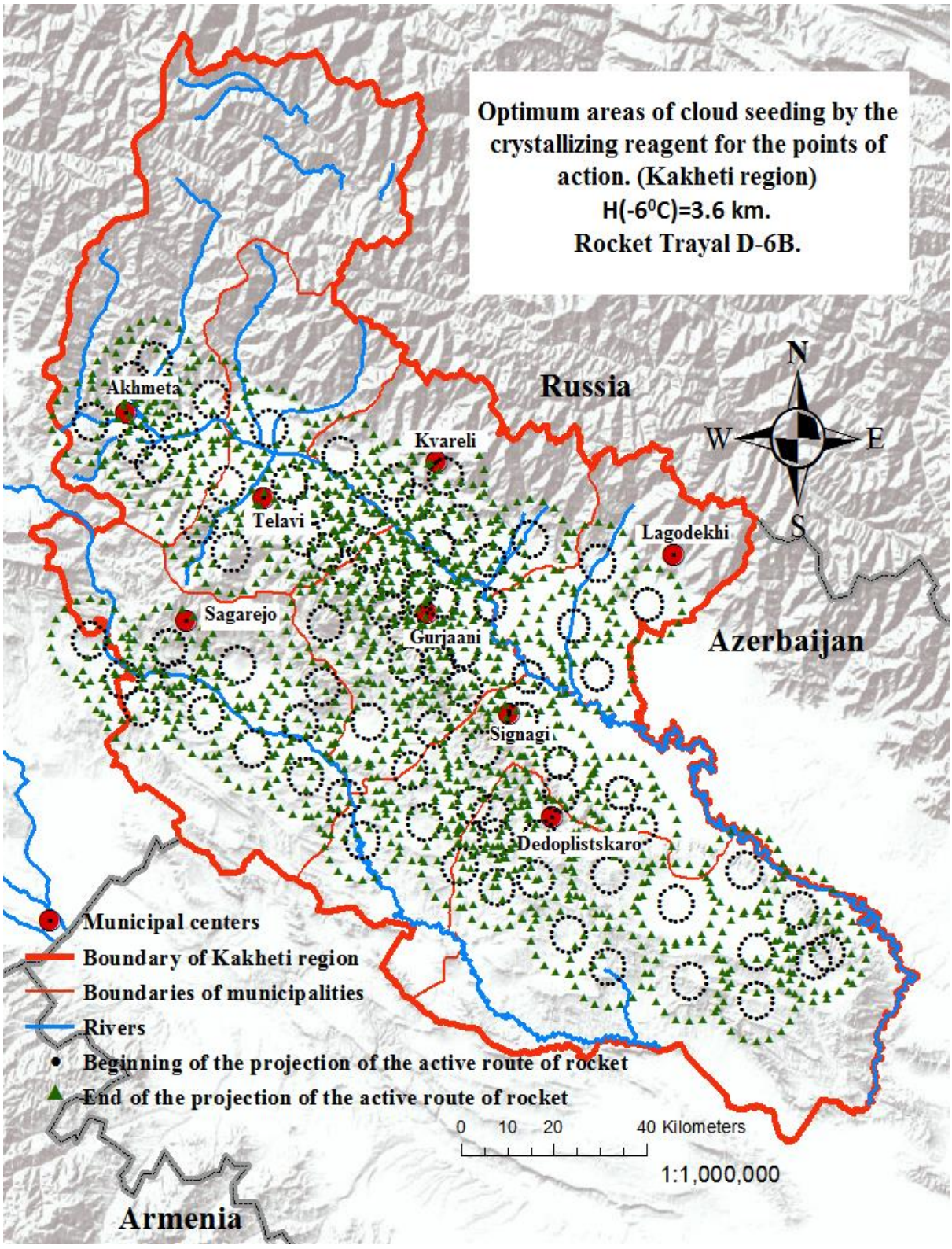

Fig. 3. Optimum areas of cloud seeding by the crystallizing reagent for the points of action by anti-hail rockets “Trayal D-6B” in the protected territory in Kakheti. Height of the isotherm -6°C = 3.6 km.

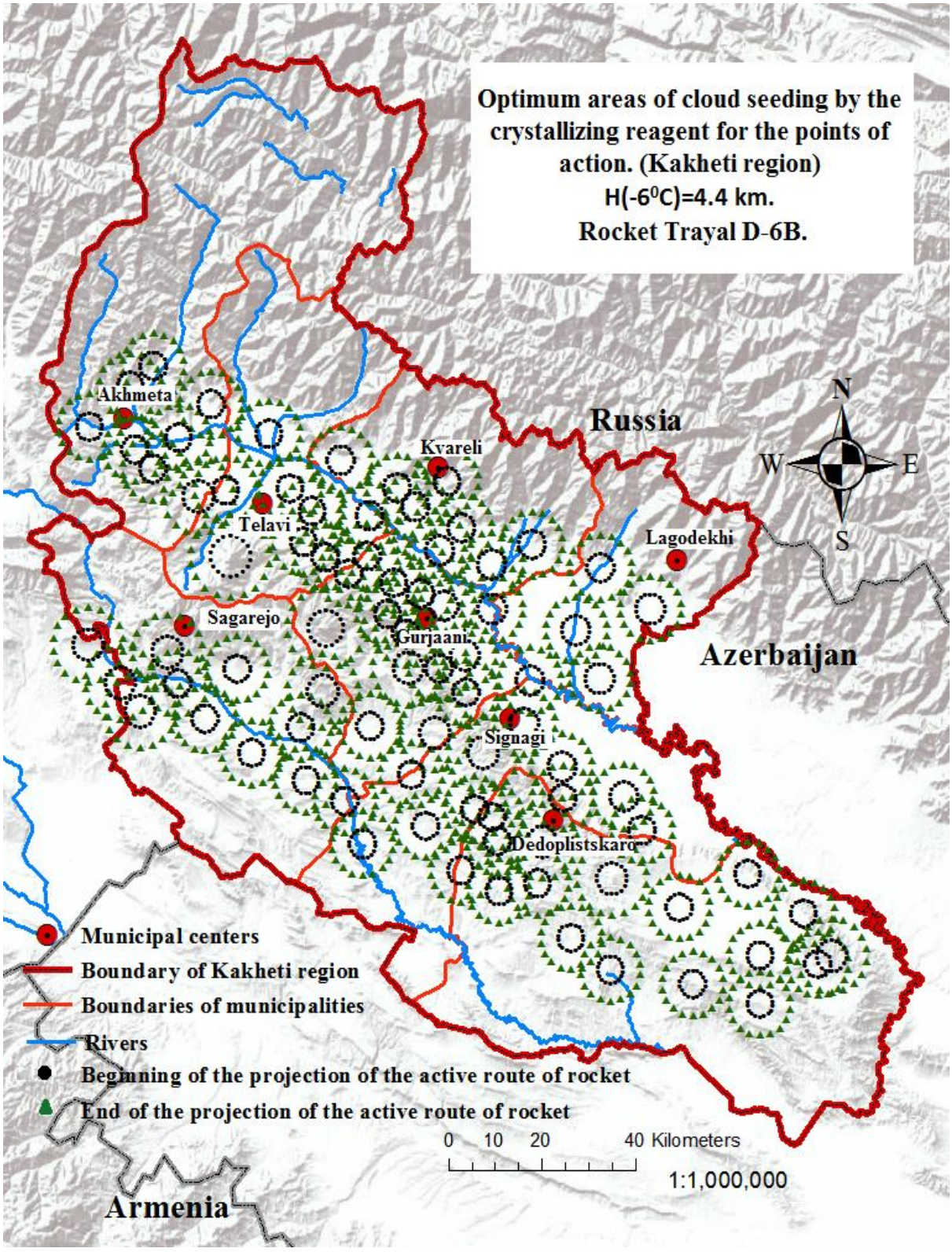

Fig. 4. Optimum areas of cloud seeding by the crystallizing reagent for the points of action by anti-hail rockets "Trayal D-6B" in the protected territory in Kakheti. Height of the isotherm -6°C = 4.4 km.

Optimum areas of cloud seeding by the crystallizing reagent depend on the height of the arrangement of launchers and level of isotherm -6℃ (Fig. 3,4). As follows from these figures distribution of the optimum areas of cloud seeding by reagent is unevenly. Basic reason for this - the insufficiently long courses of the rocket "Trayal D-6B". Therefore, in near future the production of anti-hail rockets with the improved ballistic characteristics is planned (increase in the effective radius of action, etc.).

Conclusions

The Anti-hail service in Kakheti for several years will be function in test regime. In this period of time it is planned to improve means and methods of anti-hail protection in connection with local conditions and possibilities of obtaining the means of action and tracking of the hail clouds. The newly created distance automatic system of action on the clouds will be simultaneously improved, a question about the organization of own production of anti-hail rockets will be examined, etc.

References

[1] Amiranashvili A., Dzodzuashvili U., Lomtadze J., Sauri I., Chikhladze V. Some Characteristics of Hail Processes in Kakheti. Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, v. 65, Tb., 2015, pp. 77 – 100, (in Russian).

[2] Abshaev A.M., Abshaev M.T., Barekova M.V., Malkarova A.M. Rukovodstvo po organizacii I provedeniu protivogradovih rabot. ISBN 978-5-905770-54-8, Nalchik, Pechatni dvor, 2014, 500 s, (in Russian).

[3] Amiranashvili A., Ghlonti N., Dzodzuashvili U., Lomtadze J., Chikhladze V. On the renewal of anti-hail works in Georgia. Int. Conf. "Advanced Problems in Geophysics". Reports, presented on the Scientific Conference "80 years of the M. Nodia Institute of Geophysics". Tb., 2014, pp. 208-212, (in Russian).

[4] Amiranashvili A., Ghlonti N., Dzodzuashvili U., Lomtadze J., Chikhladze V. O vosstanovlenii sluzhby bor'by s gradom v Kakhetinskom regione Gruzii. Doklady Vserossiyskoy otkrytoy konferentsii po fizike oblakov i aktivnym vozdeystviyam na gidrometeorologicheskiye protsessy, posvyashchennoy 80-letiyu El'brusskoy vysokogornoy kompleksnoy ekspeditsii AN SSSR, 7-9 oktyabrya 2014 g., chast' 2, FGBU «Vysokogorniy Geofizicheskiy Institut», Nal'chik, 2015, s. 132-139, (in Russian).

[5] Amiranashvili A.G., Chikhladze V.A., Dzodzuashvili U.V., Ghlonti N.Ya., Sauri I.P. Reconstruction of Anti-Hail System in Kakheti (Georgia). Journal of the Georgian Geophysical Society, Issue B. Physics of Atmosphere, Ocean and Space Plasma, v.18B, Tb., 2015, pp. 92-106.

[6] Amiranashvili A., Burnadze A., Dvalishvili K., Gelovani G., Ghlonti N., Dzodzuashvili U., Kaishauri M., Kveselava N., Lomtadze J., Osepashvili A., Sauri I., Telia Sh., Chargazia Kh., Chikhladze V. Renewal works of anti-hail service in Kakheti. Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, v. 66, Tb., 2016, pp. 14 – 27, (in Russian).

[7] Amiranashvili A., Dzodzuashvili U., Chikhladze V. Anti-Hail Rockets of the Surface-to Air Type. Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, v. 64, Tb., 2013, pp. 151 – 159, (in Russian).

[8] Amiranashvili A., Dzodzuashvili U., Lomtadze J., Sauri I., Chikhladze V. Means of action on atmospheric processes in Kakheti. Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, v. 65, Tb., 2015, pp. 113 – 120, (in Russian).

[9] Amiranashvili A., Barekchian I., Dvalishvili K., Dzodzuashvili U., Lomtadze J., Osepashvili A., Sauri I., Tatishvili G., Telia Sh., Chikhladze V. Characteristics of ground means action on hail process in Kakheti. Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, v. 66, Tb., 2016, pp. 39 – 52, (in Russian).

[10] Anti-hail Rocket "Trayal D-6B" Technical Description. TRAYAL Corporation Factory for Production Explosives and Pyrotechnics. Ševac, Serbia, 2016, 20 p.

[11] Budagashvili T., Karchava J., Gunia G., Intskirveli L., Kuchava T., Gurgenidze M., Amiranashvili A., Chikhladze T. Inventory of Greenhouse Gas Emissions and Sinks. Georgia's Initial National Communication on Under the United Nations Framework Convection on Climate Change, Project GEO/96/G31, Tb., 1999, 137 p.

[12] Amiranashvili A., Chikhladze V., Kartvelishvili L. Expected Change of Average Semi-Annual and Annual Values of Air Temperature and Precipitation in Tbilisi. Journ. of Georgian Geophysical Soc., Issue B. Physics of Atmosphere, Ocean and Space Plasma, ISSN 1512-1127, v. 13B, Tb., 2009, pp. 50 – 54.
[13] Amiranashvili A., Matcharashvili T., Chelidze T. Climate change in Georgia: Statistical and nonlinear dynamics predictions. Journ. of Georgian Geophysical Soc., Iss.(A), Physics of Solid Earth, v.15A, Tb., 2011-2012, pp. 67-87.
[14] Tavartkiladze K., Begalishvili N., Kharchilava J., Mumladze D., Amiranashvili A., Vachnadze J., Shengelia I., Amiranashvili V. Contemporary climate change in Georgia. Regime of some climate parameters and their variability. Monograph, ISBN 99928-885-4-7, Tb., 2006, 177 p., (in Georgian
[15] Bliadze T., Jamrishvili N., Iobadze K., Tavidashvili Kh. Changeability of height of zero isotherm in Kakheti into the season of the anti-hail works of 2015. Transactions of Mikheil Nodia Institute of Geophysics, v. 66, ISSN 1512-1135, Tb., 2016, pp. 90-95, (in Russian).
[16] Jamrishvili N. K., Tavidashvili Kh. Z. Vertical distribution of the monthly mean values of the air temperature above the territory of Kakheti (Georgia) in the central months of the year 2012-2016. Journal of the Georgian Geophysical Society, Issue B. Physics of Atmosphere, Ocean and Space Plasma, v.19B, Tb., 2016, pp. 66-72.

კახეთის (საქართველო) სეტყვასაწინაათმდეგო სისტემის მუშაობაში “Trayal D 6-B” ტიპის სეტყვასაწინააღმდეგო რაკეტების გამოყენების შესახებ

ა.ამირანაშვილი, ვ.ჩიხლაძე, უ.ძოძუაშვილი, გ.ჯინჭარაძე,
მ.ფიფია, ი. საური, შ. თელია

რეზიუმე

2016 წლის სექტემბრიდან საქართველოში კახეთის რეგიონში სეტყვასაწინააღმდეგო სამსახურში გამოიყენება სერბეთის წარმოების “Trayal D 6-B” ტიპის სეტყვასაწინააღმდეგო რაკეტები. კახეთში დასაცავ ტერიტორიაზე განლაგებული ზემოქმედების 83 პუნქტისთვის მაკრისტალიზებელი რეაგენტით ღრუბლების ჩათესვის ოპტიმალური ფართობების გათვლების ზოგიერთი შედეგია მოყვანილი.

Об использовании противоградовых ракет “Trayal D 6-B” в работе противоградовой системы в Кахетии (Грузия)

**А.Г. Амиранашвили, В.А. Чихладзе, У.В. Дзодзуашвили,
Г.А. Джинчарадзе, М.Г. Пипиа, И.П. Саури, Ш.О. Телия**

Резюме

С сентября 2016 года в Кахетинском регионе Грузии в работе противоградовой системы используются противоградовые ракеты “Trayal D 6-B” производства Сербии. Приводятся некоторые результаты расчетов оптимальных площадей засева облаков кристаллизующим реагентом для 83 пунктов воздействия, расположенных на защищаемой территории в Кахетии.