Materials of Conferences

OPTIMIZATION OF PRECIPITATION MODIFICATION AIMED AT RAINFALL ENHANCEMENT AND HAIL PREVENTION

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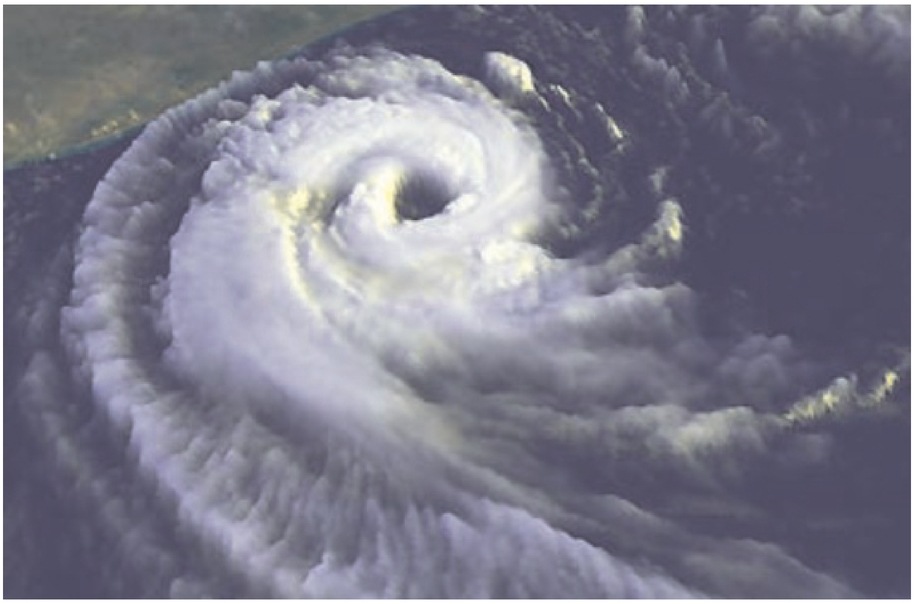
Introduction. Advantages and disadvantages of rocket cloud modification technology are analyzed, and optimization directions are outlined.

The proposed optimization techniques are based on:

– the author's personal long-term experience as the founder and director of research-production organization engaged in solving multiple problems of active modification of meteorological processes (Moldova, 1965–1991)

The organization, established in 1965 by the Central Aerological Observatory the (city of Dolgoprudny) from its onset became the center of research and development of rocket cloud modification technology in the USSR. The technology is aimed at prevention of hail formation, enhancing rainfall from various cloud types in different seasons, as well as dissipation of super cooled fogs, prevention of light frosts, reduction of thunderstorm activity etc.



In the picture of Hurricane Katrina, which took place along the coast of Santa Catarina (Brazil) March 27, 2004. 13 dead

– The author's theoretical and experimental research works presented in numerous publications, the major of them given in the list below:

– Dinevich L., S. Dinevich, 1994. The Effect of Hail Suppression Seeding of Cumulonimbus Clouds on Precipitation Forming Process. Part 1 and Part 2. P. 16–22, 22–28. Proceedings of the Fifth national symposium with international participitation "Physics-agriculture". Sofia, 23–24 November, 1994.

– Dinevich L., Dinevich S, Leskov B, 2008. Cloud Modification for Rain Enhancement. P. 105–153. Questions of physics of clouds. Moscow, Hydrometizdat.

– Dinevich L., Shalaveus S., 2008. Using Tracers in Studies of Agent Propagation in Convective Cloud Modifications. P. 58–104. Questions of physics of clouds. Moscow, Hydrometizdat.

– Dinevich L., Ingel L., Khain A. 2011. Evaluations of vertical transport of ice-formingparticles produced by ground-based generators // Journal "Scientific Israel-Technological Advantages" Vol. 13, № 1, P. 95–107, 2011.

– Dinevich L., Ingel L., Khain A. 2012. Formingparticles produced by ground-based generators. (Some recommendations on practical applications) // Journal "Scientific Israel – Technological Advantages" Vol. 13, № 4.

– Dinevich L., Ingel L., Hain A. 2013 Using pipes to increase the efficiency of ground generators crystallizing reagent. Modern high technologies // number 11, 2013, P. 38–46.

– Dinevich L., Dinevich S., Leonov M., Seregin Ju., Berulev G. 1998. Precipitation Characteristics Variations Effected by Hail Protection Techniques, 1998, (296 p).

– Dinevich, L., Shilin V., 1983. Methodical Aid for Conducting of Hail Suppression Operations by Rocket Complexes Kishinev, Moldavian Research. Institute of Scientific Information, 1983, (86 p.)

– Dinevich L., Dinevich S., Kudlaev E., Leonov M. 1995. Physical and statistical investigations of influence of the hail prevention seeding of cumulus rain clouds on regime of precipitation. Review of Applied and Industrial Mathematics. Scientific Publishers "RTA". Moscow, P. 253–287.

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USING MRL-5 RADAR FOR IDENTIFYING RADAR ECHO OF MIGRATING BIRDS AND PLOTTING RADAR ORNITHOLOGICAL CHARTS

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The computerized radar ornithological system based on MRL-5 meteorological radar enables to perform automatic 24-hour monitoring of bird flights. The MRL-5 capacity of simultaneously obtaining both the meteorological and ornithological data made it possible to design an algorithm for plotting superposed weather and ornithological charts and to provide them every 15–20 min online to be used by air traffic control services.

Introduction. The progress of aviation, high density of aircraft over relatively small areas (especially in the vicinity of large airports), as well as striving for higher speeds using the lightest possible aircraft constructions – all these factors have inevitably created a conflict between the technological advancement and the nature. The most serious manifestation of this conflict is collisions between aircraft and birds (Ganja et al.,1991). The main routes of bird migration from Europe to Asia and Africa and back lie over Israel (Leshem and Yom-Tov, 1998). It was shown (Bruderer, 1992) that during the migration period the average number of birds over a cubic km of the air may exceed 500. As the airspace over Israel is also dense with aircraft, collisions are not rare during vigorous spring and autumn migrating bird flows, resulting in loss of bird life and sometimes human casualties (Bahat and Ovadia, 2005). Bird-aircraft collision are not rare in other regions (Thorpe, 2005). This situation calls for development of operational techniques aimed at assessment and control over the ornithological status in order to ensure air traffic safety.

The main idea underlying the algorithm

Tables 1 and 1(a) present the typical characteristics of migrating birds' radar echoes.

Table 1

Typical characteristics of radar echoes of migrating birds

Typical characteristics of radar echo	Studies*
– relatively low power. Reflectance coefficient (Z < 30dBZ), – forward and relatively linear movement – maximum amplitude fluctuations within the low frequency range (below 10 dB in 2–50 Hz frequency range). – MRL-measured σ are greater on the 10 cm wave length than those on the 3 cm wavelength – polarization characteristics of the signal are typical of horizontally-oriented targets. Differential reflectance as the ratio of horizontally-oriented signal (with pulse horizontally polarized) to vertically-oriented signal (with pulse vertically polarized) exceeds the unity significantly ($dP = P_{\parallel}/P_{\perp} >> 1$). For small droplets within clouds and precipitation this value is close to unity. – in the λ wave-length range of 3 to 100 cm, σ of both birds and insects decrease noticeably as the radar wavelength increases. At the same time, there is a distinct maximum of the σ (λ) frequency dependency that occurs at λ = 10 cm wave-length. – high dispersion of experimental data at λ = const (from few tens of cm^2 at λ = 3 см to σ = 10^{-1} cm^2 at λ = 100 cm). σ values for some bird species with wings folded are presented in Table 1(a). – the mean σ-values of different bird spices at the value of radar wavelength from less than 10 cm^2 (Sparrow) up to 400 cm^2 (Albatross). – σ-values of birds are approximately by order of 2–3 greater than σ-values of insects	Edwards, Houghton, 1959; Salman, Brilev, 1961; Schaefer, 1966; Chernikov and Schupjatsky, 1967; Skolnik. 1970; Chernikov, 1979; Bruderer and Joss, 1969; Bruderer, 1992; Ganja et al. 1991; Buurma, 1999; Larkin et al., 2002; Gudmundsson et al., 2002; Gauthreaux and Belser, 2003; Zavirucha et al., 1977; Zrnic and Ryzhkov, 1998.

N o t e s : * – Table presents only a small part of the numerous studies of bird echo characteristics. ** – ESA (σ) – effective scattering area