

# Multithreshold Procedure for Evaluating Parameters of Meteorological Objects against the Background of Local Objects Clutter in Pulsed Doppler Weather Radars

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**Abstract**—A multithreshold procedure for estimating parameters of meteorological objects (MO) against the background of interferences from local objects in pulsed Doppler weather radars has been proposed. It is based on using the operation results of introduced detector of local objects for making a decision on estimating the parameters of meteorological objects before or after the nonadaptive MO suppression filter. The task of detection in this detector is solved by the threshold processing of correlation coefficients of reflections carrying the information on both the composition of analyzed mixture and MO parameters. This feature of the proposed detector compares favorably with a large variety of the known detectors. It is shown that the proposed detector makes it possible to take a correct decision about the composition of the mixture with probability  $D > 0.9$  already at MO radial velocities  $V_r > 2$  m/s. The possibility and expediency of practical use of the proposed procedure in the system of estimating the MO parameters under the real conditions of limited sample sizes of processed inputs were confirmed by mathematical experiment. In this case, the accuracy of estimates is shown to be more than twice as high as that of the known procedures.

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## INTRODUCTION AND PROBLEM STATEMENT

The timely and reliable detection of meteorological objects (MO) and measurement of their parameters play an important part in ensuring the flight safety. In real conditions of reflections from MO (RMO), we can observe mixtures of RMO with reflections from local objects (LO) [1–5] that significantly affects the estimation accuracy of MO parameters [6].

The harmful effect of LO usually is weakened by nonadaptive LO suppression filters (NSF) [1, 3–6, 8]. However, they can increase the measurement errors of MO parameters. This is related to the fact that the tasks of detection and estimation of parameters of RMO in pulsed Doppler weather radars (PDWR) usually are not separated [9]; therefore, the estimated parameters may not be related to MO.

The absence of information regarding the mixture composition in standard estimation procedures [1, 3, 4] is partially compensated by the threshold processing of the modulus of the first correlation coefficient (CC) of the mixture at the NSF output and blanking the measurements in the range of mean zero motion velocities of MO.

However, these procedures can limit the range and reduce the accuracy of MO parameter measurement by using their mixture with receiver internal noise [6].

The purpose of this paper is to substantiate a rational procedure for estimating MO parameters with due regard for the possible presence of interferences from LO, to estimate its errors of measurements and compare them with errors of standard procedure in the real conditions of limited volume of samples of processed inputs.

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