Abstract The compound-Gaussian model is often used in radar signal processing to describe the heavy-tailed clutter distribution. The important problems in compound-Gaussian clutter modeling are choosing the texture distribution and estimating its parameters. Many texture distribution models have been proposed [1], [2] and their parameters were typically estimated using the (statistically suboptimal) method of moments, see [2]. In this paper, we develop maximum likelihood (ML) methods for jointly estimating target and clutter parameters in compound-Gaussian clutter. In particular, we estimate (i) the complex target amplitudes, (ii) covariance matrix of the speckle component, and (iii) the texture-distribution parameters. Several existing texture models are considered: (i) gamma (leading to the well-known K clutter distribution [1], [2]), (ii) lognormal, and (iii) Weibull. Motivated by the robust regression model in [3], we also develop a complex multivariate t distribution model for the clutter. We utilize the expectation-maximization (EM) algorithm to estimate the unknown parameters. Numerical integration is typically needed to compute the conditional expectations in the expectation (E) step of the EM algorithm; here, we employ the Gauss quadratures to perform this integration. Interestingly, the proposed complex multivariate t distribution model does not require numerical integration, allowing for remarkably simple estimation and detection algorithms. We will also compute Cramer-Rao bounds (CRBs) for the unknown parameters and demonstrate the performances of the proposed methods via numerical simulations.