Estimating large covariance matrices from small samples is an important problem in many fields. Among others, this includes spatial statistics and data assimilation. In this thesis, we deal with several methods of covariance estimation with emphasis on regularization and covariance models useful in filtering problems. We prove several properties of estimators and propose a new filtering method. After a brief summary of basic estimating methods used in data assimilation, the attention is shifted to covariance models. We show a distinct type of hierarchy in nested models applied to the spectral diagonal covariance matrix: explicit estimators of parameters are computed by the maximum likelihood method and asymptotic variance of these estimators is shown to decrease when the maximization is restricted to a subspace that contains the true parameter value. A similar result is obtained for general M-estimators. For more complex covariance models, maximum likelihood method cannot provide explicit parameter estimates. In the case of a linear model for a precision matrix, however, consistent estimator in a closed form can be computed by the score matching method. Modelling of the precision matrix is particularly beneficial in Gaussian Markov random fields (GMRF), which possess a sparse precision matrix. The score matching estimator is a key component of the ensemble filtering algorithms proposed in the second part of the thesis, that is devoted to data assimilation. In every time step, the proposed *Score matching filter with Gaussian resampling (SMF-GR)* provides a consistent (in the large ensemble limit) estimator of the mean and covariance matrix of the true forecast distribution, under the condition that the original process can be assumed to be a GMRF. Further, we propose a filtering method called *Score matching ensemble filter (SMEF)*, which is based on regularization of the well-known Ensemble Kalman filter (EnKF). The filter performs very well even for some particular examples of non-Gaussian systems with nonlinear dynamic.