The solution to inverse thermal problems to identify parameters invariably involves some degree of regularization. Such regularization can be viewed as prescribing a prior probability distribution of the parameter. In fact, using Baye’s theorem for conditional probability, regularization as proposed by Tikanov can be shown to be equivalent to defining the prior which contains the minimum amount of information. The regularization parameters are then either estimated from experienced or based upon a criterion such as Morozov’s.’ In some situations, we may have sufficient information to define a more appropriate prior. For this case, termed Stochastic Regularization, Turchin has proposed two additional methods of estimating the regularization parameters, a) the narrowest admissible values; b) the most probable values, and has shown that both methods give reasonable estimates of the parameters for the vertical distribution of temperature in the atmosphere.

Mathematical models of systems include a number of parameters (properties, initial and boundary conditions, etc) all of which are presumed to be known except for the parameters to be estimated. Emery et al. have extended the usual method for parameter estimation based upon weighted least squares to include cases where some of the “known” parameters are uncertain. In the examples studied, including the uncertainty in the “known” parameters roughened the functional to be minimized, suggesting that regularization should be used. This paper develops the theory for including prior distributions of both the sought after parameters and the uncertain “known” parameters and explores the application of regularization to such problems and compares results obtained using the usual Tikanov approach to that of Statistical Regularization.