Data Assimilation for Parabolic Problems

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Data Assimilation aims at estimating states of interest by combining partial information on the state with the knowledge that the state obeys a certain law given, for instance, in terms of a partial differential equation. In this talk we focus on states satisfying a parabolic equation with known right hand side but unknown initial values. Partial information is given in terms of data in a subdomain of the whole space-time cylinder up to a fixed time horizon which gives rise to an ill-posed problem. Earlier contributions typically employ mesh-dependent regularizations in a discrete setting. In contrast, we start from a regularized least-squares formulation based on a proper infinite-dimensional space-time variational formulation for the parabolic problem. This allows us to disentangle discretization and regularization parameters as well as to incorporate data and model uncertainties. We discuss a priori estimates for recovered states as well as a posteriori strategies for determining suitable regularization parameters.