State and Parameter Estimation of Spatio-Temporally Chaotic Systems: Application to Rayleigh-Benard Convection MATTHEW COR-NICK, BRIAN HUNT, EDWARD OTT, University of Maryland, HUSSEIN KUR-TULDU, MIKE SCHATZ, Georgia Tech — Data assimilation refers to the process of obtaining an estimate of a system's state from a time series of incomplete and noisy measurements along with a model (possibly approximate) for the system's time evolution. Here we demonstrate the applicability of a recently developed data assimilation method, the Local Ensemble Transform Kalman Filter (LETKF), to Rayleigh-Benard convection, a non-linear, high dimensional, spatio-temporally chaotic fluid system. Using this technique we are able to extract the full temperature and velocity fields, including the mean flow, from experimental images of shadowgraphs. In addition, we describe extensions of the algorithm for estimating fluid parameters.

Matthew Cornick
University of Maryland

Date submitted: 20 Nov 2006   Electronic form version 1.4