Analysis of Monitoring Data for Time Trends
Using Maximum Autocorrelation Factors

Paul Switzer
Stanford University

ABSTRACT: Consider monitoring data from a regional monitoring network as a rectangular spatial-temporal array. The goal here is to re-express these monitoring data so as to extract dominant temporal components, filter out variations that are not part of these dominant time trends, and display the spatial variation of these dominant time trends. To this end regional weather or pollution data are commonly analyzed using methods closely related to principal components analysis, although such methods are not specifically optimized for time trend detection. Less common alternative analyses use variants of MAF, maximal autocorrelation factor analysis. I describe MAF optimality properties that are specific to time trend extraction for monitoring data and illustrate MAF's trend extraction possibilities in low signal-to-noise situations. A MAF analysis is applied to air pollution monitoring network data and a resampling approach is applied to assess the statistical stability of the MAF analysis. Finally, a method is described for examining the regional variation of the time trend components that are extracted by MAF. A second example applies MAF trend detection to climatic output of General Circulation Models.