Geophysical Research Abstracts, Vol. 9, 03773, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03773

Improving Dst index prediction for colored measurement noise using Kalman Filtering

B. Kaewkham-ai, R. F. Harrison

Department of Automatic Control and Systems, The University of Sheffield, Sheffield, UK (b.kaewkham-ai@sheffield.ac.uk)

This study presents an application of Kalman filtering (KF) techniques for predicting the disturbance storm time (Dst) index. Two unknown parameters, process and measurement noise covariance, are derived. To verify the measurement noise covariance, a measurement noise model has been estimated using the quick look Dst (Dst^{ql}) and the provisional Dst (Dst^{pv}) in the period 15 March 2004 to 31 December 2005 [http://swdcdb.kugi.kyoto-.ac.jp/dstdir/dst1/quick.html]. Since the final Dst index is not yet available, the provisional Dst has been used to compute the measurement noise model which is found to be colored. Two existing models, modified Burton et al. (1975) and O'Brien and McPherron (2000) are chosen and called, here, M1 and M2, respectively. The colored measurement noise is modelled by using an ARMA structure and set in association with an extended Kalman filter (EKF) to try to improve the prediction of M1 and M2.

The rms errors of M1 and M2 models for all Dst are given as $\sim$17.49 and $\sim$13.59, whereas of with the EKF, the rms errors are reduced to $\sim$11.37 and 11.24, respectively. Similarly, the rms errors for Dst below -80 nT are examined. With model alone the rms errors are $\sim$67.73 and $\sim$ 36.74, whereas with EKF they are given as $\sim$18.79 and $\sim$ 16.78. This is implies that in the colored noise case, the KF methods can improve and reduce prediction error for both all Dst and Dst below -80 nT.