

## **Review for T-SP-19627-2015: Bayesian Learning of Degenerate Linear Gaussian State Space Models using Markov Chain Monte Carlo**

The paper presents a Bayesian learning method based on Markov Chain Monte Carlo for linear Gaussian state space models. The model may have singular transition covariance matrix. The objective is to infer the unknown states and learn the model parameters given the sequence of observations. Gibbs sampling as well as Metropolis-Hastings methods are utilized.

The reviewer has the following comments:

- A main concern is that the paper is not easy to follow. Many statements are mentioned without sufficient or clear justifications. Such as: in Section II.B: “The appropriate posterior distribution is not amenable to efficient MCMC sampling,...”.
- Can the model be extended to the case where the model parameters  $H$  and  $R$  in (6) are not fixed? Please add discussions
- It will be helpful to provide some relevant applications in Section I, explaining why a degenerate model will be more appropriate.
- There is no complexity analysis.
- The advantages over existing methods, such as those methods that use product of marginal distributions or other more recent approaches, have not been adequately demonstrated.
- The presentation needs to be improved:
  - (i) This includes correcting typos, such as: in abstract “it is possible deduce”
  - (ii) Defining notations before/when using them, such as  $F$  and  $H$  in equations (1) and (2)

Overall, the above concerns need to be addressed before a decision can be made.