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“Robust data assimilation using L_1
and Huber norms”

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Compute the Future



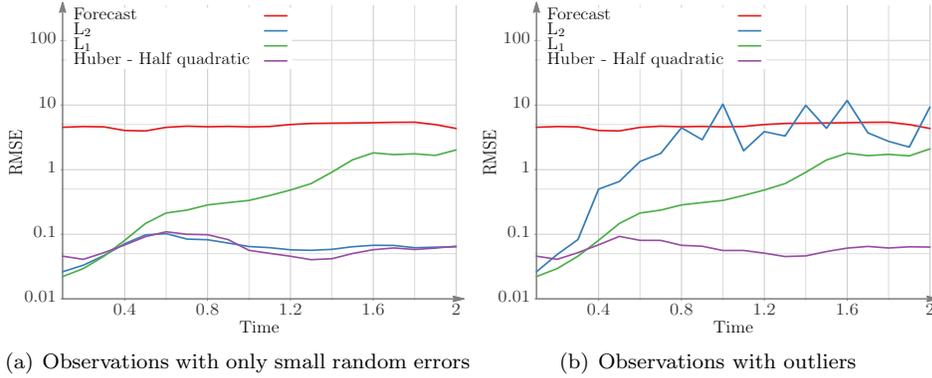


Fig. 6.11: LETKF results for the Lorenz-96 model (6.2). The frequency of observations is 0.1 time units. Erroneous observations occur every 0.2 time units. The Huber norm uses $\tau = 3$.

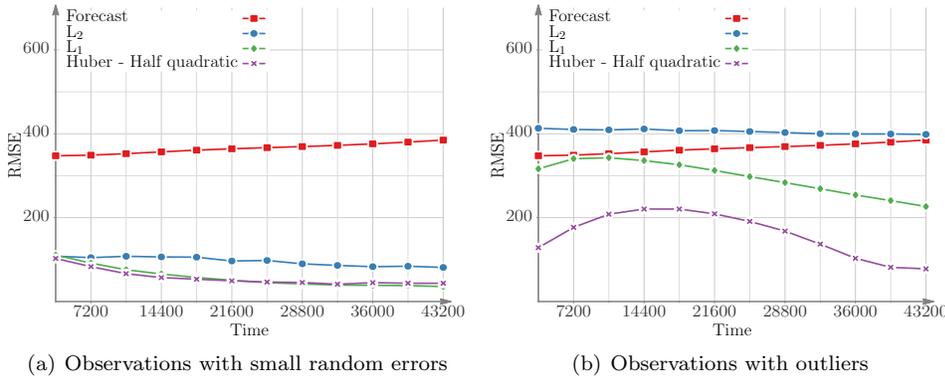


Fig. 6.12: LETKF results for the shallow water model (6.3). The Huber norm uses $\tau = 1$.

able to fully use the information from “good data” while remaining robust (rejecting the influence of outliers). We consider two solution methods for Huber norm optimization. The shrinkage operator solution displays slow convergence and can become impractical in real-life problems. The Huber norm solution using the half-quadratic formulation seems to be the most suitable approach for large scale data assimilation applications. It is only slightly more expensive than the traditional L_2 4D-Var approach, and yields good results both in the absence and in the presence of data outliers. Future work will apply robust data assimilation algorithms using a Huber norm formulation with a half-quadratic solution to real problems using the Weather Research and Forecasting model [31].

REFERENCES

- [1] A. Attia, V. Rao, and A. Sandu. A hybrid Monte-Carlo sampling smoother for four dimensional data assimilation. *Ocean Dynamics*, Submitted, 2014.
- [2] A. Attia, V. Rao, and A. Sandu. A sampling approach for four dimensional data assimilation.

