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Geoscientific Instrumentation Methods and Data Systems
Discussions

Interactive comment on "Designing optimal greenhouse gas observing networks that consider performance and cost" *by* D. D. Lucas et al.

Anonymous Referee #2

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The paper "Designing optimal greenhouse gas observing networks that consider performance and cost", by D.D. Lucas and co-authors, provides a description of a multi-objective approach for optimal network design of greenhouse gas monitoring stations. The authors make use of synthesized measurements of 1,1,1,2-tetrafluoroethane (CH2FCF3, HFC-134a) over California, and the genetic algorithm for the optimization procedure.

The paper is well written, providing a clear illustration of the Pareto frontier method for multi-objective optimization. In addition, the authors also describe an alternative approach to prescribing posterior uncertainties for the Bayesian inversion procedure. This is through evidence approximation, which is an iterative method for obtaining the

parameter estimates of the uncertainties associated with the observations and prior emissions.

Although the authors do discuss a previous incremental optimization (IO) application for network design which considers only a single objective, in the discussion of the genetic algorithm, the authors do not mention previous applications of this optimization routine for solving the single-objective design problem (e.g. Rayner, 2004. Optimizing CO_2 observing networks in the presence of model error: results from Transcom3, Atmospheric Chemistry and Physics vol 4, pp. 413-421).

In the discussion of the Incremental Optimization results, the authors base the efficiency of the optimization routines on the number of evaluations. Although the IO may take 17511 evaluations, the first 2921 evaluations are made with a transport matrix which is six times smaller than each of the transport matrices used in the evaluations during the SOGA method, the next 2920 evaluations of the IO method would be with transport matrices only one third of the size of those used in the SOGA evaluations. Only the final 2916 evaluations would be carried out using transport matrices of the same dimensions as for the SOGA evaluations. Therefore, in terms of time taken to compute the evaluations and the amount of computing resources, IO does not perform as inefficiently compared to SOGA as implicated by the total number of evaluations. Time taken to run the optimization algorithm could be used as an alternative indicator of efficiency.

Page 728, line 9: "The match is not expected to perfect ..." should be " The match is not expected to be perfect".

In Figure 9: The colors used in the colorbar do not match up exactly with the colours used in the plot, although it is still possible to determine which color matches up with which sampling frequency.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 4, 705, 2014.