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Geoscientific Instrumentation Methods and Data Systems Discussions
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Interactive comment on "Designing optimal greenhouse gas monitoring networks for Australia" *by* T. Ziehn et al.

Anonymous Referee #1

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The authors derived optimal observation networks for surface flux estimation of the three major greenhouse gases (CO2, CH4 and N2O) in Australia using a Lagrangian particle dispersion model combined with the Bayesian theorem. They extended the already developed network design method, which targeted only CO2 (Ziehn et al. 2014), to also consider CH4 and N2O. Furthermore, they newly introduced a simple assessment of economic costs to establish and maintain additional observation sites. In the manuscript, methods, results and discussion are well presented. This is publishable after minor revisions described below.

P251, L12: I suggest the authors to add the equation for Cf here, because all the evaluations in this study are based on this variable. Moreover, it would be helpful for readers

to understand the fact that Cf does not depend on surface fluxes nor observations.

P252, L25: Is the contribution of the initial condition also negligible?

Section 2.2.1: I would like the authors to elaborate the description of CO2 prior flux uncertainties more, even though it is the same as Ziehn et al. (2014). At least, the data sources of the terrestrial biosphere and fossil fuel fluxes should be described.

P254, L8: “assuming three different flux levels (high, moderate and low)” Please elaborate “high, moderate and low” by using numbers and how to determine the level for each grid.

P254, L11: “(50 % of their value)” This is important information of the flux uncertainty. It should be described more clearly, not being in parentheses.

P256, L20: Does "n” include not only the number of model grids but also the 4 months (seasons)? Because the authors do not discuss differences of the cost function (reduction) among the 4 months, it is conceivable that the cost function is defined over the 4 months. However, it is not clearly described in the text.

P257, L5: “which is also know” ==> “which is also known”

P258, L11: “Similar” => “Similarly”

P258, L7-13: Probably, the reason why the aobs for Cape grim is halved is that the measurement accuracy is also high for this station. But I cannot understand the difference of aobs between Cape Grim and Gunn Point. Please elaborate the reason more.

P259, L8-12: Please clearly say that the GWP weights are not used in this case.

P260, L14: In Eq. (6), probably summation for d is missing.

P262, L15: “show in Fig. 5a” => “shown in Fig. 5a”

P262, L19-22: I cannot understand these sentences clearly. It seems that CO2 has

GID

5, C96–C98, 2015

the smallest impact on the cost function reduction according to the GWP weights. The largest uncertainty of CO2 in the prior flux significantly contributed even with the smallest GWP weight. Is this understanding correct? If so, could you show with some numbers how large the flux uncertainty of CO2 is compared to the other uncertainties?

P264, L3 and elsewhere: “performance” is a little bit ambiguous word and should be replaced with “uncertainty reduction”, for instance.

P265, L12: “the flux uncertainty” => “the flux uncertainty reduction”?

P265, L28: “3 GHG” => “3 GHGs”

Figure 5, 7: Color legends would be helpful.

Figure 5: The unit of “Uncertainty reduction” is missing.

Figure 5: The x-axis labels should be integer and the smaller scales (by 0.2) are not necessary because the x-axis shows only the 5 ranks.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 5, 247, 2015.