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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Designing optimal greenhouse gas monitoring networks for Australia" *by* T. Ziehn et al.

Anonymous Referee #2

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The authors used the Bayes theorem and a Lagrangian particle dispersion model in reverse mode to design a optimal observational network in Australia for the three of the most important green house gases(CO2, CH4 and N2O). A previous study for CO2 network design (Ziehn et al., 2014) has been taken as support for the Lagrangian backward modelling methodology and, in this manuscript, the study has been extended to CH4 and CO2 gases. In addition, the maintenance costs of the new observation sites were taking into account as estimation of the economic cost of the new network. The manuscript represents a clear contribution to scientific progress within the scope of the journal. The methods, results and discussions are well presented. This is accepted after minor revisions described below.

P251, L9-10: "assuming a Gaussian error distribution for the surface fluxes and concentrations. . ." Is this supported by the literature or by any previous error analysis done by the authors?

P251,L12: A equation for the covariance matrix Cf could be helpful for the reader.

P252,L25-L26, P253,L1-2: In Zienh et al. (2014), was established " . . . the uncertainty contribution of the boundary concentrations to the uncertainty observations can be consider negligible. . ." This conclusion was obtained for CO2 and Darwin, Aspendale, Arcturus and Geraldton stations that are close to the Australian coasts. The authors suggest the same behavior expected for CH4 and N20 boundary concentrations. Some experiments has been done in that sense? What happen with initial condition uncertainty?

P255, L9-10: "The spatial distribution of the wetland CH4 fluxes . . . is based on Australian mean rainfall" but in P255, L4 "Emissions depend mainly on temperature and ground water (Bloom et al.,2010)" . Although ground water has a strong correlation with the men rainfall the temperature distribution has not been taken into account to compute the CH4 fluxes. Could the authors justify the use of the mean precipitation as single estimator of the wetland fluxes?

P257, L12-14. The global-warming potential for 100 years time has been derived for Myhre et al.(2013) to obtain the GHGs weights. This is one of the multiple plausible future escenarios for the GWP. A discussion about the GWP estimates could be interesting for the reader.

P261, L16-18: Although the motivation for selecting only 2 stations has been described on P257, L23 and P258 L1-6,. and this 2 stations are able to reduce the uncertainties in the 3 GHGs fluxes between 12 and 17 %, such small number of station on base network could produce a bias on the final locations selection. Could the authors justify, among P257-258 reasons, the influence of the number and location of the stations of the base network in the final network proposed?.

P266. L8-9: The authors suggest constraint to network design due to preselected locations Are the size and location of the base network could be consider an other constraint? Have other posible base networks been considered?

Figure 4a: Some of the station numbers are over the coast line, would be better to put in a more readable place. I understand that in Figure 4b it is not possible due to the large number of the stations.

Figure 5 and 7: Color legends could be added for clarity.

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