

Interactive comment on “Assisting the Evolution of the Observing System for the Carbon Cycle through Quantitative Network Design” by Thomas Kaminski and Peter Julian Rayner

Anonymous Referee #1

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This manuscript describes advances in the use of Quantitative Network Design (QND) to analyse carbon cycle observing systems such as flask measurements and eddy covariance flux networks. The paper ends with a brief illustration of the impact of using separate and integrated QND (where “separate” refers to each observing network component being analysed separately and “integrated” refers to analysing the entire system simultaneously). The results indicate that separate QND can lead to significant biases.

Overall the manuscript is very well written and provides an informative description of QND and its recent evolution and application to carbon cycle problems. The brief analysis of separate vs. integrated QND provides a useful illustration but feels quite

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incomplete. It is clear – even intuitive perhaps – that separate QND will potentially lead to biases but the fact remains that for many practical purposes integrated QND is likely to be too expensive to use routinely. The key question, therefore, is to ask how bad these biases will be in typical carbon cycle problems. The analysis presented in section 4.2 (“complex analysis”) instead looks at the somewhat artificial example where model error is ignored. The authors acknowledge that ignoring model error makes the contrast more drastic.

The main modification I propose for the manuscript is to include the posterior estimates for the separate and integrated QND when model error is included (in addition to the results already presented). This will help the reader better understand what the practical implications are when making these choices. It is also important that the authors include details about the error values used for the different components rather than just referring to the “tool’s default.” Perhaps a table detailing each of these.

I picked up the following small errors:

The 2 in CO₂ has not consistently been subscripted throughout the manuscript.

If possible use a multiplication sign instead of an “*” to represent multiplication.

Line 250: Should this be “XCO₂”?

Line 250: The statement about OCO being the first mission designed to observe atmospheric CO₂ is a little misleading. SCHIMACHY was designed to observe CO₂, despite what is said later in the manuscript. I think the distinction that the authors are trying to make is that the focus of the OCO mission is CO₂, whereas SCHIMACHY was designed to observe a range of trace gases.

Line 290: SDBM Knorr -> SDBM; Knorr

Line 301: BETHY, Knorr -> BETHY; Knorr

Line 357: allowed to change aspects -> allowed changes to aspects

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Line 380: even amplifies -> amplifies

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