

**“Analysis of a 39-yr continuous atmospheric CO<sub>2</sub> record from Baring Head, New Zealand”**  
**B. B. Stephens et al.**

**Response to Reviewer #2 (anonymous)**

We thank the reviewer especially for their time and also for their positive comments. The constructive suggestions offered will improve the paper. We have responded to all comments as detailed below. Note, *the reviewer’s original comments are shown in blue italics*, while our responses are shown in black plain type.

*The manuscript ‘Analysis of a 39-year continuous atmospheric CO<sub>2</sub> record from Baring Head, New Zealand’ by Stephens et al. presents unique CO<sub>2</sub> background data set from the southern hemisphere. Sources of seasonal, inter-annual and long-term CO<sub>2</sub> variations are analyzed and compared to the data sets from the Mauna Loa and South Pole observatories. Time series decomposition is nicely done by Loess routine. TM3/CarbonTracker model is used to estimate contribution of terrestrial and marine sources on CO<sub>2</sub> concentrations at Baring Head. There is companion paper: Brailsford, G.W., Stephens, B.B., Gomez, A.J., Riedel, K., Mikaloff-Fletcher, S., Nichol, S., and Manning, M.: Long-term continuous atmospheric CO<sub>2</sub> measurements at Baring Head, New Zealand, *Atmos. Meas. Tech.*, 5, 3109–3117, 2012, on the techniques of these measurements. This manuscript takes advantage of this very recent article by referring to it on the technique description. This study is interesting and well within the scope of BGS.*

*Concern is on the structure of the manuscript because headlines and contents of the chapters are not always consistent. 1 Introduction is rather general. 2 Background; 2.1 site location and air origins, 2.2 Data filtering – These two chapters document well the information on these important matters. They are Methodology chapters. 3. Results; 3.1 Time series – This describes methodology of time series analysis and should be in the Methodology chapter. Results are presented in 3.2 Annual-mean mole fractions, 3.3 Seasonal cycles, 3.4 Inter-annual variations, 3.5 Long-term trends. In the beginning of 3.4. and 3.5, there are long introductions mixed with some discussions. It would be better to move the most introductory type text to Introduction and change heading 3. Results to 3. Results and discussions. 4 Conclusions is again rather general.*

We have rearranged the sections much as suggested, renaming Section 2 “Background and methods” and creating a new “Section 2.3 Atmospheric transport modeling.” We have left the discussion text in Section 3 in place, to avoid an extremely long introduction and to keep the relevant parts of discussion and results close together, but have renamed this section “Results and discussion” as suggested.

*TM3/CarbonTracker is used to analyze sources of CO<sub>2</sub> variations. A short description should be added to the methods section. Describe very shortly what is ‘TM3 model sensitivities’.*

The new Section 2.3 now includes the TM3/CT description that was previously hidden in the results section. Also, included is the text “to determine the modeled sensitivity at a particular

station to a particular source, we divide the corresponding CO<sub>2</sub> signal, averaged over the years 2003-2009, by the corresponding source strength.”

*Results/Arguing in 3.5 between P.15525, Line 7 –P.155256, Line 14 are confusing. Please, try to clarify.*

(actually P. 15255 line 7 -15256 line 14) We have added these numbers to the new Table 1, which we hope makes the text easier to follow.

*Page 12 line. On the seasonal cycles of BHD and SPO, authors say that ‘Figure 7 shows the interannually varying 5-year-smoothed seasonal components from STL fits to both Baring Head and South Pole, and their similarity indicates that these variations are often consistent over large areas of the high southern latitudes.’ From the Figure 7 it is difficult to say that they are similar. At least amplitude variations look dissimilar. Please, clarify.*

We have added a second panel showing the amplitude variations directly and have revised the text to reflect that the amplitude variations are not as similar as the original text implied.

*Figure 6. In the BGD print out, the black dashed-dotted lines in the graph are difficult see which one is which one. Could you change the appearance of these lines to make them look different.*

We have converted 3 of the black lines to color to aid visual distinction.

*Comments on References:*

*Update Brailsford et al (2012)., Atmos. Meas. Tech., 5, 3109–3117, 2012*

Done.

*Gu et al. 2002 or 2003 ?*

2002

*P. 15254, line 23, Zickfeld et al. 2009, not in the Reference list*

Now reads 2008.

*P. 15252, line 22, Bulter ->Butler*

Fixed.