

Interactive comment on “Analysis of a 39-yr continuous atmospheric CO₂ record from Baring Head, New Zealand” by B. B. Stephens et al.

Anonymous Referee #2

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The manuscript ‘Analysis of a 39-year continuous atmospheric CO₂ record from Baring Head, New Zealand’ by Stephens et al. presents unique CO₂ background data set from the southern hemisphere. Sources of seasonal, inter-annual and long-term CO₂ 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 CO₂ 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 CO₂ 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
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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. TM3/CarbonTracker is used to analyze sources of CO₂ variations. A short description should be added to the methods section. Describe very shortly what is ‘TM3 model sensitivities’. Results/Arguing in 3.5 between P.15525, Line 7 –P.155256, Line 14 are confusing. Please, try to clarify. 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.

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. Comments on References: Update Brailsford et al (2012)., *Atmos. Meas. Tech.*, 5, 3109–3117, 2012 Gu et al. 2002 or 2003 ? P. 15254, line 23, Zickfeld et al. 2009, not in the Reference list P. 15252, line 22, Bulter ->Butler

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