"Analysis of a 39-yr continuous atmospheric CO₂ record from Baring Head, New Zealand"
B. B. Stephens et al.

Response to Short Comment (A. Manning)

We thank the reviewer for his time and 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.

Dear Britt et al.,
Given my interest in Baring Head, I have read your BGD paper in quite some detail, and so thought I'd quickly jot down some review-type comments that occurred to me as I was reading it, and that I hope you will find useful. Please note that the page and line numbering below refers not to the BGD-formatted document, but to Stephens_et_al_BHDCO2_Analysis_120915_forsubmission.docx", which I believe to be essentially the same document. Kind regards,
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Last sentence of the abstract: I had to read it 4 times before I think I understood it. Could it perhaps be improved? Text from 'to be detectable...' is the problematic part.

We could have said "to result in" instead of "to be detectable as" but we wanted to emphasize the use of atmospheric observations to detect flux changes. Added a few commas, which hopefully help.

p. 4 - need NDIR in full.

Done.

Fig 1 caption - might be helpful to explain reason behind location of the '+' symbol (e.g. why not at BHD itself?) - have read it in the text now - would be helpful to have further explanation about how you went about choosing and verifying the ideal location of the '+'

In text, added "The selection of this point is somewhat arbitrary, but avoids local terrestrial influences and is close to the two southerly back-trajectory clusters." In caption, added "The + symbol indicates the location of TM3 model output used for comparison to steady- period data in order to avoid local terrestrial influences in the model"

p. 6 - 'almost exclusively experiencing due northerly or southerly winds' - but Fig 1b appears to show 2 clusters (_30%) coming from almost due west. I think you've explained this in previous section, but I wonder if it's possible to show a zoomed in inset of Fig 1b in the vicinity of BHD, showing how these winds turn around? It's rather important, I would think...

Added "Most of the back-trajectories from the northwest sector in Figure 1b correspond to local winds from the due north at Baring Head, although the model used to produce the back-trajectories does not have sufficient resolution to capture this topographic forcing."

Fig 2b caption - haven't explained what you mean by variability (except to say it's 1-sigma). Presumably it's the standard deviation of the mean?

Yes, sigma represents standard deviation.

Fig 3 - looks black, not grey, because of the density. Why not just make it and call it black?

Done.

Fig 3 caption: end 2nd sentence and begin 3rd sentence, you use the word 'period' with very different meanings. Could change 3rd sentence to 'interval', but might be better to expand 2nd sentence to be more clear what is meant by 'entire period' - i.e. steady period. Incidentally, I agree with Rachel Law's review, that 'steady interval' is pretty much a term only used at NIWA, whereas 'baseline' or 'background' air is more generic. But I also recognise that these terms can be problematic too, with inconsistent and unclear definitions. . .

Added text "We use the term "steady interval" to refer to a 6-plus hour span from a single inlet with 0.1 ppm or less standard deviation, and the term "steady period" to refer to a complete set of overlapping intervals to be consistent with prior Baring Head data reports. Steady periods further filtered on meteorological conditions then represent what other investigators often call "baseline" data." We are also now avoiding using "interval" or "period" in other contexts.

Fig 3 caption: last sentence, what does 'high-rate' mean?

Changed to "Prior to 1978, high-rate measurements were recorded on strip charts but only the steady period data is available in digital form."

Fig 4. Worth emphasising in caption that bottom 3 panels all have the same y-axis range.

Done.

p. 10 line 20: is 'counteraction' a word? In any case, I don't know what it means.

Yes.

Done.

p.10 2nd para: very hard to follow. Considering BHD-MLO only, you say that TM3 gives -4.57 ppm, and that -0.38 and -0.87 of that is from high-lat S. Ocean and temperate SH ocean respectively. Next you talk about other processes to get to the observed value of -3.03, but surely what you really need are other processes to get to the modelled value of -4.57? Furthermore, why are these other processes 'countering' the first? Seems to me they're in the same direction, since we have -1.25 from first two, and we need to get to -4.57. Perhaps I have missed something? At what point do you talk about the discrepancy between the overall model result (-4.57) and the observations (-3.03)? - In general, I'm very confused by this para. And I have even got to the BHDSPO discussion... Also, the 'monthly site differences (see next section)' sentence just makes the para even harder to follow - perhaps delete? - One suggestion to consider: perhaps put all these numbers into a table.

We made a new Table 1 with these numbers and deleted "(see next section)". The -4.57 value is just for fossil emissions. Getting from there to the observations involves the 2 negative ocean flux numbers and a positive "countering" influence from other processes.

Fig 5 caption: Perhaps state is monthly means of 39 yrs of data. I don't understand 2nd sentence – there must be some very subtle nuance I'm not picking up on - I read 'monthly means of STL seasonal component' in both! The word 'fit' is in the 1st sentence, but that doesn't mean anything extra to me?

Yes, it is a subtle and not important difference. We have deleted this sentence to avoid confusion.

Fig 6: Would be very insightful to add the observations to this figure, so can see how well TM3 agrees with the observations. The figure is already very busy, so perhaps add the observations as symbols - would have to choose time period of observations to do this, i.e. should you use monthly means as shown in Fig 5, or should you use 2010 data, since TM3 is being forced by 2010 fluxes. I think this could be very helpful.

Done.

p. 11 l. 30 - since you're using US spelling, I think it should be 'cancelation'. But actually, I found a grand mixture of both US and UK (NZ) spelling.
Similarly 'modeled', p.12 l. 3

We have spell-checked the entire document to be consistent with US English spelling.

p.12 l.13 – Is 'differencing' a word? Even if it is, it reads somewhat awkwardly.

Yes.

p.12 l. 19 - need citation.

Added.

I think you should perhaps write 'CO2' in more of the fig captions, e.g. figs 5, 7, 8.

Done.

Fig. 8 caption - state green and purple.

Done.

p. 13 para 2: what is meant by 'optimal lag'? do you mean you've chosen the lag that gave you the highest percentage ENSO correlation of the growth rate variability? This needs to be clarified. And how did you calculate the percentages 23 and 16?

The optimal lag is that which gives the maximum correlation coefficient and we use the correlation coefficient as an estimate of the % variance explained. We have added "As estimated by correlation coefficients," to clarify.

p.13 l.20 - perhaps cite L. M. Mercado et al., Nature, 2009.

Done.

p.14 l.13, comma after Palmer Station.

OK.

Write 'Mt.' in front of 'Pinatubo' (p. 13+14)

Done.

p.14 l.18-22 - 1991-94 decrease in growth rate and corresponding increase in seasonal amplitude could also be an artefact of the STL fit, could it not?

True, and it would be good to test if this feature is found by other time series decomposition methods, but we feel that because the increase in seasonality and decrease in trend are clearly visible in the measurements themselves (Figure 3), that STL is not producing them as an artifact.

p.15 l.18, if US spelling needs to be 'behavior'

Fixed.

'PgCyr-1' needs a space between Pg and C, and C and yr-1.

Done.

p.17 para 2 end: can you give a concluding sentence at the end of this para? It got a bit confusing, and was not clear to me what your argument is.

We hope that the new Table 1, makes this paragraph easier to follow.

p.18 l.1 - 'labs' in full.

Fixed.

p.18, 'second longest globally' - why not say this in the Introduction and Abstract?

Added "and the second longest globally" in section 2.1. More repetition would sound boastful.

p.18 l.26 'do not appear to be levelling off" - implying what?

Added "as might be expected if Southern Ocean uptake were reducing dramatically."

p.18 l.27 - need citation(s).

Added.

p.19 l.8 change 'effect' to 'effects'

Done.

If you wanted to shorten the paper, Fig 8 could possibly go? And Figs 10 and 11 could surely be combined into one? Looks like they won't overlap at all. On the other hand, if you have drawn them separate so that variability is not visibly reduced owing to larger y-axis ranges, then in this case, you could actually zoom in on the ranges even more, especially Fig. 11.

Neither of the reviewers suggested shortening, but we have combined Figures 10 and 11 as suggested.

Figures general - some minor tick marks might be helpful on many figures (both x and y axes). And tick marks on top and right hand axes would help a lot too.

We have added top and right tick marks to all figures and minor tick marks where helpful.