In the abstract, this very long sentence needs to be revised, and there seems to be a misplaced full-stop:

"Our study thus demonstrates the value of multiple-data stream assimilation for the simulation of terrestrial biosphere dynamics. and highlights the poten- tial role of remote sensing data, here the TIP-FAPAR product in stabilising the strongly underdetermined atmospheric inversion problem posed by atmospheric transport and CO_2 observations alone."

Page 2, second column, this sentence reads strange to me:
"Further, at the example of assimilating atmospheric CO_2 and TIP-FAPAR, we demonstrate the mutual benefit of the two data streams in constraining parameters in JSBACH."

Your use of "at the example" reads strange.

Page 3, first column, I don't understand what you mean by "via automatic differenti- ation (AD: Griewank 1989) of the model's source code."

And what exactly does TAF stand for? This acronym is used without any explanation.

Page 3, first column, you introduce the acronym BFGS, but this acronym is not used at all in the rest of the manuscript? Why do you add this acronym then? You also introduce the acronym AD which only seems to be used once. Please do not add too many un-necessary acronyms, it makes the paper very hard to read.

Rather than using the term "divided differences of model runs" which reads rather strange to me, and I have not heard of this term used before, can't you use the term "numerical differentiation" rather than put this in brackets? Also you refer to machine precision, but to my knowledge, differences in machine precision do not matter as these are very small, especially when focusing on long term means.

Page 4, second column, line 103-14. Replace "The prior sensitivity studies revealed" with "Prior sensitivity studies have revealed".

Page 3, second column, line 74, fix "the the"

Rather than state that "The uncertainty of these parameters were based on expert knowledge", I suggest to use something like "The uncertainty of these parameters was estimated from prior sensitivity studies....". The use of the term "expert knowledge" is a bit weird. In your reply to reviewer 1, you state that CO2offset is limited to 3 ppm, but in the actual manuscript you state "a few ppm". Please be more precise than "a few ppm" – This is rather subjective. If it was 3 ppm, then state 3 ppm, rather than "a few".

In response to Reviewer 3 comments about the colour scale used, perhaps it would be good to mask changes in LAI between 0.1 and -0.1 as grey.

Page 4, second column, what do you mean by "maximum amount of leaves" you mean the LAI? Then use the term LAI rather than "amount of leaves".

Page 7, line 12, wrong cite command for Pinty et al (2006).

Page 14, "can not" should be "cannot"

Page 15, second column, the DOC acronym is suddenly introduced?

I request that the first author and ALL co-authors carefully proofread this manuscript again, and in your revised manuscript, highlight all changes in blue.