General: The contribution of global freshwater reservoirs to the atmospheric CO2 is an important problem. Although the storage bodies, the reservoirs proper have been examined in reasonable detail, emissions in the downstream regions adjacent to the dams in the flow paths have not been addressed sufficiently. In this background, the present paper is welcome. The authors previously published in the same journal (Biogeosciences) on CH_4 emissions, as 2 papers, the first one dealing with downstream stations (Deshmukh et al., 2016) and the second dealing with the reservoir proper (Guelin et al., 2016). This MS is on CO2 emissions for the combined area. The experimental work is solid strong and data of high quality. However, after reading their 2 papers also (along with the present), the sampling protocol, flux calculations and discussion of results are much the same. The readers would be justified to expect from this paper not just about concentrations and fluxes of CO_2, but a critical appraisal, in particular differences between CH_4 and CO_2 and a geochemical reasoning in terms of the processes / geochemistry. To a reader with taste for science, the Results and Discussion appeared routine, unnecessarily long and repetitive.

The authors, during discussion (L. 553/557) did briefly mention about the differences in concentration trends of CH_4 and CO_2 but did not go further as to explain the processes except to mention that higher solubilization of CO_2 leads to higher concentration. CO_2 indeed provides a greater opportunity to discuss its more complex environmental response than CH_4. CO_2 is a reactive gas, unlike CH_4 which undergoes only physical dissolution. CO_2's reaction with water produces HCO_3^- , CO_3^{2-}, H_2CO_3 in addition to physically dissolved CO_2(aq) species all of which inter-convert as part of the carbonate equilibria. Due to the pH dependence of their inter-conversion, CO_2(aq) and HCO_3^- are ~50% each at pH 6 while at pH 10, HCO_3^- and CO_3^{2-} are ~50% each. At lower pH, degassing is favoured which happens in 2 cases, (i) seasonally in winter when the reservoir experiences overturning and (ii) spatially at the reservoir station 9 where mixing with the low pH deepwater takes place. The pH which varied significantly – in different ranges at different stations / regions may be reflecting these processes. In the reservoir and at various other water stations pH varied significantly. For example, at reservoir surface, the range was 5.21 - 8.76 (L. 271) when the corresponding share of CO_2(aq) in the CO_2 system is >80% and ~10% respectively, and the former situation is a hugely favourable CO_2 emission condition. Post degassing, pH should be expected to increase at surface (up to the limit of neutral pH). But the higher limit of pH which was on the alkaline side (pH>7) shows that there are cations (from dissolved minerals) e.g., Na^+, K^+ etc whether derived naturally or anthropogenically. In addition to CO_2 (aq), authors measured TIC, but they did not explore CO_2 emission in relation to the TIC-CO_2(aq) equilibrium leading to the basic question as to why they presented the latter data. Discussion of Figs. 2 and 3 is absent except for a brief mention of the relative quantities / fluxes of DOC, POC and TIC.

For CO_2 and TIC determination, authors gave citations of their earlier works. It would be useful if the methods are explained in brief.

Production and accumulation of CO_2: Authors have not explained how. Using water residence time and vertical stratification index authors explained in their papers (e.g. Guerin et al., 2016). They also could relate CO_2 production (by the metabolism of organic matter of sediments and water column by bacteria) and accumulation to age. The deep water is more aged than the surface water, and in it CO_2 accumulated over longer periods also resulting in lower pH. The detailed hydrology and minor variations in concentrations should all fall in pattern if this were done. Thus, authors have to better consider a process-oriented description of their results rather than a just presentation of concentrations and fluxes.

Further comments:

General:

1. The CO2 concentrations (Text e.g., L. 394, 396, 428 etc.) and emissions (Table 3) are given in grams. The standard method is to give them in terms of CO2-C. The values would then be down by a factor of 44/12 i.e., 3.67.
2. Please give a space after semicolon (;) for all multiple citations.
3. L. 73: drawdown emissions: To my understanding, draw-down is opposite of emission. The former is from atmosphere to surface water when surface water is under-saturated (this is promoted by primary production) and the latter is from the surface water to the atmosphere in case of surface super-saturation (this is promoted by winter convection, which you are calling as reservoir overturning). There is no mention of drawdown emissions in for example Chen et al., 2009 cited by you. Do you mean emission in the drawdown area i.e., the reservoir or river area where the water level is lowered due to the construction of the reservoir? If so, the drawdown emissions should be replaced with emission in drawdown area throughout the MS.
4. Often, the results are specific to only the study area, and not applicable as a general phenomenon which makes the reading less involving for the reader. Hence, the authors better discuss critically their results focusing on (i) similarities and (ii) differences with other similar reservoirs. In the Discussion section, attention may be paid to spatial differences and seasonal differences in sub-sections.
5. Fig. 8a constitutes the core result, and instead of waiting till the end of discussion, this figure may be brought to Results section, and later discussed critically (in the light of relevant comments below).
6. A significant part of discussion draws on CH4 distribution, but a direct comparison of the two results is not made. The drawdown area is an important source of CH4
7. Let me also give my opinion on the Title: As commented above, emissions from the drawdown area are significant only during the warm season when the drawdown area is exposed with fall in water level. Moreover, there is a gradual fall in these emissions too. Perhaps, if the dam were visited in 2017, the emissions may be expected to be further low, which is also mentioned by authors (L. 61-61 and 632-634). Hence, it may be misleading to say that drawdown areas are a neglected pathway to the atmosphere.
8. Interestingly, CH4 emission also took place during the dry season and the authors (Deshmukh et al., 2016) explained it to be due to intermittent exposure (and inundation) when anoxic (and oxic) conditions prevailed. Perhaps this point in itself would suggest the need for a direct comparison of the CO2 and CH4 results.

Specific:

L. 35: Pl. include in Laos PDR before in the Mekong River water shed.

L. 39-40: Where are the river stations (Nam Theun watershed) in Fig. 1? Should there be a comma after Nam Theun watershed in Line 40?

L. 40: Nine: Change to 9 for consistency.

L. 44: in 2012-2013: Pl. change to during 2013-2013, as monitoring was done in both years.

L. 77: Pl. add in China before the citation.

L. 104: decreased down to 107 km^2: from what area? Is it about 500 km^2?

L. 107: m^3s^{-2}: This is not a correct unit for discharge. Later you mentioned m^3s^{-1} which is right.

L. 123-125: besides the hydrology details which were already described in Guerin et l. (2016), it would be good if you can give depths of the stations also.

L. 159: What is specific water discharge?
L. 197: soils types: Pl. correct to soil types
L. 199: details: Pl. use singular (detail) as above. And pl. make similar corrections elsewhere also.
L. 199: Table 1 – what is interm. for?
L. 213: One of the subsample: Pl. correct it as one of the subsamples (Pl. compare with the above two corrections).
L. 221: What is specific water discharge? What is Hum?
L. 236: In Fig. 2, it would be better if the data are provided for the area classification followed in Fig. 8.
L. 255 (also L. 638): This data has not been critically discussed.
L. 259: This figure is illegible. The trends are not clearly seen due to the problem of scaling of the X-axis.
L. 300: Are 70% and 56% (for 2011 and 2010 & 2012) annual average O2 saturation values or seasonal values? Pl. clarify. Pl. modify text for better clarity.
L. 301: the is a repetition.
L. 325: From March to August: You have referred so far to seasons. Better be consistent and refer as WD and WW seasons.
L. 332: space between five and fold.
L. 338: Pl. change a to an.
L. 337-340: Why was this? Pl. explain in Discussion.
L. 342: Pl. use on instead of to.
L. 344: Figure 5e: These are also the trends shown in 5c. Suggest removing. Suggest removing 5f also as this data is given in Table 3 (column 3).
L. 390: -32-33762: Pl. clarify the hyphen. The first hyphen seems to be a negative sign and the latter for range.
L. 391: (not shown): The data can be included in Figure 5 as replacements for 5e and 5f to be deleted (see an earlier comment).
L. 401: Fig. 6b: This data are included in Table 3 (column 5). Pl. remove.
L. 419: Where is Figure 6d?
L. 424-425: no bubbles was ever observed for depth higher than 16 m: Pl. delete text as this was given in Methods section.
L. 434: stagnic property: Pl. explain briefly what a stagnic property is.
L. 439-440: surface moisture ranging from 17.5 to 51.2% and temperature ranging from 18.1 to 34.2°C (Table 2): For consistency, pl. change text as: surface moisture (17.5 - 51.2%) and temperature (18.1 -34.2°C) (Table 2).
L. 443: This p value of 0.452 is not significant! Is it a typo?
L. 443-445: This sentence is not self-explanatory.
L. 449: could reach: For consistency, pl. change to reached.
L. 450, 451: Pl. change changes to changed.
L. 454-455: Fig. 7 indicates that 2012 emissions were higher as July and August were also CO2-emitting. Pl. explain why under Discussion.
L. 473-475: This sentence is a repetition of the earlier sentence in content.
L. 475: This assumption is reinforce: Pl. correct to This assumption is reinforced
L. 475: hot moments: When were those hot moments and why?

L. 477: the higher concentrations were observed: Pl. remove the definite article. Also, explain why.
L. 481: Pl. change the first of to a
L. 482: change was observed nutrient concentrations: Correct to change was observed in nutrient concentrations.
L. 487-489: No, the quantity of autochthonous OM is not greater than phytoplankton primary production. Hence, there should be some other mechanism (source).
L. 498: older reservoir: Pl. change to older reservoirs.
Fig. 1: This figure is cluttered. The station codes are too long (and also not explained) and contribute to this clutter. What is the direction of river flow? What are NKT, TRC, DCH and XBF? The artificial channel is not marked properly in figure, and it is difficult to understand when mentioned e.g. in L. 530. Some terms included in legend e.g., Stream and downstream channel occur nowhere in text.
Res 1 and downstream of reservoir – are they same? It should help the reader if you explained the provenance of different sampling stations in the Methods section, or as commented under Table 3.
L. 549: For consistency, pl. change between the WD and the WW season (April – July).
L. 551: emissions factors: Pl. change to emission factors.
L. 552-557: This difference between CH4 (earlier work) and CO2 could be explored further.
L. 555: Table 3: Pl. give data separately for Res 9. This can be done by inserting a row after the header row for giving the stations included.
L. 559: compare to most of the reservoirs: Pl. correct as compared to most of the reservoirs.
L. 564-567: This sentence is a repetition from earlier discussed.
L. 568: For consistency of tense, pl. change increase to increased.
L. 568-569: This sentence is also a repetition (Pl. see the opening sentence of this Section!).
L. 579: down to 7^{o}C in air in March 2011: Was this given under Results?
L. 620: were taking into: Pl. correct as were taken into
L. 624: this study highlights: But this study is about CO2 only.
L. 688: Pl. correct algaes as algae
L. 696: in a tropical reservoir: Pl. specify. Correct it as in the tropical NAM 2 reservoir.
L. 705: Pl. change all with different
L. 708-711: This sentence is redundant.
L. 712: with time over the years: Pl. remove with time.
L. 713: represent: Pl. correct it to represents.
L. 715-717: But this is important only in the initial years after impoundment as evident in Fig. 8a. By the year 2013, the emissions have decreased significantly. Also, during the WW and particularly CD season, a seasonal shift of emissions happened and the reservoir emissions far surpassed the emissions from the drawdown area, thereby restoring the condition existed pre-power plant commissioning. Thus, the drawdown area and Reservoir have their own seasons when emissions peak – WD and the initial part of WW seasons in the former and the later part of WW season and CD season in the case of the latter.
Pl. explain clearly under Discussion the result and why it is so.
L. 718-720: Although the % emissions from the drawdown area is 75% of total, in absolute terms, the emission (quantity) is same or perhaps less in 2013, as prior to commissioning.
L. 729: footprint of the reservoir: What is footprint? Not discussed earlier under Discussion.

I am of the opinion that the paper requires major revision.