Dear Reviewer,

First of all we would like to thank you for the time and effort you spent on reviewing our MS. We very much appreciate your comments that clearly identify some parts of the submitted MS that need more effort, clarification and re-organization. We will try to address all the questions and comments you raised and we are convinced that the revised MS will be improved significantly.

Best regards,

Loris Deirmendjian & Co-authors

Comment#1: *"Interesting, significant work, but presentation is poor and unacceptable. One of the reason for this is insufficient reviews of similar studies. Although the studies in which DOC/DIC exports are compared with NEE measured by eddy covariance method in the same site may be limited, there are many studies discussed about DOC/DIC exports and their mechanisms."*

Reply#1: We thank the Referee 2 for his/her constructive comment concerning the organization and presentation of our MS. This general evaluation is quiet consistent with that expressed by Referee 1 and for that reason we will be able to provide a revised MS that will satisfy all these comments. We clearly realize that the submitted paper suffered from poor organization and presentation and needed a complete re-organization and a more thorough review of similar studies in forested catchments. However, we would like to stress the general scarcity of studies that report DIC and DOC concentration in groundwater, and even less studies that compare groundwater and streams. We have performed a thorough review of similar study in forested and other type of catchments, which reveals that, the few available works that estimates lateral export of carbon are based: (1) on observations in soil water in the unsaturated zone combined with soil water model (Öquist et al., 2009; Kindler et al., 2011; Leith et al., 2015), (2) on differences in the flux between upper and lower stream reaches (Shibata et al., 2001, 2005), or (3) on observations in stream water combined with stream discharge (Dawson et al., 2002; Billett et al., 2004; Dinsmore et al., 2010; Olefeldt et al., 2013). We found few works that reported DIC/DOC concentrations and dynamics in groundwaters (saturated zone). Kawasaki et al. (2005) reported DIC/DOC dynamics in groundwaters but this study is out of the scope of our watershed with sandy podzols as it focused on a watershed with granite rocks overlied by cambisols. Venkiteswaran et al (2014) reported DIC concentrations in groundwaters but this paper focus on degassing in streams based on an isotopic model. Artinger et al (2000); Baker et al (2000) and Shen et al. (2015) reported DOC dynamics and concentrations in groundwaters but these works focus on the characterization and/or metabolism of groundwater DOC and not on carbon export to streams.

Changes in the revised MS#1: We will cite these references in the revised MS, stressing their different scientific objectives and approaches. We will put important effort in improving our revised MS to address the questions of presentation, description of the state of the art, and discussion in the light of previous works. We will modify the Introduction section and profoundly rework the text of the Results and Discussion sections of our revised MS that will include 2 new figures (Fig. 7 and 8 in the revised MS) and 5 revised figures (Fig. 1, 2, 4, 5, 6 in the revised MS) (see new figures at the end of this document). The figure 3 of the submitted MS did not change. The figure 6 and 7 of the submitted MS were removed (see below).

Comment#2: *"The result section is hard to catch up. It should be rearranged to show more clearly to guide the readers for your discussion."*

Reply#2: We agree with the need of better organizing the Results section, a comment also shared by the Referee 1.

Changes in the revised MS#2: In the revised MS, we will split the Results section in five paragraphs: (i) water mass balance; (ii) carbon net ecosystem exchange; (iii) dissolved carbon in groundwater; (iv) dissolved carbon in first order streams; (v) hydrological carbon fluxes.

Firstly, in the 3.1 section, based on hydrological and eco-physiological criteria we will distinguish 4 different hydrological periods within the sampling period (Jan. 2014-Jul. 2015): HF, GS, LS and EW periods, respectively for high flow, growing season, late summer and early winter periods (see revised Fig. 2). Then, results will be described according to these 4 hydrological periods in the revised text as well as in the different revised figures, which we believe, will lead to greater clarity and understanding.

Secondly, we will modify Fig.4 (of the submitted MS) by separating the distribution of DIC and DOC concentrations in groundwater as a function of water table depth (panel A), from the time-course of concentrations (new Fig. 4 and 5 in the revised MS) (see below). We will also add new Figures 7 and 8, which describe a conceptual model of the groundwater-stream interface and the different measured and calculated carbon fluxes between the atmosphere, the groundwater and the streams during these 4 different periods and, respectively (see new Fig. 7 and 8 at the end of this document). These two new figures allowed us to better discuss the seasonality of carbon fluxes in interaction with hydrological and biogeochemical processes without excessive interpretations.

Thirdly, as suggested by both referees, results of the Pearson's correlations will be much less emphasized in the revised version of the MS, as they appeared too simplistic to fully explain biogeochemical and hydrological processes controlling dissolved C concentrations and fluxes.

Comment#3: *"The discussion section is also need to rearrange. I suppose that the contents in this is version of manuscript may be true, but may be incorrect at this moment."*

Reply#3: In the revised MS, we have split the Discussion section in three paragraphs: (i) water mass balance; (ii) soil carbon leaching to groundwater; (iii) carbon transfer at the groundwater-stream interface.

In addition, we will clarify the Discussion section and add more literature and discussion about DIC/DOC export from land to surface waters. However, we also stress the lack of carbon studies in groundwater, the knowledge gap at the soil-groundwater interface, and how our study helps in feeling these gaps.

We will also modify significantly our figures by splitting Fig. 4 (panel a and panels b&c of the submitted MS) into two separate figures (revised Fig.4 and 5). Indeed, we believe that the opposite evolution of groundwater DIC and DOC with water table is a first key result of our work that needs to be more highlighted. We will also show additional discharge data in first, second, and third order streams that will allow a much better description of the simple hydrological model used in the watershed.

Comment#4: *"L.59 '... generally'. Here, the authors must refer some studies. Moreover, clarify how different this study from these studies?"*

Reply#4: We will change this sentence and added references that focused on the factors controlling C export from land to streams in temperate forested catchment.

Changes in the revised MS#4: "The carbon dynamics in forest stream ecosystems results from the interaction between biogeochemistry, *i.e.* biological activity and retention mechanisms in soils, and hydrology, *i.e.* water infiltration in soils and drainage (Shibata et al., 2001; Kawasaki et al., 2005)."

Comment#5: *"L.74. The Leyre watershed is very large, but the piezometers are only three. Consider and clarify whether or how the data shown here represent whole the watershed. In other words, do the results in Bilos site (0.6km2) represent the whole Leyre watershed?"*

Reply#5: In the Leyre watershed, there are 3 types of soil: wet Landes, dry Landes and mesophyl Landes (Augusto et al., 2006; Jolivet et al., 2007). Each type was characterized with different amplitude of water table depth. In the upper parts of the watershed, as well as near watercourses, the water table is always more than 2 m deep: it is the dry Landes. In the lower parts, or in the vast interfluves, the groundwater is close to the surface of the soil in winter (0.0-0.5 m depth) and generally remains close to it, even in summer (1.0-1.5 m): it is the wet Landes. The mesophyl Landes corresponds to the intermediate situation. In the Leyre watershed, the dry Landes, the mesophyl Landes and the wet Landes represents respectively 17%, 36% and 47% of the watershed area (Augusto et al., 2006). This spatial soil distribution is representative of the "Landes de Gascogne" forest massif (Trichet et al., 1999). According to the depth and amplitude of the water table, our three piezometers were representative of dry Landes (Piezometer 2), mesophyll Landes (Piezometer 3) and a situation between mesophyll and wet Landes (Piezometer Bilos).

Changes in the revised MS#5: We agree with the reviewers that the question of representatively of piezometers must be addressed when extrapolating fluxes at the scale of the watershed. In the revised MS, we will estimate C export from shallow groundwaters to first order streams with the data of the 3 piezometers (not only Bilos), by calculating an export with a mean weighted (by surface) concentration of carbon in the 3 shallow groundwaters. This procedure will improve the mass balance at the scale of the watershed; however, we will still discuss the limits of the approach in the revised MS, providing maximum and minimum C export for the three piezometers.

Comment#6: *"L. 80 & 90 XIXth Change to Arabic"*

Changes in the revised MS#6: We changed to Arabic.

Comment#7: *"L. 91.Consequently...' References about hydrology in the Leyre watershed must be sited around this sentence. If the authors does not cite any studies here, the descriptions are suspicious."*

Reply#7: We would like to apology for the poor and confusing description of how stream discharge was obtained in the present study. In fact, the detailed description of the hydrological approach appears in a companion paper (Deirmendjian & Abril, submitted to Journal of Hydrology). When resubmitting the present paper, we will upload to the BG site the last version of this companion paper, in order to facilitate the reviewer's work. Because the two papers were written and submitted almost simultaneously, we did not realize that the description of hydrology was so poor in the present paper submitted to BGD. The companion paper describes the dynamics of DIC and its isotopic composition from groundwater to the outlet of the Leyre watershed (stream order 4) and contains a detailed analysis of river discharge data in streams orders 1 to 4. Our study took benefit from four calibrated gauging stations of the French water quality agency (with a daily temporal resolution), located on two second order streams, one third order stream and one fourth order stream (see revised Fig.1) (Deirmendjian, 2016). We also performed additional discharge measurements in first order streams. For each stream order, we calculated with a daily temporal resolution for a two years period the drainage factors (i.e., discharge divided by the corresponding catchment area, in m^3 km^{-2} d^{-1}). We then determined the drainage enrichment factors α defined as the ratio between drainage factors of streams of successive orders. Because of the specific characteristics of the Leyre watershed with no surface runoff, we showed a regular increase in drainage factors (hence the drainage enrichment factors is > 1) between two streams of increasing orders, with enrichment factors relatively constant temporally. This allowed us a precise quantification of additional diffusive groundwater inputs in stream reach compare to that coming from the stream of inferior order. Our analysis leaded to the conclusion that monthly drainage values in first order stream was on average 2.3 times lower than that measured in fourth order stream. We will provide a copy of the submitted companion paper in order to help the review of the present paper.

In addition, we should mention that the Leyre watershed is a very flat coastal plain with almost no slope (mean slope is less than 0.125%) (Jolivet et al., 2007), soils are sandy with allover no clay minerals (i.e., very low soil water retention) (Augusto et al., 2006) and permeable (i.e., hydraulic conductivity is about 10^{-4} m s^{-1}, Corbier et al., 2010). Combining the above factors the infiltration of rain water was fast (around 50 to 60 cm h^{-1} on average) (Vernier and Castro, 2010) and surface runoff cannot occur. To support this, (i) our water budget calculated from drainage (that considers only shallow groundwater drainage) was fairly consistent (Fig. 3, end of this document); (ii) there was a lag time (about 3 months) between high precipitation and high river flow (revised Fig. 2, end of this document).

Changes in the revised MS#7: In the revised MS, we will cite our companion paper and resume the hydrological method to make it fully understandable. We will also provide additional information on local hydrology including references on the subject.

Comment#8: *" L.103. Although soil preparation, fertilization and seeding was done in 2005, the referred paper was published in 2003. Why ?"*

Reply#8: We would like to apology for this imprecise and confusing statement. In fact, in December 1999, cutting of the 50 years old forests began with on one quarter of the plot (15 ha) but it was delayed due to a windstorm (Kowalski et al., 2003). Following clear-cutting in 1999, the site was ploughed to 30 cm depth and fertilized with 60 kg P per ha in 2001 (Moreaux et al., 2011). Measurements of eddy covariance fluxes at this site started in 2000 (Moreaux et al., 2011). In November 2004, the site was divided into two parts, which were seeded with maritime pine (Pinus pinaster) with a 1-year lag, in 2004 and 2005, respectively, tree rows being spaced at 4 m (Moreaux et al., 2011).

Changes in the revised MS#8: The above information will be added in the revised MS.

Comment#9: *" L.180. What is the 'CO2 SYS'? No information"*

Reply#9: CO2 sys (Lewis et al., 1998) is a EXCEL Macro spreadsheet that calculates the concentrations of all species of the carbonate system from two measured parameters (in our study we calculated DIC from pCO_2 and alkalinity) temperature, and pressure.

Changes in the revised MS#9: Reference Lewis et al (1998) will be cited in the revised MS.

Comment#10: *" Result. Too complicated. I highly recommend the authors to reconsider what are your main points."*

Reply#10: As we mentioned above (in Changes in the revised MS#2), we will rearrange and clarified the Result section.

Comment#11: *"L.376. 'groundwater uptake'. This term is suspicious. Generally, many plants including pine trees use the soil water within unsaturated zone, and cannot survive if the roots are immersed in groundwater, saturated zone"*

Reply#11: Referee 2 is right, and this is the reason why the network of drainage ditches was created by foresters in order to accelerate the evacuation of the water in excess when the groundwater level rises. In addition, Bakker et al (2006) and (2009) showed that pine roots in the Landes of Gascogne area are confined to the first meter of the soil, probably because of winter anoxia related to the groundwater saturation. However, pine trees exhibit water uptake from the water table and the unsaturated zone (Vincke and Thiry, 2008)**.**

Changes in the revised MS#11: In the revised MS, we will rewrite the sentence as follows: "The water table depth (and thus the groundwater storage) is mostly impacted by evapotranspiration of pine trees, as attested by (i) the correlation between groundwater storage and evapotranspiration (submitted Tab.2) and (ii) this is agree with Vincke and Thiry (2008) who found that water table uptake contributes to 61% of the evapotranspiration for an experimental Scots Pine plot in a flat area of Belgium and (iii) with Guillot et al (2010) who found that groundwater contribution to the evapotranspiration was 50% in the Bilos pine plot.

Comment#12: *"L. 378- and Table 2. The discussions are generally based on the Pearson's correlation coefficient. However, the real hydrological and biogeochemical phenomena cannot be sufficiently described by this kind of simple value; for example, how do you explain the time lag among precipitation, response of groundwater table, and drainage? "The relationship between the groundwater storage and drainage in your site (L.381) is unclear in your consideration, but I suppose that it means the nonlinearity between these parameters, and it cannot be shown by the Pearson's correlation coefficient."*

Reply#12: The lag time between precipitation and groundwater storage is short at our study site, as attested by the strong linear relationship between GWS and P (submitted Tab. 2). This is consistent with the sandy texture of soils with a high proportion of coarse sands (between 60 and 70%) in the Landes de Gascogne (Augusto et al., 2006) which makes the infiltration of rain water fast (around 50 to 60 cm h^{-1} on average) (Vernier and Castro, 2010). The correlation between GWS et P is also consistent with findings of Alley et al (2002) who highlight that groundwater recharge can occur in response to individual precipitation in regions having shallow groundwater table.

However, there is a lag time between groundwater storage and drainage, attested by the nonlinear relationship between GWS and D (submitted Tab. 2). This lag time is due to the combined effect of very low slope and high soil permeability that prevent pulsed hydrological events. In the Leyre watershed, shallow groundwaters acts as a buffer, the river flow being mostly controlled by water table depth and its capacity to store or export water. This buffer capacity of groundwater storage is illustrated in the revised figure 2: (i) river discharge increases in Feb. 2015, more than 2 months after the water table started to rise in Dec. 2014 (revised Fig. 2); (ii) river discharge remained constant between Sep. and Dec. 2015, although the water table was rising, but remaining at low stage (revised

Fig. 2); (iii) there was a lag time (about 3 months) between high precipitation and high river flow (revised Fig. 2)

Changes in the revised MS#12: The above information will be added in the revised MS. In addition, the revised figure 4 that shows DIC and DOC concentrations in groundwater as a function of water table depth will allow us to stress more the non-linearity of the processes mobilizing dissolved C from soil to groundwater and then from groundwater to streams.

Comment#13: *"The authors also mentioned about this at L.382, but why this occurs in the flat topography of the watershed? Any references? I think this occurs not only in flat watershed, but also in steep watershed. Again, many discussions are not supported by reliable previous studies, previous knowledge.*

Reply#13: Transfer of precipitation to rivers involves temporary water storage in reservoirs where different residence times influence the hydrological cycle (*e.g.* Oki and Kanae, 2006). The time of travel in the soil system depending on the spatial temporal gradient of hydraulic head, hydraulic conductivity, and porosity of the system (Alley et al., 2002; Ahuja et al., 2010). In lowland watershed, with overall a small hydraulic gradient, we expected a residence time in groundwater longer than in a steep watershed.

Comment#14: *"L.388-395. The discussion about (annual?) soil water storage is not clear for me. The authors mentioned that it was larger in 2015 (126mm) than in 2014 (71mm). Is this correct? The annual rainfall was much smaller in 2015, and the soil water storage will be smaller as well as the groundwater storage. If the authors can show the data of soil water and/or hydraulic head, we can get more reliable information."*

Reply#14: We totally agree with this comment. We do not have soil water data or hydraulic gradient data at the Bilos site. Consequently, as the Referee 2 mentioned, some discussion on water storage cannot be done.

Changes in the revised MS#14: We will remove this paragraph from the revised MS. Water budget is secondary for our revised MS which is focused on carbon.

Comment#15: *" L. 402. Insert period after 'bicarbonates'."*

Reply#15: We inserted period.

Comment#16: *" L. 463. Discussion of this paragraph is strange""L. 470 'Thus, when the forest ecosystem is a source of CO2 for the atmosphere, it is also a source of CO2 for the underlying groundwater.' ... Even under the drought condition or even when the ecosystem act as a sink of CO2, below ground part of the vegetation 'only' act as the CO2 source; respiration by root always occur.*

Moreover, degradation of organic carbon, including DOC always occur. It's a respiration by microorganisms"

Reply#16: Indeed, we apologize for the confusing formulation in the submitted MS. The Referee 2 is right when she/he mentions that respiration always occurs in soils.

Changes in the revised MS#16: We will change the text of our revised MS as follows: "thus, the late summer period, when the forest ecosystem is a source of CO_2 for the atmosphere, also corresponds to a maximum in CO_2 concentration in groundwater and thus a maximum contribution of soil respiration to groundwater DIC" To our best knowledge this is another original finding of our work.

Comment#17: *"L.482 and other parts. Mean residence time, define by S/flux in this manuscript, should be reword as 'apparent turnover time'. In addition, it was calculated between two sampling days. This method cannot consider the time lag between the storage and output flux, as same as mentioned above. The Pearson's correlation coefficient cannot explain this"*

Reply#17: We will take this comment into account in the revised MS, by changing term "mean residence time" to "apparent turnover time" and defining precisely how it was calculated. It is worth to note that in our MS, we use the apparent turnover times only to support the fact that during the growing season periods, DOC apparent turnover time in groundwater is long enough to assume that respiration of this DOC accounts for a large part of the increase in groundwater DIC.

Changes in the revised MS#17: This information does not require a Figure, and figure 6 of the submitted MS was removed.

Comment#18: *"L. 503. The comparison with peat systems in less meaningful. Should be compared to similar ecosystem with your site. Moreover, I agree with the contents of the four referred papers (L.503-507), but how related them with your results? As I mentioned above, your discussion does not consider about the time lag, or times for decomposition and transport. The referred studies essentially mentioned about this"*

Reply#18: Indeed, the reference concern peatland ecosystems which might behave very differently from our well-drained sandy watershed.

Changes in the revised MS#18: However, in the revised MS we will add other references (Shibata et al., 2005; Jonsson et al., 2007; Dinsmore et al., 2010; Kindler et al., 2011). These studies all show the importance of lateral export of DOC and DIC from different terrestrial systems and that could potentially represent 40-100% of the NEE in peatland systems (Billett et al., 2004; Dinsmore et al., 2010), 10% in boreal systems (Jonsson et al., 2007) , 28% in forests, grasslands, and croplands across Europe (Kindler et al., 2011) and 2% in Japan temperate deciduous forest (Shibata et al., 2005). We will discuss the fact that the proportion of NEE exported laterally by varies a lot depending on ecosystem types. We would like to discuss the fact that in other types of ecosystems, a part of the NEE may be lost by other processes such as litter fall, fine roots turnover and root exudates, even if we cannot relate these processes with our results. We will also highlight the importance to extend this investigation to other landscapes, climatic zones, soil types, vegetation and hydrological regimes, that could considerably improve estimates of carbon budgets of terrestrial ecosystems.

Comment#19: *" L. 508. What's the meaning of this sentence here?"*

Reply#19: We will change this sentence to "As in groundwaters, DOC and DIC in first order streams were anti-correlated, suggesting that C dynamic in first order streams was mostly impacted by groundwater inputs".

Comment#20: *" 'reported' ... Need appropriate citation. 'elsewhere'... ??? Where? Too irresponsible!!"*

Reply#20: In the revised MS, we will cite the references Dawson et al. (2002), Striegl et al. (2005), Raymond and Saiers (2010) and Alvarez-Cobelas et al. (2012) in order to compare our study site with other ecosystems and reinforce our statements.

Comment#21: *"L. 512. As I mentioned at L. 74, I wonder how the authors can show that the observed groundwater is representative of whole the watershed. I think the authors cannot discuss about the spatial variation of data. This is one of the weak point of this paper"*

Reply#21: In the Leyre watershed, there are 3 types of soil: wet Landes, dry Landes and mesophyl Landes (Augusto et al., 2006; Jolivet et al., 2007). Each type was characterized with different amplitude of water table depth. In the upper parts of the watershed, as well as near watercourses, the water table is always more than 2 m deep: it is the dry Landes. In the lower parts, or in the vast interfluves, the groundwater is close to the surface of the soil in winter (0.0-0.5 m depth) and generally remains close to it, even in summer (1.0-1.5 m): it is the wet Landes. The mesophyl Landes corresponds to the intermediate situation. In the Leyre watershed, the dry Landes, the mesophyl Landes and the wet Landes represents respectively 17%, 36% and 47% of the watershed area (Augusto et al., 2006). This spatial soil distribution is representative of the "Landes de Gascogne" forest massif (Trichet et al., 1999). According to the depth and amplitude of the water table, our three piezometers were representative of dry Landes (Piezometer 2), mesophyll Landes (Piezometer 3) and a situation between mesophyll and wet Landes (Piezometer Bilos). Combining the above factors, with a relatively homogenous lithology, topography and slope as well as simple hydrological functioning all over the Leyre watershed, the representativity of our piezometers is quite good because we selected contrasting study site representative of the diversity of the ecosystem.

See also Reply#5.

Changes in the revised MS#21: We agree with the reviewers that the question of representatively of piezometers must be addressed when extrapolating fluxes at the scale of the watershed. In the revised MS, we will estimate C export from shallow groundwaters to first order streams with the data of the 3 piezometers (not only Bilos), by calculating an export with a mean weighted (by surface) concentration of carbon in the 3 shallow groundwaters. This procedure will improve the mass balance at the scale of the watershed; however, we will still discuss the limits of the approach in the revised MS, providing maximum and minimum C export for the three piezometers.

Comment#22: *"L.513-. 'Also, …'. I agree with the first part of this sentence (but need some references about this phenomena), but cannot agree with the second part. Why the absence of correlation support the phenomena? The correlation is just a correlation; it cannot attest the phenomena. Comparison of concentration is different from the correlation"*

Reply#22: We will take this comment into account and rewrite the sentence as suggested:

Changes in the revised MS#22: This might be due partly because groundwater DOC is quickly respired before reaching the stream. Also, as groundwater DOC enters the superficial river network through drainage it might be rapidly recycled by photo-oxidation (Macdonald and Minor, 2013; Moody and Worrall, 2016) or respiration within the stream (Roberts et al., 2007; Hall Jr et al., 2016)/

Comment#23: *"L. 517. (Righi and Wilbert, 1984) This reference is too old. The studies about DOC quality is making steady progress. I think the authors can find more up-to-date studies to support your findings.?"*

Reply#23: We added a more recent reference (Augusto et al., 2006) in the revised MS.

Comment#24: *"L. 521. There are no data, analysis, and discussion about the relationship between the topography and DOC concentration. How and why the difference of DOC concentration between three piezometers was occurred by the effect of topography"*

Reply#24: We wanted to highlight the fact that the export of DOC is impacted by the water table depth. Indeed (i) soil DOC seems to be mobilized only when soil organic horizons are saturated with water; and (ii) water table depth drives the watershed pressure hydraulic head driving the drainage. The water table depth might be influenced with local hydrological heterogeneities or with local topography effect resulting from different soil types. In the Leyre watershed, there are 3 types of soil: wet Landes, dry Landes and mesophyl Landes (Augusto et al., 2006; Jolivet et al., 2007). Each type was characterized with different amplitude of water table depth. In the upper parts of the watershed, as well as near watercourses, the water table is always more than 2 m deep: it is the dry Landes. In the lower parts, or in the vast interfluves, the groundwater is close to the surface of the soil in winter (0.0-0.5 m depth) and generally remains close to it, even in summer (1.0-1.5 m): it is the wet Landes. The lmesophyll Landes corresponds to the intermediate situation. In the Leyre watershed, the dry Landes, the mesophyl Landes and the wet Landes represents respectively 17%, 36% and 47% of the watershed area (Augusto et al., 2006). This spatial soil distribution is representative of the "Landes de Gascogne" forest massif (Trichet et al., 1999). According to the depth and amplitude of the water table, our three piezometers were representative of dry Landes (Piezometer 2), mesophyll Landes (Piezometer 3) and a situation between mesophyll and wet Landes (Piezometer Bilos).

See also reply#5 and #21.

Changes in the revised MS#24: We will calculate the DOC (and DIC) export rates from each piezometers and account for the spatial heterogeneity induced by topography by calculating an export with a mean weighted (by surface) concentration of carbon in the 3 shallow groundwaters.

Comment#25: *" L. 525. The authors have mentioned about the possibility of photodegradation (or photo oxidation) of groundwater DOC at L. 514. However, the authors also mentioned as 'DOC was not labile, and not degraded in the superficial river network' during base flow period. These two comments make me confuse. Generally, the base flow condition occurs in fine (or no rain) days. Why the photodegradation does not occur under base flow condition? Which comment is true for you (and for us)?"*

Reply#25: During high flow periods, the higher DOC concentration in shallow groundwaters than in first order streams could originates from 2 phenomena: (i) oxidation of DOC in the groundwater itself, which leads to a simultaneous increase in groundwater DIC (see revised Fig. 5b-c and new Fig. 7) (ii) respiration and photo-degradation of groundwater-derived DOC in first order streams. However, according to the mean stock of DOC (S_{DOC}), the mean export of DOC (DOC_{ex}) and the respiration rates of 93 mmol m^{-2} d^{-1} (L.444 of the submitted MS) during HF periods, the second phenomenon seems to be less significant than the first because about 60% of the stock of groundwater was respired directly in the groundwaters and only about 4% was exported to streams during HF periods.

During the other hydrological periods, DOC concentrations in shallow groundwaters and in first order streams are very similar and stable, suggesting that DOC behaved conservatively. This was consistent with findings of Schiff et al. (1997) who found that a small temperate basin had wide range in 14C-DOC, from old groundwater values at base flow under dry basin conditions to relative modern values during high flow or wetter conditions.

Changes in the revised MS#54: We will carefully discuss these issues and cite theses references in the revised MS.

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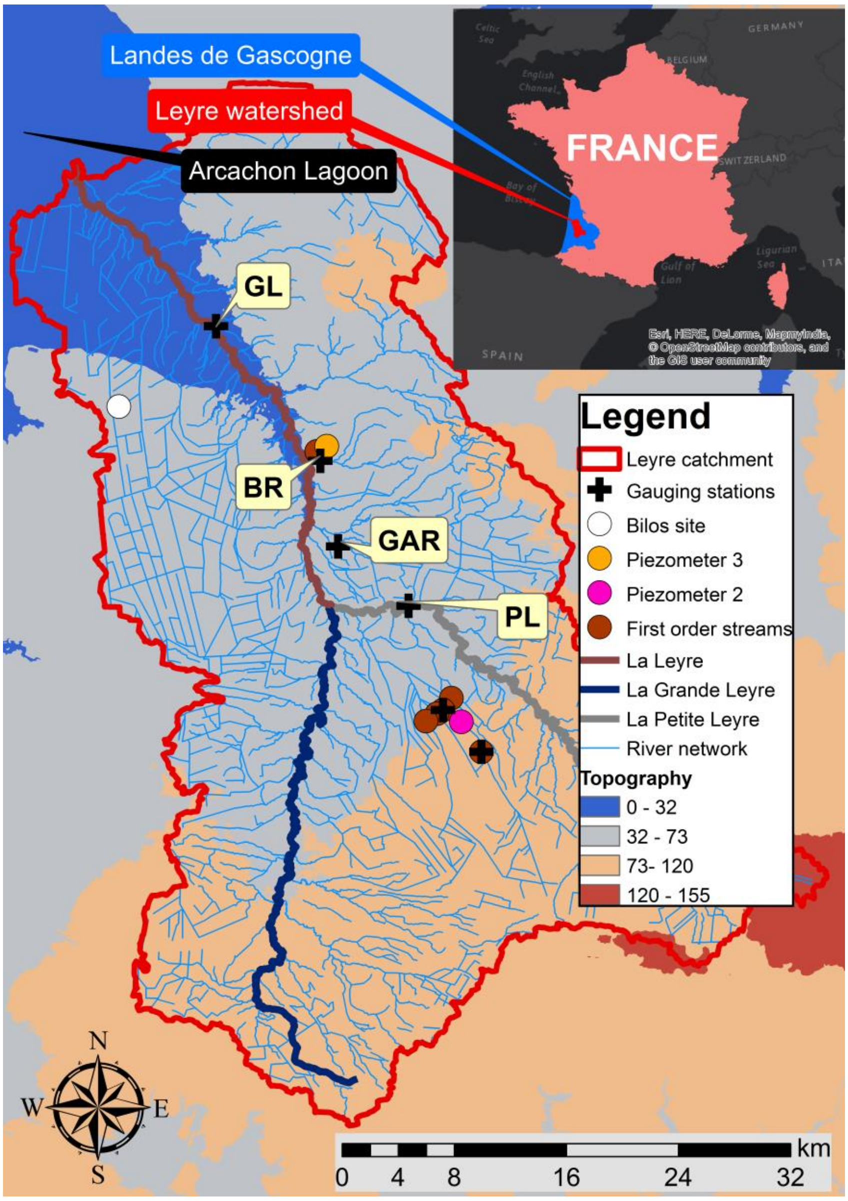
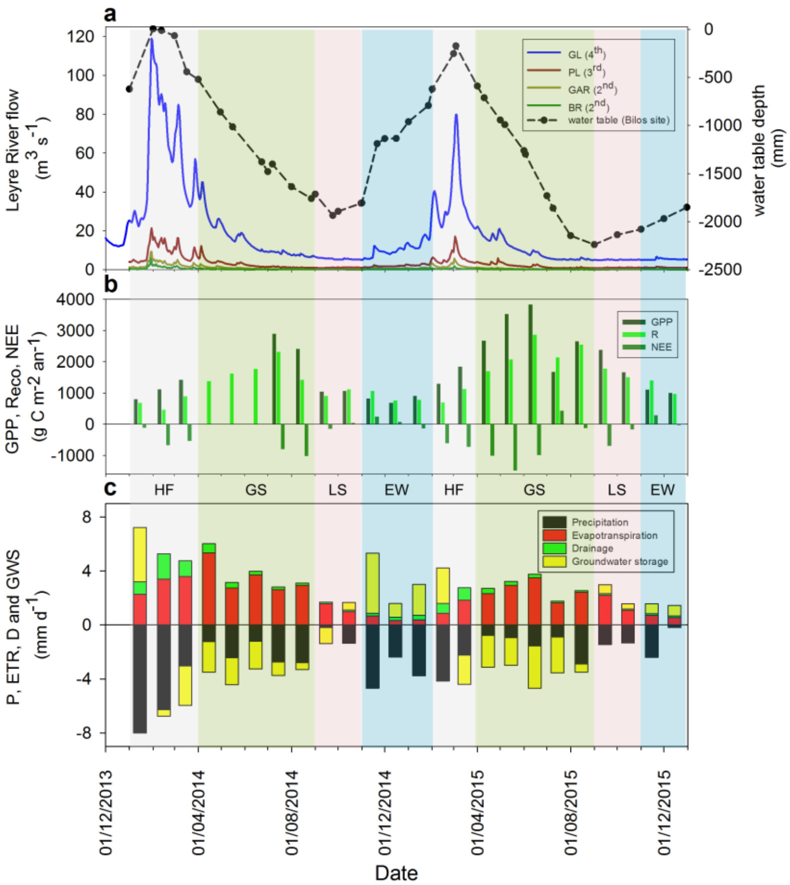


Revised Fig. 1: Map of the Leyre watershed with topography showing the location of the gauging stations (GL, PL, GAR and BR for the Grande Leyre, the Petite Leyre, the Grand Arriou and the Bourron, respectively), the Bilos site as well as the locations of the other sampled groundwater and first order streams. Rain gauge and Eddy tower are located at the Bilos plot.



Revised Fig. 2: Seasonal variations of hydrological parameters in the Leyre watershed. (a) Discharge of the Leyre River (GL), Petite Leyre river (PL), Grand Arriou (GAR) river and Bourron (BR) river associated with water table at the Bilos site; (b) Eco-physiological parameters (NEE, GPP, R_{eco}) estimated at the Bilos site; (c) Monthly precipitation (P), drainage (D), evapotranspiration (ETR) and groundwater storage (GWS) at the Bilos site. HF, GS, LS and EW represent respectively high flow, growing season, late summer, and early winter periods.

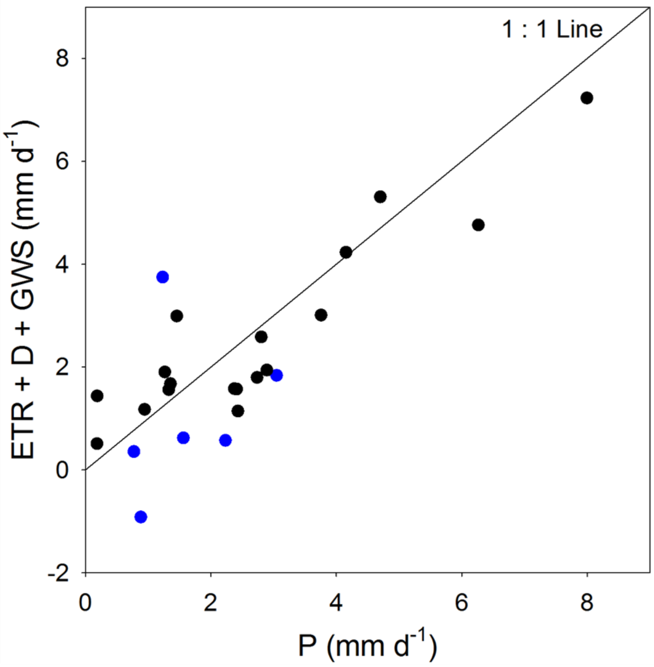
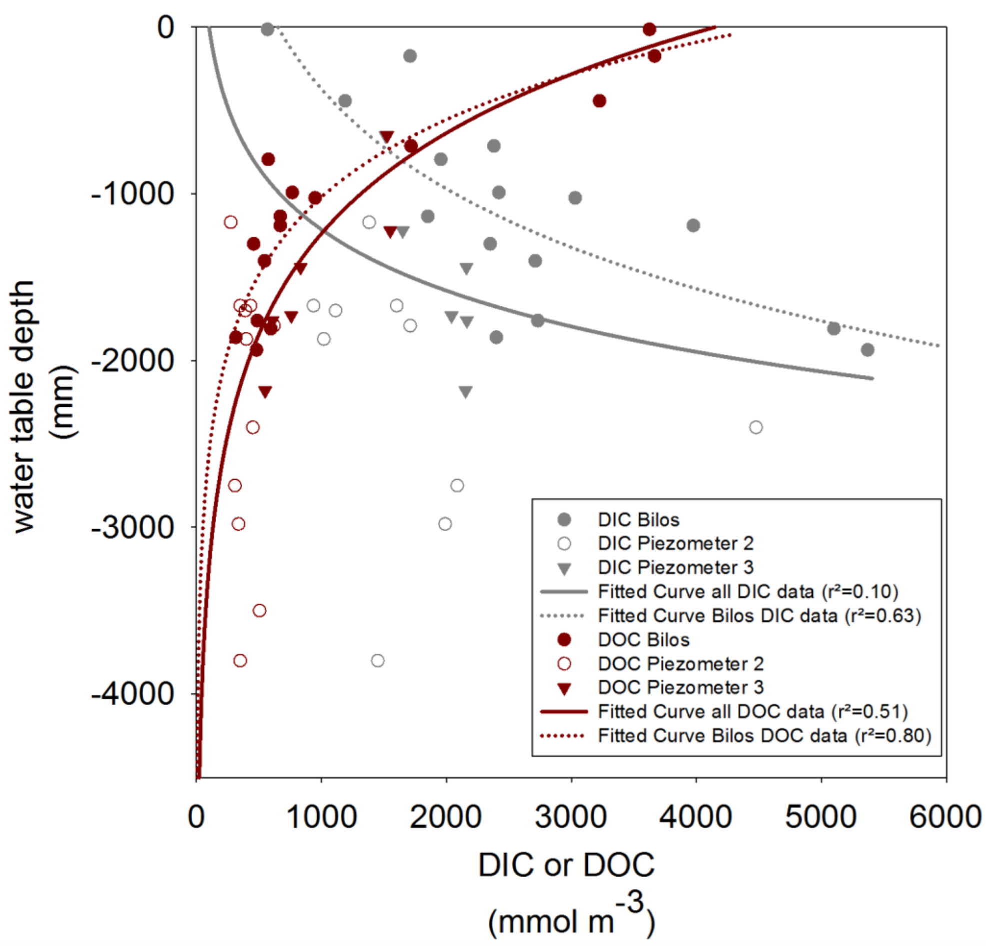
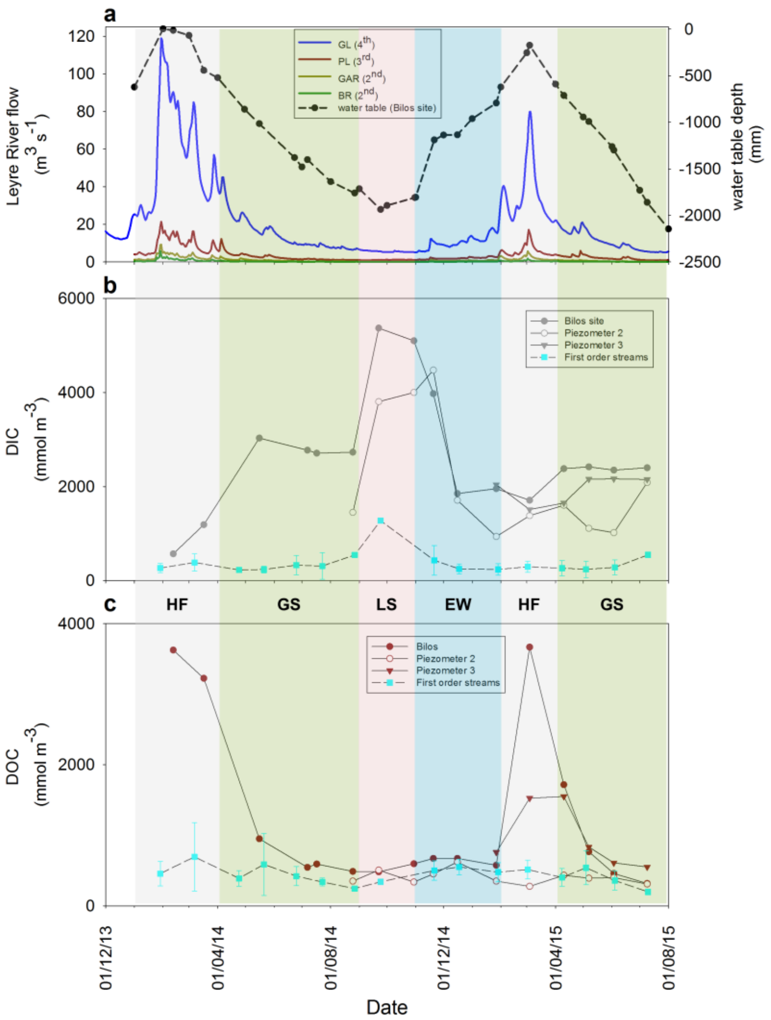


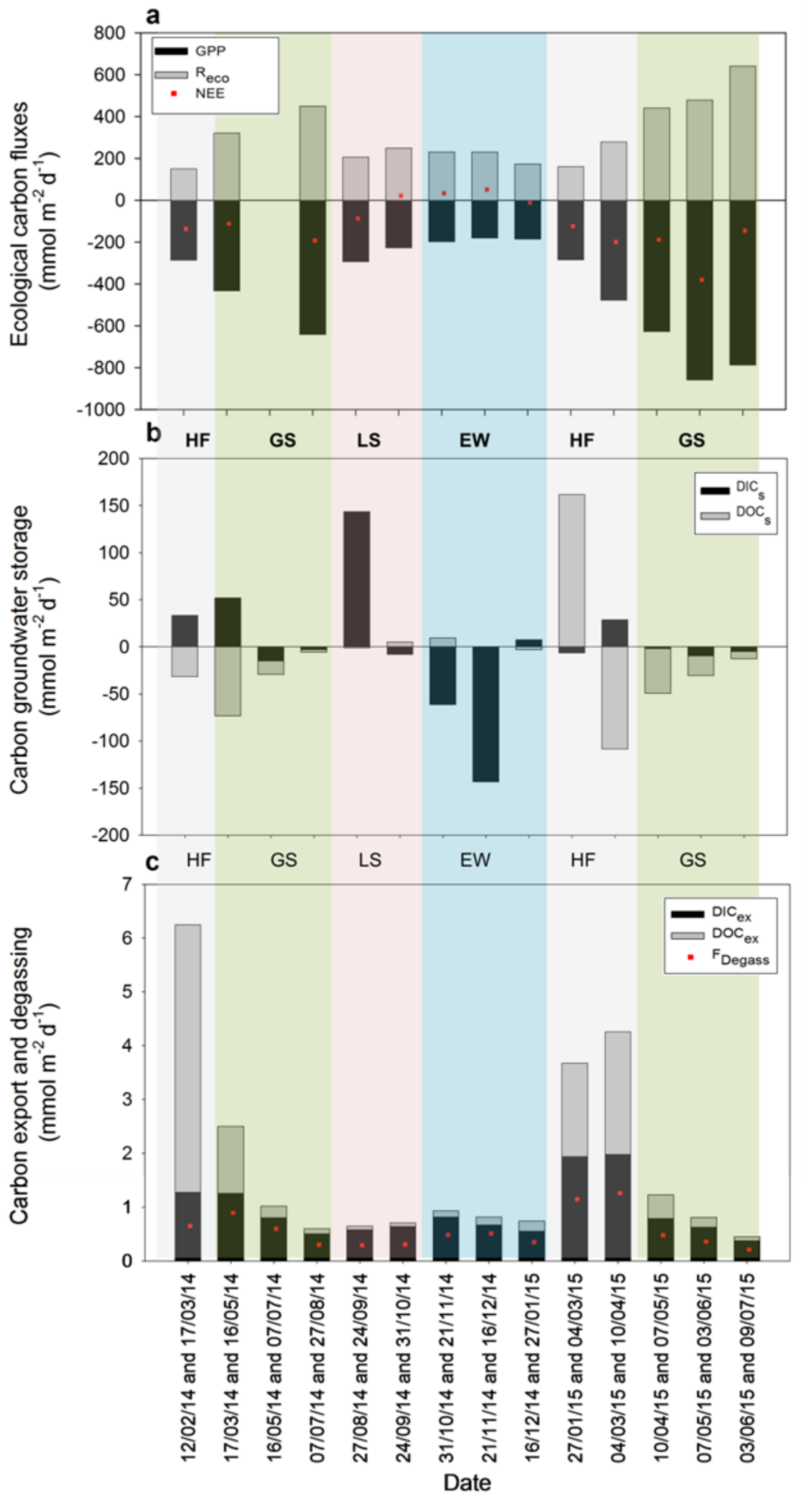
Figure 3: Monthly water mass balance (see section 2.5) at the Bilos site for 2014-2015. Pearson coefficient R = 0.85, p-value < 0.001. Blue points represent months where GWS (Mar. 2014, Apr. 2014, Mar. 2015, Apr. 2015, Jun. 2015, Jul. 2015) is extremely negative (see Fig. 2). These blue points are further away from the 1:1 Line than the other months (represented in black). The drainage of the Leyre River is delayed compared to the drainage of Bilos plot. Thus, when the loss of groundwater is extremely high (GWS negative), calculated D do not correspond to measured GWS. Hence, we expected more mistakes when GWS is extremely negative.



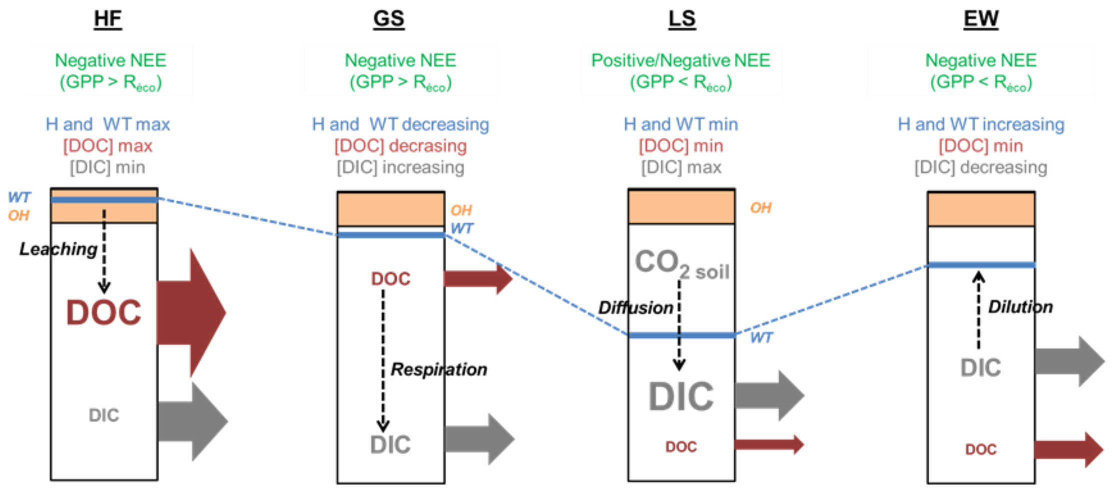
Revised Fig. 4: Concentration of DIC and DOC in groundwaters as a function of water table



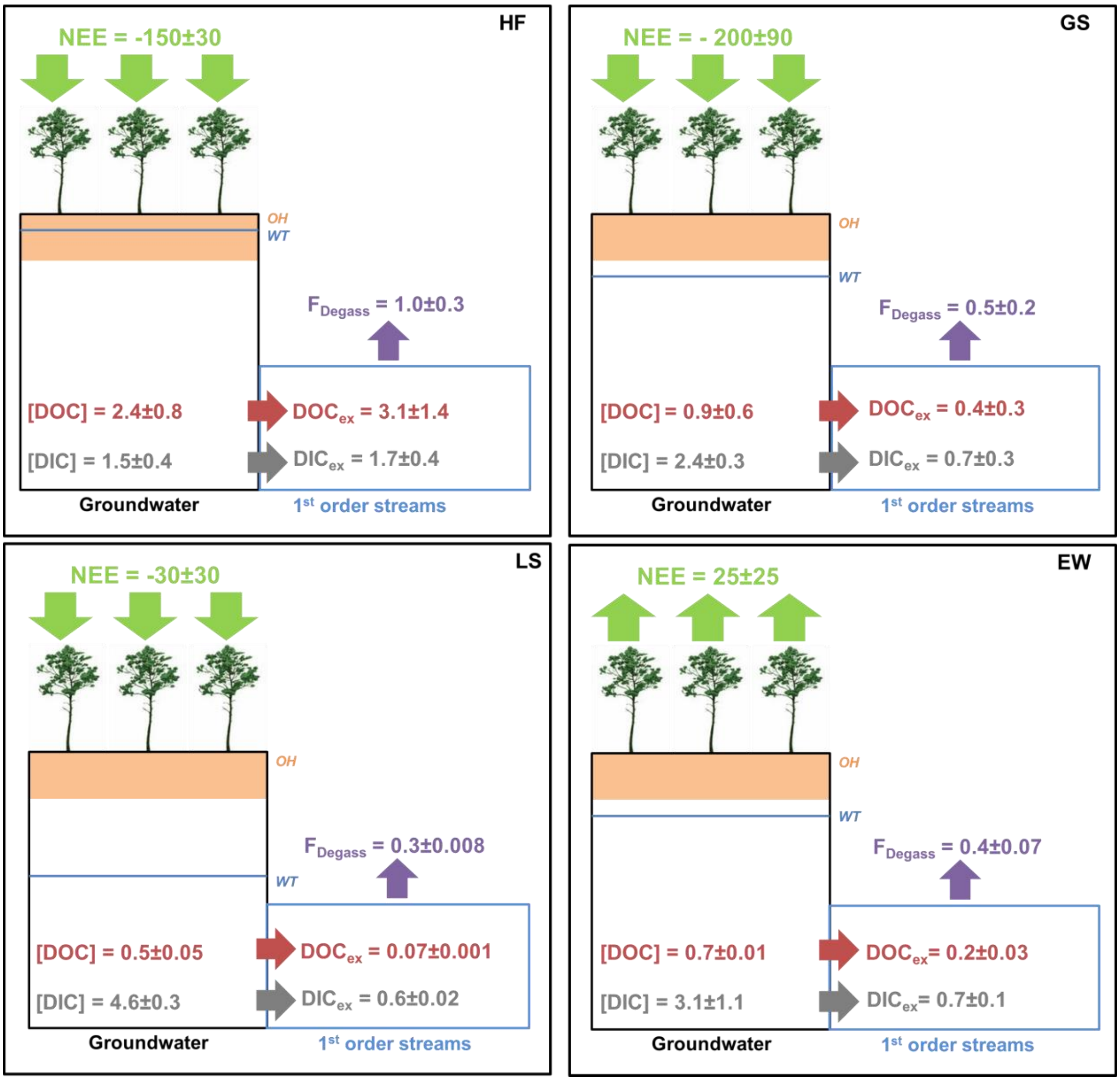
Revised Figure 5: (a) Discharge of the Leyre (GL), Petite Leyre (PL), Grand Arriou (GAR) and Bourron (BR) rivers associated with dwater table at the Bilos site Temporal variations throughout the sampling period of (b) DIC in groundwater (Bilos and the two other piezometers) and DIC in the 6 first order streams (medium dashed line; errors bars represent standard deviation of the 6 first order streams) and (c) DOC in groundwater (Bilos and the two other piezometers) and DOC in the 6 first order streams (medium dashed line; errors bars represent standard deviation of the 6 first order streams). HF, GS, LS and EW represent respectively high flow periods, growing season periods, late summer periods and early winter periods.



Revised Figure 6: Temporal variations throughout sampling period of (a) ecological parameters at the Bilos site (*GPP*, *R* and *NEE*), here *GPP* is represented negative (b) storage of DIC and DOC in groundwater at the Bilos site and (c) export of DIC and DOC throughout Bilos groundwater and degassing of CO_2 in first order streams. HF, GS, LS and EW represent respectively high flow periods, growing season periods, late summer periods and early winter periods.



New Fig. 7: Conceptual model at the vegetation-soil-groundwater-stream interface of the Leyre catchment. OH, WT, D are organic horizon of the soil, groundwater table and drainage, respectively. Hydrobiogeochemical processes are represented in medium dash black arrows. Carbon export are represented in full arrows, the thickness of the arrow provide qualitative information on the flux. . HF, GS, LS and EW represent respectively high flow periods, growing season periods, late summer periods and early winter periods.



New Figure 8: concentration of carbon in shallow groundwaters and fluxes of carbon at the vegetation-groundwater-stream-atmosphere over the 4 hydrological periods. Fluxes of carbon are in mmol m^{-2} d^{-1}. Concentrations of carbon ([DOC] and [DIC]) are in mol m^{-3}. Error bars represent the standard deviation of the different hydrological periods.