In general, reviewers requested to (1) discuss the scientific novelty of this study and (2) have a depeer discussion on the phase relationships between the flow variability and the low frequency oceanographic/climatic oscillations (i.e. AMO, PDO and TNA). All questions and comments from reviewers were answered and uploaded to the system on March 1st 2019.

We now attach the revised manuscript, which not only incorporates answers to comments and recommendations raised by the reviewers, but also includes answers to comments presented by the Editor in his most recent communication. With respect to the editor comments we would like to highlight here some answers to his comments:

Hypothesis and objectives

we think this paper deals with a relevant topic in the field of surface hydrology as the reviewers pointed out. The analysis of the effect of large-scale atmospheric/oceanographic oscillations (particularly those of low frequency) on local hydrology variability and on the modulation of other drivers that have received the most attention, such as the ENSO, allows to address questions of scientific relevance.

Page 2 - Line 11*: Multiple atmospheric/oceanographic oscillations collectively impose a more complex influence on hydrology (Labat, 2010; Nalley et al., 2016; Shi et al. , 2017). Thus, changes in the intensity and frequency of extreme events depend on the coupling and teleconnections of these large-scale atmospheric/oceanographic processes.*

Page 2 - Line 18: *... a major question in the study of hydrology is the potential effect of longer-period climate modes on the variability of hydrological processes and on the strength of a particular event, such as El Niño / Niña. That exists between the multiple large-scale oscillations and the regional hydrological processes at a complex climate-land coupled system (Steinman et al., 2014, Murgulet et al., 2017)*

There is not much information about the effect of low frequency large-scale atmospheric/oceanographic oscillations on the hydrological variability at the sub-regional scale (especially in Northern South America), where it has been pointed out that the ENSO is the pre-eminent element of such variability.

Page 2 – Line 3: *The El Niño-Southern Oscillation (ENSO) is among the most prevalent oceanographic/atmospheric processes linked to streamflow variability in tropical and subtropical areas (Battisti and Sarachick, 1995; Amarasekera et al., 1997; García and Mechoso, 2005, Labat, 2010)*

Page 2 – Line 22: *Several authors have examined the relationship between streamflow variability in northern South America and large-scale oceanographic/climate indices, particularly those linked to ENSO (e.g. the Southern Oscillation Index [SOI], the Multivariate ENSO Index [MEI], and Niño 1, 2, 3, 4) (Robertson and Mechoso, 1998; Hastenrath, S., 1990; Gutiérrez and Dracup, 2001; Poveda et al., 2001; Restrepo and Kjerfve, 2004; García and Mechoso, 2005)*

Page 3 – Line 7*: Overall, contribution from low-frequency oscillations to streamflow variability is poorly understood, particularly in small, tropical, coastal mountain rivers (Stevens and Ruscher, 2014; Nalley et al., 2016; Marini et al., 2016).*

Due to the differences that have been established previously between the rivers of the Sierra Nevada de Santa Marta (SNSM) and other rivers that drain the northwest of South America, our work suggests that there is a discernible and quantifiable effect of the low frequency oscillations in the patterns of streamflow variability of the SNSM rivers.

Page 3 – Line 1*: Pierini et al. (2015) indicated that rivers from the SNSM exhibit a distinctive hydrological pattern, which differs from that of other rivers in northwestern South America. Differences are especially pronounced between rivers in the SNSM and those with headwaters in the Colombian Andes. SNSM rivers exhibits a relatively low contribution from ENSO-related oscillations and a larger influence of quasi-decadal oscillations in their streamflow variability signals, compared to Andean rivers (Restrepo et al., 2012, 2014)*

Page 3 – Line 6*: The magnitude of such influence and its link with large-scale climatic/oceanographic oscillations is still unknown*

The objectives of this study are aimed at verifying this approach (i.e. testable hypothesis). Each of the sub-sections of the results section is aimed at developing these objectives.

Page 3 – Line 21*: (1) explore the temporal characteristics of streamflow variability, with emphasis on low-frequency oscillations, (2) estimate the net contribution (i.e. energy spectrum) of low-frequency oscillations to streamflow anomalies, and (3) analyze the linkages between streamflow anomalies and large-scale, low-frequency, oceanographic/atmospheric processes (Table 2) in small, tropical, coastal mountain rivers of the SNSM (Fig. 1 and Table 1)*

Experimental design and data analysis techniques.

Methods used in this work (i.e. Spectral Wavelet Analysis and Hilber Huang Transform) were selected based on their ability to process non-stationary data that respond to multiple and diverse factors (i.e. streamflow time series). Appropriate methods are considered to develop the objectives outlined in the Introduction

Page 5 – Line 17*: We used Continuous Wavelet Transform (CWT) and Hilber Huang Transform (HHT) analyses to estimate periodicities, variability patterns (****Objective 1****), and the net contribution (i.e. energy spectrum) of low-frequency oscillations to streamflow anomalies (****Objective 2****). We also used Wavelet Coherence (WTC) and Cross Wavelet Transform (XWT) to estimate the correlation between streamflow and eight large-scale climate/oceanographic processes (****Objective 3****).*

These methods offer great advantages over conventional statistical methods and have therefore been widely used for processing and analysis of geophysical data (eg Long et al., 1995, Huang et al., 1999, Grinsted et al., 2004; Labat et al., 2005; Pasquini and Depetris, 2007; Torrence and Compo, 2008; Labat, 2010; Barnhart, 2011; Massei and Fournier, 2012; Jhonson et al., 2013; Nulley et al., 2016; Schulte et al. ., 2016). The Continuous Wavelet Transform (CWT) and Hilbert Huang Transform (HHT) analyzes are robust, sufficient and widely tested methods to address objectives such as those proposed in this paper, as the evaluators pointed out in their comments.

Page 3 – Line 15*: Standard statistical techniques are generally unable to explain the complex interactions, based on non-linear and non-stationary underlying processes, among a wide range of climatic/oceanographic oscillations and their associated eﬀects on hydrology (i.e. Grinsted et al., 2004; Xu et al., 2004; Labat, 2005; Shi et al., 2017). Spectral analyses such as Wavelet Transform (WT) and the Hilbert Huang Transform (HHT) (Grinsted et al., 2004; Labat et al., 2005; Torrence and Compo, 2008; Massei and Fournier, 2012; Schulte et al., 2016) have proven useful to identify the timing of important features of non-stationary signals and to discriminate the relative contribution of signal components, which may change through time*

The approach and experimental design of this study is not novel, since the paper applies established methods and it follows ideas that other papers have developed/applied (e.g. Grinsted et al., 2004; Labat et al., 2005; Pasquini and Depetris, 2007, Torrence and Compo, 2008, Massei and Fournier, 2012, Restrepo et al., 2014, Schulte et al., 2016, Valdes-Pineda et al., 2017). This aspect is pointed out by reviewers. The Data and Methods section provides information on the robustness of these analyzes, their ability to test hypotheses in geophysical data and the statistical precision estimators used so that the patterns and relationships identified are not the result of chance and/or randomness, but of physical links.

Page 6 – Line 19*: A value of 6 was defined for the frequency localization of the Morlet wavelet (ωo) to fulfill the admissibility condition (localization in time and frequency, zero mean, and to acquire a proper balance between frequency and time) (Torrence and Compo, 1998; Grinsted et al., 2004; Nalley et al., 2016). The 95% confidence level was calculated for contours and edge effects area after the method of Torrence and Compo (1998). The edge effect was addressed by the zero-padding approach. This procedure creates discontinuities at both ends of the data, particularly at larger scales. The power displayed in this area is expected to be weaker than actually shown (Nalley et al., 2016). The area in the WT spectrum where the edge effect is shown is referred to as the Cone of Influence (COI). The interpretation of the WT power spectra was limited to the area outside the COI, thus the COI is represented by the region outside of the concave-up area*

Page 6 – Line 11*: An in-phase relationship is indicated by arrows in the enclosed significant regions of the XWT and WTC spectra that point straight to the right. On the other hand, and anti-phase relation is indicated by arrows pointing straight to the left. Arrows that do not point straight to the right or left indicate a lead/lag relationship, when a climate/oceanographic index led the streamflow response (Grinsted et al., 2004; Nalley et al., 2016)*

Page 9 – Line 12*: Thus, it is likely that longer time series are required to test the low-frequency oscillations statistical significance within the global wavelet spectrum. Information on these low-frequency oscillations was considered useful because (1) the zero-padding technique reduces the lower frequencies true power, (2) the CWT isolates hidden signals* *not shown by other techniques, and (3) they are within the range defined by edge effects and cut-off frequency*

Page 9 – Line 21*: Information on the last IMF mode of Fundación (C7) and Gaira (C7) Rivers must be analyzed cautioulsy as they are outside the range established for the edge effects approach (Table 4)*

Page 13 – Line 22*: Such consistent varying phase lag, implies a phase-locked relationship and suggests a physically link (i.e. not a casual relationship) between the streamflow variability and each of the climatic/oceanographic indices (Grinsted et al., 2004; Labat, 2005)*

Discussion

The novelty of this study lies, fundamentally, in the location (Caribbean) and basins' physiography from which the analyzed data come from (**Page 2- Line 31, Page 3 - Line 1**).

These unique charactersitics allowed us to:

(1) highlight the influence of low frequency climate indices (ie PDO, AMO and TNA) on the surface hydrology of northern South America (where its effect had previously been minimized - **Page 13 - Line 1**)

(2) provide strong evidence that low frequency oscillations are major players on the streamflow variability for this area. Its magnitude is of the same order (or higher in some cases) than that of the ENSO (considered as the main driver of the superficial hydrology of Northwestern Southamerica) (**Page 11 - Line 3, Page 11 - Line 7**)

(3) show that flow variability is a consequence of the concurrence of different frequency signals, rather than to a specific signal. This also highlights the modulating effect of quasi-decadal signals (**Page 11 - Line 16**)

(4) understand the role of low frequency oscillations in the streamflow of basins with a small drainage area. These signals had shown less intensity in regional scale studies. (i.e. Murgulet et al., 2017) (**Page 11 - Line 11**).

All these aspects, together with the limitations of this work, were highlighted in the discussion and conclusions sections.