We wish to express our appreciation to the reviewer for the effort and for the constructive comments. Detailed answers to the reviewer`s comments and suggestions is provided below.

## Reviewer #1

### General Comments

In this study the authors use a suit of hydro-meteorological tools to assess the sensitivity of the hydrological regime of two catchments in a convective rainfall environment (in Israel) with respect to projected climate change. The tools were :(1) a synoptic classification using the NCEP/NCAR reanalysis data; (2) convective rainfall space–time characterization and empirical distributions per synoptic system using weather radar; (3) selected GCM simulations from CMIP5 were bias corrected, and changes in the occurrence frequency of the synoptic systems were estimated; (4) rainfall ensembles for current and projected climate were generated by the HiReS-WG; and (5) the streamflow in the catchments' outlets was simulated using the Sacramento Soil Moisture Accounting Model (SAC-SMA). The paper is well written and the results are presented clearly. Here are some comments regarding the structure, the references, analytical possible problems, and some minor remarks on the text.

We thank the reviewer for his specific comments, all were answered below.

### Specific Comments

1. The article reflects the use of large analytical effort in several directions, and cites a number of previous papers of the authors. Therefore it is not clear to the average reader what the specific contribution of this article is, or in other words, how is it different from previously published papers by the same authors. I assumed that the new aspect presented in this article is the integration of several tools developed at an earlier stage by the authors. If this assumption is correct, it should be stated clearly in chapter 2. Moreover, it seems logical that the pieces of the framework presented in chapter 2 and chapter 3 should be listed with the adjacent paper developed previously. For example, page 10557 line 20 "Second, a historical record of remotely sensed rainfall estimate is used to derive the relevant rainfall spatiotemporal statistical properties for each synoptic system" should be followed by the reference of Peleg and Morin, 2012 and/or other relevant references. Additional comment on the same issue: There is not much difference between the first to sixth steps in chapter 2, and the methods and models 1-5 in chapter 3. They should be easily combined.

The reviewer assumed correctly, the new aspect in this manuscript is the integration of previously developed tools and models to a new framework, as presented in section 2. We deliberately separated section 2 (the conceptual framework) from section 3 (demonstration of the framework through a case study, combining tools from our previous studies) and wish to keep this format. We accept the reviewer suggestion to add the references to our previous published paper at the beginning of sections 2 and 3. The text was modified as follows:

Section 2 – "A **conceptual** framework for assessing the sensitivity of the hydrologic regime to climate change is presented on the left side of Fig. 1**. This framework integrates several tools and models that were previously developed by the authors. The steps of the conceptual modeling framework and their relation with the previously developed tools and models are presented in the following section**".

Section 3 – "To achieve this goal the following methods and models (Fig. 1, left side in italic) were used: (1) a synoptic classification was carried out using the NCEP/NCAR reanalysis data **(Peleg and Morin, 2012);** (2) convective rainfall space–time characterization and the associated empirical distributions per synoptic system were computed using data from the Shacham–Mekorot weather radar **(Peleg and Morin, 2012; Peleg et al., 2013);** (3) selected GCM simulations from CMIP5 were bias corrected and changes in the occurrence frequency of the synoptic systems between the historical and future periods were estimated **(Peleg et al., 2014);** (4) rainfall ensembles with convective features for current and projected climate were generated by the HiReS-WG **(Peleg and Morin, 2014);** and (5) the streamflow in the catchments' outlets was simulated using the Sacramento Soil Moisture Accounting Model (SAC-SMA) **(Shamir et al. 2014)**".

2. Page 10556, rows 23 -26: A. Write only the reference. The reader, if interested, can easily find out that (for example) Roberson et al 2004 was written about Northeast Brazil. The same is applied for Page 10563 rows 14-19. B. Samuels et al (2009; see below) did just that (rainfall generator based on synoptic systems analysis) for catchments in northern Israel (closer than Brazil, Greece or Arizona).
The citations of the references were corrected, as suggested, and a citation to Samuels et al. was added.

3. The term "5 min intervals" or "5 min" is mentioned 8 times in the paper. The reader understands it after the second or third time.
We reviewed the usage of the term "5 min" throughout the manuscript and removed it in cases that the term does not contribute to the paragraph's narrative.

4. Page 10564, row 15-22 and Figure 5: It is written "initial cumulative rainfall is required in the beginning of the rainy season before measurable streamflow is recorded in the stations". This is a typical relationship between annual surface flow (ephemeral streams) and the annual rainfall (See Figure 1). It was documented by Arie Ben-Zvi from the Israeli Hydrological Service already in 1992 using the equation: (Total Runoff/Precipitation) = (Precipitation -270mm)*1.905*10^-2, where the left hand side is given in %. The physical mechanism of this delay is well explained by the Hermon karst model developed by Rimmer and Salingar (2006). Dry summer makes the top soil profile dry, and the water absorption potential of this profile very large (it can be estimated by approximately 250 to 300 mm of rain). This amount, typical to the Mediterranean, is much larger than absorption potential of a typical profile in northern Europe, for example.
Similar behavior was given by Samuels et al., (2009) (Figure 1). They revealed that at the Mt. Hermon karst as long as the annual rainfall exceeds 400 mm, the relation ("surface flow"/precipitation) is nearly linear. However if annual rainfall is less than 400 mm (very dry year in terms of this region) minimal additional "surface" flow to the rivers is expected; a stronger reduction in the surface flow component than the reduction in rainfall amounts, and a significant deviation from the linear relations are expected. Similar behavior but for the relations of groundwater recharge/precipitation was clearly observed by Hartmann et al. 2014 (Figure 1) for karst regions in Spain. These previous findings by the following references support the author's model under nearly similar geographic and/or climatic conditions, and therefore should be cited and added to the references.
Samuels R., A. Rimmer and P. Alpert, 2009. Effect of extreme rainfall events on the water resources of the Jordan River. Journal of Hydrology. 375, Issues 3-4, Pages 513-523.
Hartmann A, M. Mudarra, B. Andreo, A. Marín, T. Wagener, J. Lange, 2014. Modelling spatio-temporal impacts of hydro-climatic extremes on groundwater recharge at a Mediterranean karst aquifer. WRR in press.
Rimmer, A., Y. Salingar, 2006. Modelling precipitation-streamflow processes in karst basin: The case of the Jordan River sources, Israel. Journal of Hydrology, 331(3), 524-542.

We thank the reviewer for this detailed remark and for suggesting the aforementioned papers that report similar phenomenon, as we observed, of initial seasonal rainfall amount that is required prior to generation of streamflow events.

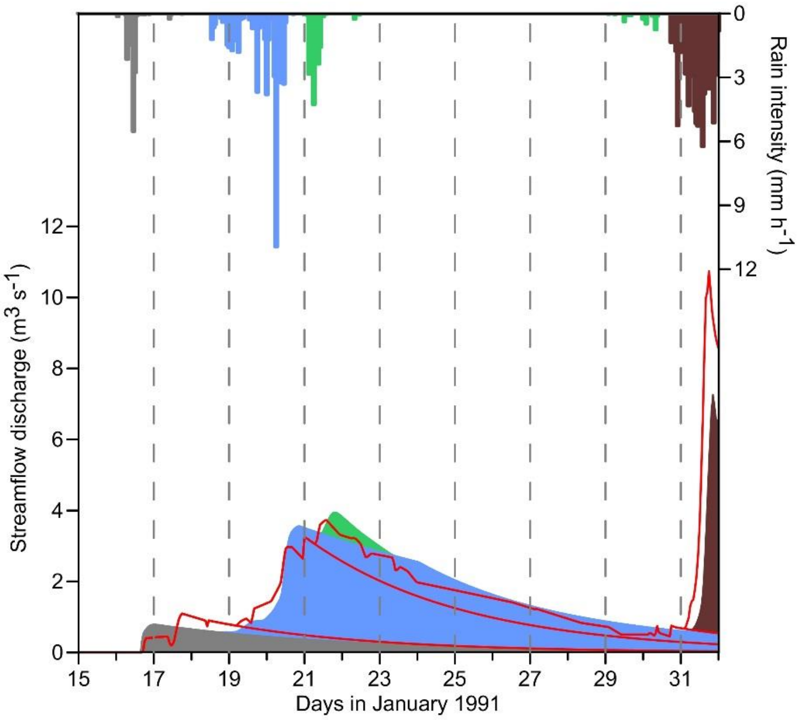
The following text was added (P10564, L18):

**"This phenomenon was previously reported in other Mediterranean- karst-catchments (e.g., Ben-Zvi, 1988; Hartmann et al, 2014; Rimmer et al., 2006; Samuels et al., 2009)"**.

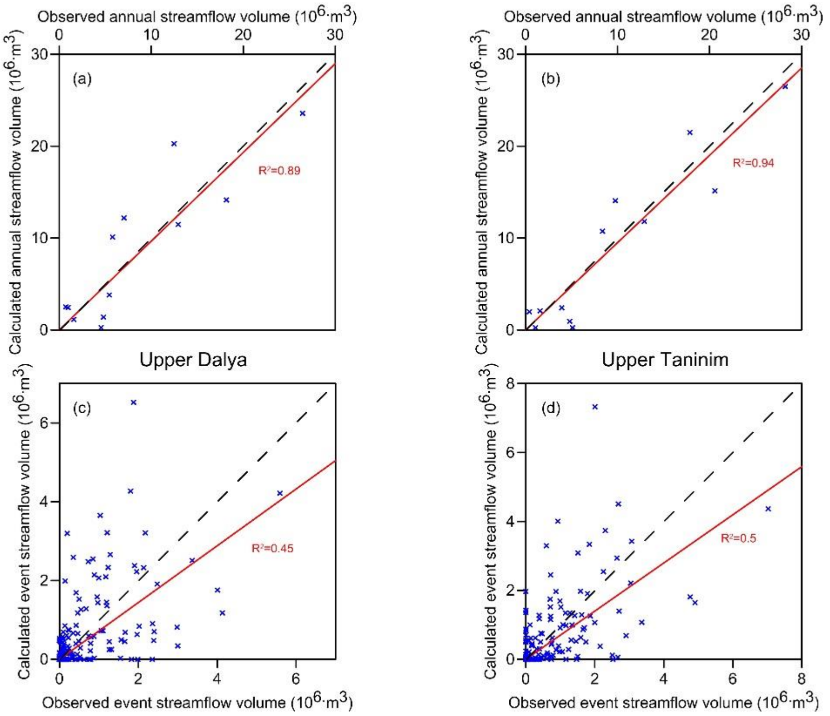
5. Page 10565, row 1-7 and Figure 4: The idea expressed in the sentence "A streamflow event begins when a corresponding rain event begins and ends either when a new rain event begins or after 720 h" and the example in Fig. 4 are not in line with the basic assumptions of linear hydrology systems or with the integral equation for linear systems (the convolution integral), expressed for example by Dooge & O'Kane (2003) or Singh (1988). While the time of the beginning of the streamflow event is the time of beginning of rain, the abrupt cut of the streamflow event is a non-physical interpretation of rainfall-runoff relationship. Instead the authors should use slightly less simplistic formulation, more suitable to classical rainfall-runoff relations by using an exponential decay function ("linear reservoir") of the type Q(t)=Qoexp(-alfa*t) that start when the previous rain event ended with Q(t=0)=Qo, and decay to nearly zero with time, controlled by the recession constant alfa, which is usually typical to the basin. With this method Figure 4 will look as Figure 2 below, and would likely improve the r^2 results of Figure 3c and 3d in the paper.

Dooge, J. C., & O'Kane, P. 2003. Deterministic Methods in Systems Hydrology: IHE Delft Lecture Note Series. CRC Press.
Singh, V. P. (1988). Hydrologic systems. 1. Rainfall-runoff modeling.

We accept the reviewer suggestion for the definition of rainfall-runoff event. We fitted an exponential decay function (α=0.01) to the data starting at the peak discharge of each event. A lower threshold of 100 $m^3/s$ was used. We re-plotted Fig. 4 accordingly:




Following this change in methodology, Fig. 3c and 3d were also slightly changed, resulting in a somewhat lower $R^2$ value:




The text was modified as follows:

Figure caption 4:"**An example of rainfall and streamflow discharge from the upper Dalya catchment separated into different events of rainfall and streamflow. Red line represents the observed hydrograph obtained from the hydrometric station and filled areas represent the hydrograph simulated by the SAC-SMA. See text for details about the separation procedure for rain and streamflow events**".

Section 3.5:"To examine the fit at the event level we defined rain and streamflow events as follows: a rain event begins when rain first appears over the catchment and ends when there is a dry spell intermission that exceeds **at least** three hours before the next pulse of rain occurs; a rain event is being accounted for only if its mean areal rainfall exceeds 10 mm. A streamflow event begins when a corresponding rain event begins. **The end of the streamflow event was determined by fitting an exponential decay to the discharge recession limb (using a decay constant of 0.01 $h^{-1}$ for both catchments), cut at a threshold closer to zero (~0.03 $m^3\ s^{-1}$)**. An example is shown in Fig. 4 for a two weeks period in January 1991 for the upper Dalya catchment. The SAC-SMA simulates the events streamflow volumes reasonably well (Fig. 3c and d), with an acceptable slope of the linear fit between observed and calculated data of **0.72** for the upper Dalya catchment and **0.7** for the upper Taninim catchment ($R^2$ of **0.45** and **0.5**, respectively)".

6. Page 10571, row 13: Three (not two) studies assessing climate change impact on the hydrological regime of the east Mediterranean are there: Samuels et al, 2009 (see above); Samuels et al, 2010; and Rimmer et al, 2011.

Thank you for indicating this additional reference. We have added Samuels et al., 2009 paper and corrected the text as follows:

"Only **three** studies that assessed climate change projected impact on the hydrological regime for this region (using A1B emission scenario) were found. **Samuels et al. (2009) evaluated the impact of projected increase of multi-year droughts and extreme rainfall events on the streamflow of the Upper Jordan River and its tributaries. They found that while the projected increase in extreme rainfall events increases**

**the streamflow intensity and change the extreme events recurrence distribution; no substantial changes were found for the low flow regime**".

Finally, we would like reiterate our appreciation to the Reviewer I for the constructive and thoughtful comments that helped us improve the presentation of our study.