General comments

This paper presents an interesting study that uses geomorphic indexes to classify the landscape of different regions in order to unravel its tectonic history. The analysis focuses in the North America – Caribean – Cocos plate boundary, in the Sierra

The geomorphic analysis is quite detailed and the authors do a good job by interpreting the extracted geomorphic indicators in terms of landscape tectonic evolution and relate them to different tectonic events. Some of the conclusions of this paper are new and quite interesting to improve the knowledge about this plate boundary. Authors define different landscape stages with the aid of geomorphic indexes. One of the main findings is the interpretation of the evolution of the Maya Mountains in the context of the plate boundary (although a proposal, it is very interesting). I think that this paper is suitable for publication if some aspects are improved.

The introduction in some parts is a bit vague and it could be improved by highlighting one of the key points of this study; the interpretation of Maya Mountains in the context of the plate boundary. Authors stated in the introduction that MM is one of the key areas in this plate boundary but do not explain **why**. Until the 2.3 section readers don't know that this region has been poorly studied respect to other areas of the North American–Caribbean plate boundary. Moreover, MM is out of all the revisited tectonic models, proving that this region has been obviated. Authors should address these problems in the introduction as one of the objectives of this paper.

Some of the references for methodological sections are not up to date. Authors should include some relevant references missing in their study (I proposed some recent works, see detailed comments).

The authors use in the paper "isobase maps" but they are not described in the methodological section.

Specific comments.

The bibliography in section 3.1 (swath profiles) is scarce. Swath profiles have been used intensively in tectonic geomorphology. Reinforce this methodology section by adding some recent and relevant references.

HI has demonstrated to be a very useful tool to analyze landscape dissection. There are a lot of works that use HI values to classify landscape forms but only few that do such classification spatially. Your results also reinforce the usefulness of this methodological approach to evaluate spatially tectonic activity. You could add some references to this kind of analysis (e.g. you could add some of these references in this section: e.g. Mahmood and Gloaguen, 2011; Siddiqui and Soldati, 2014; Andreani et al. 2014).

There are many kind of surface roughness parameters in earth sciences (see Smith 2014), and some of them do not necessarily have to indicate high landscape dissection but only an irregular surface. There are many different formulations for surface roughness, and probably for clarity you should describe a bit more the selected approach for this paper. Maybe a synthetic figure where HI, SR and RA are explained would help readers.

The last two area-slope plots of the Figure 10 (profiles 21 and 24) present a problem. I guess that in each regressed segment the two black lines should represent ks and ksn. As ksn index is defined with a fixed reference concavity of 0.45, all ksn lines should have the same gradient in the different segments. This is not true in the presented plots; segments 1-2-3 in profile 21 and 1-2 in profile 24 have very different gradients so I think that authors did not present ksn but only ks and other kind of regression index.

Minor comments.

P 942 - Line 5. Although the used DEM has been extracted by radar, I'm not sure if the term "remote sensing tectonic geomorphology" is suitable for this paper. I would remove "remote sensing".

P 953 – Line 12. D8 algoritm was first defined by O'Callaghan and Mark (1984), include this reference.

P 967 – Line 15. Sort references by date (check this throughout the paper). In this point your last reference is 13 years old (2002), you could include some newer references about this interesting topic (there are a lot of works in the recent literature). The last work of Ferrater et al. 2015 is a good example of how a change in the tectonic setting can produce complex landscapes where relict landscapes can remain in the upper parts of big drainage systems.

P 967 – Line 17. You could reinforce your discussion by adding references to other places where river base-level fall produces headward erosion waves that propagate upstream and leave relict landscapes (Reinhart et al., 2007; Pérez-Peña et al,. 2015). At this respect the use of the term "erosion wave" could be better than "erosion front".

P 969 – Line 2. Change "extremely flat" by "almost flat". Something cannot be flatter than flat.

P 972 – Line 13. You could include the more recent work of Kirby and Whipple (2012) here.

Figures 11 and 12. These two figures should include “see figure 10 for plot description”.

Figure 17. This figure is the core of the paper and it should be self-explicative. Authors should include in caption all the abbreviations used in the figure, avoiding readers to look for them through the paper.

Andreani, L., Stanek, K., Gloaguen, R., Krentz, O., & Domínguez-González, L. (2014). DEM-Based Analysis of Interactions between Tectonics and Landscapes in the Ore Mountains and Eger Rift (East Germany and NW Czech Republic). *Remote Sensing*, *6*(9), 7971–8001. doi:10.3390/rs6097971

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O’Callaghan, J. F., & Mark, D. M. (1984). The extraction of drainage networks from digital elevation data. *Computer Vision, Graphics, and Image Processing*, *28*(3), 323–344.

Pérez-Peña, J. V., Azañón, J. M., Azor, A., Booth-Rea, G., Galve, J. P., Roldán, F. J., … Al-Awabdeh, M. (2015). Quaternary landscape evolution driven by slab-pull mechanisms in the Granada Basin (Central Betics). *Tectonophysics*. doi:10.1016/j.tecto.2015.07.035

Reinhardt, L. J., Bishop, P., Hoey, T. B., Dempster, T. J., & Sanderson, D. C. W. (2007). Quantification of the transient response to base-level fall in a small mountain catchment: Sierra Nevada, southern Spain. *Journal of Geophysical Research*, *112*(F3), F03S05. doi:10.1029/2006JF000524

Siddiqui, S., & Soldati, M. (2014). Appraisal of active tectonics using DEM-based hypsometric integral and trend surface analysis in Emilia-Romagna Apennines, northern Italy. *Turkish Journal of Earth Sciences*, *23*, 277–292. doi:10.3906/yer-1306-12

Smith, M. W. (2014). Roughness in the Earth Sciences. *Earth-Science Reviews*, *136*, 202–225. doi:10.1016/j.earscirev.2014.05.016