

Interactive comment on “Mediterranean depression characteristics related to precipitation occurrence in Crete, Greece” by V. Iordanidou et al.

V. Iordanidou et al.

tsanis@hydromech.gr

Received and published: 25 May 2015

Interactive comment on “Mediterranean depression characteristics related to precipitation occurrence in Crete, Greece” by V. Iordanidou et al.

Anonymous Referee #3

Received and published: 5 May 2015

The paper “Mediterranean depression characteristics related to precipitation occurrence in Crete, Greece” by Iordanidou et al. focuses on the analysis of the cyclone tracks which are associated with rainfall over the island of Crete. In my opinion the

C3782

subject of the article is interesting but the results are still preliminary. I would encourage the authors to resubmit this work but after deepening their analysis.

My major comments go on language and on the scientific content of the article.

1) I am not a native English speaker but it is clear that language needs substantial improvement. The article is full of awkward phrasing and needs to become more attractive to the readers. As an example, I've noted several suggestions/language issues in the abstract.

Lines 1-4: please be more specific on cyclone tracks characteristics; 'variable intensity' should be deleted. I do not quite understand what do you mean by circulation patterns. In my opinion you do not address such a point in the article. Cyclones cause precipitation not the tracks, nor the circulation patterns.

RE: Circulation patterns has been removed from the sentence.

Line 5: Please note that 0.5x0.5 refers to the grid spacing. Also you could use the degree symbol (0.5°).

RE: The degree symbol has been added according to the reviewer's comment.

Line 6: I guess 'Their' refers to the cyclone tracks, which is mentioned in the first phrase of the paragraph. Please rephrase. Characteristics are 'calculated' not 'extracted' with the aid of the MS scheme.

RE: The sentence has been rephrased and 'calculated' is used instead of 'extracted'.

Line 10-11: You may delete 'severity' and the comma before the 'and'. The word 'filtered' is not appropriate here.

RE: The sentence has been changed the way the reviewer suggested.

Lines 11-14: 'atmospheric systems' could be replaced by 'Cyclones'. The word 'morphological' is inadequate. It could be replaced by 'physical'. Phrasing in these lines

C3783

is repetitive and awkward. The whole paragraph should be revised. Please be more precise in the abstract. Instead of 'such as' you could mention the few more tracks metrics that you treat in your analysis. Lines 11-14 could be rephrased to something like: "The seasonal and annual cycle of the physical characteristics of the cyclone tracks are investigated respect to the cyclones' relative location to the island of Crete."

RE: The sentence is rephrased the way the reviewer suggested.

Line 15-18: Remove 'Generally', please be more specific on the study results. The phrase is too long and difficult to understand. You just mean that the cyclones that affect Crete come from the western side of Crete, right?

RE: The sentence has been rephrased as follows: "It was found that cyclones affecting Crete most frequently approach from the western side of the island and the actual cyclone centers associated with precipitation events are usually located in northwest and southeast of Crete domain." The point of this sentence is to show not only the origination of the cyclones affecting Crete but also their actual location during the rain event.

Lines 18-20: Awkward phrasing. For instance, the phrase could read 'Cyclone induced rainfall is correlated with the intensity of the associated cyclones' or 'Cyclone induced rainfall increases in function to cyclones' depth, radius...'

RE: According to the reviewers comment, the sentence has been rephrased as follows: "Cyclone induced rainfall increases in function to cyclones' depth, radius and propagation velocity increase as well as cyclones' pressure decrease."

Line 20-21: This phrase is difficult to understand. You mean that spring cyclones that affect Crete with rainfall present lower pressures and larger radius (?) than the ones in winter?

RE: The sentence as the reviewer noticed was not appropriate and has been rephrased as follows: "Spring cyclones that affect Crete with rainfall present lower pressures and

C3784

higher cyclone propagation velocity in contrast to the ones associated with winter and autumn precipitation events."

Lines 22-25: The phrase is too long. This paper basically associates cyclone track physical characteristics with cyclone induced rainfall. I do not see how you treat hydrometeorological conditions or what kind of hydrological information is provided. .

RE: The sentence is changed according to the reviewer's comment as follows: The examination of the relation between cyclone characteristics and precipitation occurrence provides valuable information related to forecasting potential and management of the water resources and the rainfall extremes.

Line 25 misses subject. You mean water resources and rainfall extremes?

RE: The comment of the reviewer is correct and the phrase been changed accordingly.

2) Many papers in the introduction are cited without describing their results or how they are associated with this study. In addition, the current state of the art in Mediterranean cyclones is poorly reviewed. There are several recent studies that treat the association of Mediterranean cyclones with rainfall or convection, e.g.:

Claud, A., Alhamoud, B., Funatsu, B., and Chaboureau, J.-P.: Mediterranean hurricanes: large-scale environment and convective and precipitating areas from satellite microwave observations, *Nat. Hazards Earth Syst. Sci.*, 10, 2199-2213, doi:10.5194/nhess-10-2199-2010, 2010.

Miglietta, M. M., Laviola, S., Malvaldi, A., Conte, D., Levizzani, V., and Price, C.: Analysis of tropical-like cyclones over the Mediterranean Sea through a combined modeling and satellite approach, *Geophys. Res. Lett.*, 40, 2400-2405, doi: 10.1002/grl.50432, 2013.

Stephan Pfahl, Erica Madonna, Maxi Boettcher, Hanna Joos, and Heini Wernli, 2014: Warm Conveyor Belts in the ERA-Interim Dataset (1979-2010). Part II: Moisture Origin and Relevance for Precipitation. *J. Climate*, 27, 27-40. doi:

C3785

<http://dx.doi.org/10.1175/JCLI-D-13-00223.1>

Flaounas E, Raveh-Rubin S, Wernli H, Drobinski P, Bastin S (2015) The dynamical structure of intense Mediterranean cyclones. *Clim Dyn.* doi:10.1007/s00382-014-2330-21-17

RE: Additional discussion on finding from the suggested publications were added. This was also a comment of the Unknown Referee 1. According to the reviewer's suggestions the following parts have been added to the introduction from the recommended papers: "Also, Miglietta et al. (2013) found that it is before the mature cyclone phase when the most intense convective activity and rainfall happens." "According to Flaounas et al. (2014) who examined the 200 most intense cyclones over a 20 year period, the strongest rainfall is observed close to the center of the cyclone suggesting relative weakness of the Mediterranean cyclones compared to cyclones formed over the main oceans." "In the same manner, (Claud et al., 2010) stated that it is in the early stage of Mediterranean hurricanes (medicanes) that important precipitation occurs." Regarding the Pfahl et al., (2013) publication unfortunately we have no access to the journal and we cannot comment on specific results of our study area.

3) The description of the MS scheme (pg 6109, lines 11-28) should be moved to section 2.

RE: The part of the introduction concerning MS scheme has been rephrased according to Anonymous Referee #1 comments. In this new version a literature review concerning MS scheme is attained instead of a simple MS scheme description which is given in the methodology section.

4) Pg 6113, lines 15-27 and pg 6114 lines 1-10: This part could be clearer. If I got it right some of the cyclones are not associated with several events due to an inconsistency between the cyclone occurrence and the measurement time. How many events are not captured, have the authors tried to perform a sensitivity test on the cyclones radius?

C3786

RE: It is because of the fact that rain records of the gauging stations are daily while MSLP is every 6 hours that there cannot be achieved an absolute synchronization. According to the radius, it is a direct output of the tracking algorithm.

Wouldn't be simpler to associate a cyclone center with a rainfall measurement if the center is X hours before or after the measurement and if the center is Ykm far from the measurement station (where Y is the cyclone radius or something equivalent).

RE: This is exactly the idea of the methodology we followed and presented here. We measure the distance using the cyclone's radius from the cyclone center to the data frame surrounding Crete if the center is X hours before the rain event.

5) Pg. 6114, lines 14-24: this part is more adequate for the introduction.

RE: Section 2 and 3 have been reorganized according to the following comment (6) of the reviewer.

6) The section 3 should be merged with section 2. Section 2 could be divided in two subsections: one devoted to the methodology and one devoted to the tracking method and the observations.

RE: According to the reviewer's comment, section 2 has been split in two subsections: "2.1 Methodology" and "2.2 Datasets" under the general section title "2 Methodology and datasets".

7) Pg 6115, lines 7-10: Do you refer to analysis or reanalysis? I guess the second. The ERA-Interim reanalyses are available in 0.75_ and 1.5_ grid spacing from the ECMWF servers. Did you regrid the dataset? Is there a particular reason?

RE: The reviewer is right that the reanalysis datasets are available in 0.75 and 1.5. We had to regrid the dataset in order to have a better resolution concerning Crete Island. We used the higher possible resolution that could be processed by the tracking software in order to capture, more effectively, the potential subsynoptic cyclogenesis over the Aegean area.

C3787

8) Figure 2 presents three rainfall intensity maps in Crete, classified according to three quantiles. However, the rainfall intensity is defined by threshold values. I do not see how the quantiles are relevant to the authors' analysis. In fact Figure 2 seems not to be of any use in the paper.

RE: The 50th, 95th and 99.5th percentiles of daily rain are very important in this paper as they define the thresholds of the rain categories used in this study. Specifically, figure 2 shows spatially interpolated daily precipitation from all gauging stations for these percentiles, justifying why we have chosen the specific values of 10, 50 and 100mm/day as rain thresholds in terms of intensity.

9) Titles of sections 4 and 4.1 could be changed to something like 'Results' and 'Cyclone induced rainfall', respectively.

RE: 4 and 4.1 sections title have been changed to 'Results' and 'Cyclone induced rainfall' as the reviewer suggested.

10) In 4.2 it is not clear if you treat all cyclones affecting Crete or only the cyclones inducing rainfall.

In order for the section title to be clear it has been changed as follows: "Cyclones inducing rainfall RE: over Crete: track analysis".

11) Sections 4.3 and 4.4 present several statistics on the track features. These sections are very descriptive. I would suggest to the authors to use maps of the cyclones origins or maps of the cyclone track densities instead of using sectors. In my opinion this could provide more valuable information.

RE: The concept the reviewer suggests is very interesting though it has already been investigated in previous studies such as (Bartholy et al., 2008; Flocas et al., 2010). Also in our recent study (Iordanidou et al., 2014) we have examined probability density maps of cyclones inducing rain.

References

C3788

Bartholy, J., Pongrácz, R. and Pattantyús-Ábrahám, M.: Analyzing the genesis, intensity, and tracks of western Mediterranean cyclones, *Theor. Appl. Climatol.*, 96(1-2), 133–144, doi:10.1007/s00704-008-0082-9, 2008.

Catto, J. L., Jakob, C., Berry, G. and Nicholls, N.: Relating global precipitation to atmospheric fronts, *Geophys. Res. Lett.*, 39(L10805), doi:10.1029/2012GL051736, 2012. Flaounas, E., Raveh-Rubin, S., Wernli, H., Drobinski, P. and Bastin, S.: The dynamical structure of intense Mediterranean cyclones, *Clim. Dyn.*, 44(9-10), 2411–2427, doi:10.1007/s00382-014-2330-2, 2014.

Flocas, H. a., Simmonds, I., Kouroutzoglou, J., Keay, K., Hatzaki, M., Bricolas, V. and Asimakopoulos, D.: On Cyclonic Tracks over the Eastern Mediterranean, *J. Clim.*, 23(19), 5243–5257, doi:10.1175/2010JCLI3426.1, 2010.

Hawcroft, M. K., Shaffrey, L. C., Hodges, K. I. and Dacre, H. F.: How much Northern Hemisphere precipitation is associated with extratropical cyclones?, *Geophys. Res. Lett.*, 39(L24809), doi:10.1029/2012GL053866, 2012.

Iordanidou, V., Koutroulis, A. G. and Tsanis, I. K.: A Probabilistic Rain Diagnostic Model Based on Cyclone Statistical Analysis, *Adv. Meteorol.*, 2014, 2014.

Lionello, P., Bhend, J., Buzzi, A., Della-Marta, P. M., Krichak, S. O., Jansa, A., Maheras, P., Sanna, A., Trigo, I. F. and Trigo, R.: Cyclones in the Mediterranean Region: Climatology and Effects on the Environment, in *Mediterranean Climate Variability*, pp. 325–372, Amsterdam., 2006.

Miglietta, M. M., Laviola, S., Malvaldi, a., Conte, D., Levizzani, V. and Price, C.: Analysis of tropical-like cyclones over the Mediterranean Sea through a combined modeling and satellite approach, *Geophys. Res. Lett.*, 40(10), 2400–2405, doi:10.1002/grl.50432, 2013.

Neu, U., Akperov, M. G., Bellenbaum, N., Benestad, R., Blender, R., Caballero, R., Coccozza, A., Dacre, H. F., Feng, Y., Fraedrich, K., Grieger, J., Gulev, S., Hanley, J.,

C3789

Hewson, T., Inatsu, M., Keay, K., Kew, S. F., Kindem, I., Leckebusch, G. C., Liberato, M. L. R., Lionello, P., Mokhov, I. I., Pinto, J. G., Raible, C. C., Reale, M., Rudeva, I., Schuster, M., Simmonds, I., Sinclair, M., Sprenger, M., Tilinina, N. D., Trigo, I. F., Ulbrich, S., Ulbrich, U., Wang, X. L. and Wernli, H.: IMILAST: A Community Effort to Intercompare Extratropical Cyclone Detection and Tracking Algorithms, *Bull. Am. Meteorol. Soc.*, 94(4), 529–547, doi:10.1175/BAMS-D-11-00154.1, 2013.

Interactive comment on *Nat. Hazards Earth Syst. Sci. Discuss.*, 2, 6107, 2014.

C3790