

REFeree's COMMENTS TO THE EDITOR AND AUTHORS

Manuscript (nhess-2023-215) entitled: Intense rains in Israel associated with the 'Train effect', by Ziv et al.

General

This article presents a comprehensive investigation of rain events associated with the so-called "Train Effect" phenomenon, observed in the eastern Mediterranean. The authors analyze dynamical factors and phenomenological features of 17 events, all found in the southern periphery of occluded Mediterranean cyclones, using case study analysis and composite maps. The article presents two new findings and subsequent insights, for which it deserves to be published. One, the essential differences between "East-Mediterranean trains" and those studied in the US and Western Europe. The second, the difference characterized between "coastal front" events studied in the coastal area of Israel (by Rosenfeld and Nirel 1996) and the train phenomenon studied in the presented article.

The article establishes a theoretical framework for explaining "trains" as an inherent part of active cloudiness associated with occluded East Mediterranean Cyclones (i.e., Cyprus Lows). Therefore, I recommend publishing the article in *Nat. Hazards and Earth System Sciences*, after some weaknesses and mistakes are corrected, as specified below.

Major Comments

1. The study included 17 events out of 30 identified. It is essential to refer to the **13 events** that were not investigated and explain why they were not investigated. It must be explained whether they represent a different phenomenon or dynamic process, which may change the insights, or whether they were less prominent in their characteristics.
2. The authors note that based on previous studies: "'the train effect is associated with quasi-stationary cold fronts or within pre-frontal warm tongues..." (line 39). The dynamic factors and process leading to the formation of trains associated with **quasi-stationary cold fronts** in the cold front must be explained, this is to distinguish it from the different dynamical factors associated with Cyprus Lows.

Specific comments:

Page 2, lines 43-44: the authors mention "Train effect was identified also in Western Europe, near the western Mediterranean". Be more specific about the location.

Page 2, lines 45-46: "ZAMG (2014) analyzed 100 convective systems during the period 1992 – 2009...". Specify the location of this study.

Page 2, line 55: "from the North African coast..." change to: "from the North African and North Sinai Desert coasts..."

Page 2, line 57: "...the rain produced by this type of system lasts 20 hours..." For the sake of clarity specify which type of system he refers to.

Page 2, line 67: "...within the cold sector of a CL in 2018." Add **April** 2018 and stress that 'cold trains' occur not only in the mid-winter but also during spring.

Page 3, line 70: "...to document trains". I recommend changing to "... identify, document and analyze..."

Page 3, line 76: "...four consecutive winters (December-February) of the years 2018-2022 (except January-February 2019 due to missing radar data)." Change to: "...four consecutive **mid**-winters (December-February) of the years 2018-2022 (except January-February 2019 due to missing radar data), **total of 10 months**."

Page 3, lines 80-83: Why did the authors utilized data with high resolution, of 0.1°, and did not use the ERA5 data of 0.25° resolution?

Page 4, line 112: "characterized by Mediterranean climate". Please specify what are the characteristics of this type of climate and add a citation.

Page 4, line 112: "The rainiest area was the coastal plain, with 200-270 mm...". State how long this amount of rain accumulated and state the ratio between the amount that fell as a product of the trains (see line 120) and the total rainfall depth.

Page 4, line 120: "...summing up to > 60 mm for the entire event". Were there other trains that were not identified or investigated? I recommend referring to the existence of parallel trains.

Page 5, lines 136-137: "...was developed within a homogeneous air-mass". Recommend changing to: "...was developed within a homogeneous **cold** air-mass".

Page 5, line 138: "...indicate that the CL was at its occluded phase." I recommend adding a sentence (here or in the discussion section) that explains the difference from the quasi-stationary cold front, mentioned in the introduction section.

Page 7, lines 161-162: "In 13 of the 17 events, no rain was observed to the right (south) of the train." And in the other four events, was there a difference in precipitation activity?

Page 8, Table 1: titles: add °N to the Lat and °E to the Lon.

Page 8, Table 1: It is recommended to add the standard deviation in addition to displaying the average only.

Page 9, Fig. 4: After a thorough inspection I have noticed that the location of the train left of the maximum wind takes place only on the lower level (925-hPa level). Please, point to the fact that the mechanism responsible for the train originates from the below. Moreover, the figure will become clearer if you add notation of the pressure-level on each part of it. Also, why is the temperature (or temperature anomaly) plot not shown at the 850-hPa level and the 500-hPa GPH and vorticity, as shown in Figure 2?

Page 10, Fig. 5: For the sake of clarity, I suggest adding notation of the pressure-level and atmospheric variable in parts a and b.

Page 11, line 234: "...show an average significant height of 3-4 meters, with an average maximum of 5-6 meters". A citation is needed.

Page 12, lines 264-265: "...a small frequency compared to the 17 train events..." Shouldn't it be 30 events?

Typographical errors:

Page 1, line 19: change EM trains to East Mediterranean trains

Page 1, line 27: Saaroni et al 2011 should be corrected to Saaroni et al. 2010 and Sandler et al. 2023 should be corrected to Sandler et al.2024.

Page 1, line 32: delete the sign ‘ after the word mostly.

Page 2, line 43: Change “tend” to “tends”.

Page 2, line 45: Change "in the form of train" to "in the form of trains".

Page 2, line 46: “in the form of A train” (missing “a”) or “in the form of TRAINS” (in plural).

Page 2, line 50: Change "train effect has been..." to “train effect have been”.

Page 3, line 68: Change “took lives of 10 people” to “took the lives of 10 people”.

Page 3, line 71: Change "attempt" to "attempts".

Page 3, line 77: “The rain data is based" to "The rain data are based”.

Page 3, line 87: Change "These are regarded" to "These are regarded as".

Page 3, line 94: Change "modified as to fit" to " modified to fit".

Page 3, line 95: Change "location of the CLs' centers" to "locations of the CLs' centers".

Page 5, line 134: Change "the cloud were stirred" to "the clouds were stirred".

Page 6, line 149: Change "5 of them are" to "5 of them were".

Page 7, line 157: Change "while these associated" to "while those associated".

Page 7, line 159: Change "flashflood" to "flash flood".

Page 11, line 228: Change "that produce this" to "that produces this".

Page 12, line 240, caption of Fig. 6: add the word Desert after Sinai so it will be “Sinai Desert”.

Page 12, line 256: “... as is reflected in 925 hPa” Should be changed to: “as is reflected in the 925-hPa temperature map”.

Page 13, line 269: CI should be corrected to CL.

Page 13, line 272: Change "ingredient the CL" to "ingredient of the CL".

Lines 35, 40, 229: Change Chappel to Chappell.

Lines 31, 38, 229: Doswell 1996 should be changed to Doswell et al. 1996.

Delete the comma after the author’s name in the following citations: L. 31: Doswell et al. 1996; L. 35: Chappell 1986; L. 41: Corfidi 2003; L. 77: Alpert et al. 2004; L. 80: Haiden et al. 2011; L. 83: Hól m et al. 2016; L. 92: Sinclair and Revell 2000; L. 114: IMS publication 2018.

Page 14, line 316: delete the reference of Alpert et al. (1990) since it does not appear in the text.

Page 14, lines 323-324: The link to Chappell (1986) cannot be found and should be: https://link.springer.com/chapter/10.1007/978-1-935704-20-1_13

Page 15, line 364: The reference of Saaroni et al should be 2010 (and not 2011).

Page 15, line 365: The reference of Schwartz et al. (1990) should be moved after the reference of Sandler et al.

Page 15, line 368: The reference of Sandler et al., should be moved before Schwartz et al. (1990), and it needs to be corrected to: Sandler, D., Saaroni, H., Ziv, B., Hochman, A., Harnik, N. and Rostkier-Edelstein, D: A multiscale approach to statistical downscaling of daily precipitation: Israel as a test case, *Int. J. Climatol.*, 44(1), 59-71, 2024. <https://doi.org/10.1002/joc.8315>