

Review of: “Saharan warm air intrusions in the Western Mediterranean: identification, impacts on temperature extremes and large-scale mechanisms” by Cos et al. - revised version

I thank the authors for answering to my comments in depth and improving the manuscript. The manuscript has improved a lot with the current version, however, I still have some minor concerns that need to be addressed before publication, most of which are technical, but some more substantial.

Minor comments

line 72 I think if you explain all your sections like this, you should indeed mention all of them. You do not mention Section 7 here.

line 81 What do you mean by roughly? You must somehow have a specific region that you use, i.e. to compute the TX90 values? But thank you for clarifying.

line 89 double parentheses could be avoided

line 110, Fig S3 In the caption you refer to a red box, which in fact is black

line 124, Fig S4 y-axis and caption differ. Is it $\bar{\theta}_{700-925}$ or $\bar{\theta}_{750-925}$?

line 133,135 be consistent with red vs orange shading

line 132, Fig 1 be consistent with purple/fuchsia

line 135 "...a representation of how much area 5% of the WMed IS, ..."

line 139-141 Thank you for adding the sensitivity study. I thought this result was really interesting. My immediate reaction to this sentence was 'why?'. Maybe you could add a thought about what mechanism leads to these changes in the length of the detected events depending on the lower level bounds.

line 158 in panels a-d you show seasonal results, not monthly as you state in this line, or did I misunderstand?

line 159-160 And Fig2: "Results show that the months with most of the intrusions are July and August, as well as December. There is also some notable activity during January-February and May-June." Thank you for adding the panels e-h) in Fig2. However, I still have some reservations about this.

First: panel indicators are missing in the figure.

Second: panel a has a different y-scale, which makes it very difficult to compare the panels and follow your reasoning.

Third: The boxplots are hard to read as they are small, the circles big, and the y-axis too tall, so that it is squished in the bottom. Also, the median is marked in orange, which can be confusing as the data you show in the box plots refers to the blue bars not the orange ones in panels a-d.

Apart from these technical/visual things, I cannot follow the sentence I pasted above. To me it does not become obvious that e.g. December is has many intrusions, only that the spread seems higher? Also you say Jan and Feb have some activity, but from the plot they don't look too different from March or the Autumn months. This definitely needs to be addressed and made more clear before publication.

lines 213-216 These 2 sentences do not belong in the discussion about the ITs, but rather right after line 160.

line 229 Are you using the same acronym for WMed region and WMed Oscillation? This is confusing.

line 233 double parentheses. Also 'is' and 'fluctuations' - plural or singular?

line 246 I still think that the itemised list of correlations should not be itemised using dashes, as they can be read as minus signs

line 255 double parenthesis should be avoided

line 257 There is no table S2, it should be S1, and then in the supplementary you should call it that as well, it is 'Table 1' at the moment
"We aim to quantify the probability of getting..."

lines 265-267 This finding is really interesting. However, you do not really explain why you think this seasonal difference exists.

lines 270 ff 'impact on'

I was wondering here: S12 looks similar for all seasons. But you motivated it in order to explain what is happening in JJA. I am missing your reasoning then, if the behaviour in JJA is explained by a slower dynamics, or what else it could be.

line 280 Thank you for following my suggestion on how to look at the conditional probabilities. However, the equation you show here is not the odds ratio, but the relative probability or relative risk. While it has a similar meaning, please be careful about the wording and the exact conclusions you draw. Decide for either of them, but then check the meaning and be consistent.
For reference, the odds ratio is defined as:

$$O1 = \frac{P1}{1 - P1} \quad (1)$$

$$O2 = \frac{P2}{1 - P2} \quad (2)$$

$$OR = \frac{O1}{O2} \quad (3)$$

where in your case: $P1 = P(TX90p|ITnday)$, $P2 = P(TX90P|noITnday)$

line 281 '...when the day is not in ITn' A day cannot be IN an intrusion type? please rephrase.

line 283 "isn't" should be is not

line 289 to have an influence ON

line 292 the word coincide indicates a joint probability, not a conditional one

Fig 7 Thank you very much for showing this, it improves the manuscript greatly. I had a follow-up question now. Did you look at the same thing for all ITs combined? I.e. $P(TX90p|intrusionday)/P(TX90p|nointrusionday)$. Since the intrusion types are still somewhat similar, comparing to "no ITn intrusion day" will still incorporate all other ITs (which have an effect on similar regions). I assume you could see even more clearly that intrusions in general have an effect on temperature if you showed it for intrusion days in general.

line 306 you are referring to Fig4 not 5 here?

line 328 change the passive to an active citation

Fig 8/9 Your description is a little bit hard to follow, since the colour scales are different, which makes it difficult to estimate if a signal is stronger in Fig 8 or 9.

line 351 reference Fig 7 here

line 363 S4 is the wrong figure to reference here (since this is not the only instance of a wrong figure being referenced, please check carefully if all references are correct)

general be consistent in your spelling of upper-troposphere/tropospheric, i.e. with or without hyphen