Second review of

Contrasting stable water isotope signals from convective and large-scale precipitation phases of a heavy precipitation event in Southern Italy during HyMeX IOP 13

February 2019

Overview

This review comments on the revised version of the article. The authors have made a great effort to address the comments and rectify the substantial weaknesses of the manuscript, which were present in the first version. All major and minor points were adequately taken care of and I recommend publication of the manuscript after a number of minor revisions. While the comments below are numerous, none of them warrant another round of major revisions, as all of them can be addressed without investing too much time.

Minor Comments

1. While reading the manuscript, I still missed the basic justification for this article, as I have emphasized in my first round of comments. However, it turned out to be located in the last paragraph of the last section of the article. I suggest to present it toward the end of Section 1 and even make a short comment on the intentions behind this study in the abstract!

2. In section 2.1, the grid spacing and domain dimensions are mentioned at the very end of the section (p. 7, l. 2 – 6). I suggest to move them to the start of the model description or at the very least to the beginning of the second paragraph.

3. While section 3 is greatly improved, the shortening had an unwanted side effect. Due to the density of the text, the third and fourth paragraph of section 3.2 (p. 10, l. 6 – 28) contain no less than 12 references to figures, more than one every two lines, referring to four different figures in the order 5, 3, 5, 3, 4, 3, 4, 4, 5, 5, and then back to 2. I understand that it is necessary to refer the reader to the correct figure, but you should try to rearrange these two paragraphs a bit, such that they don’t jump around between figures this often and contain at least slightly fewer references to figures.

4. The manuscript contains multiple instances of the X value, where X can be a quantity like q or θ and so on, remove both, the and value, and just use X instead (e.g. p 11, l. 4, 5, 6, 7, 27, 28–29, …)
5. It says on p. 11, l. 20 that "between 18 and 6 hours before arrival... but looking at Fig. 7 shows evaporation more or less the instant the trajectories start passing over the sea, for some of them well above 24 hours before the event. Perhaps you should consider a least restrictive formulation here.

6. Section 4.1.1, third paragraph refers to dots following mixing/Rayleigh lines, but that doesn’t really seem to be the case, at least not exactly. Do these lines depend on the constants in their equation, which might fit better for other values? If so, consider using them. If not, or if this is too much effort, explain more clearly how they agree with the scattered dots.

7. At multiple locations in the text, a moist plume over Africa is mentioned, and it is not always referred to in the same way (African moist plume, African moisture plume, the plume of...), please keep this consistent throughout the manuscript. Also, explain whether this is a climatological plume or a feature of this specific event.

8. Section 5 can still be slightly shortened by removing some of the values (not needed in the conclusions) and condensing the text further, specifically the part on p. 15, l. 8 – 26.

**Typos and Formulation**

<table>
<thead>
<tr>
<th>page</th>
<th>line(s)</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>replace linked to a frontal feature with ahead of a cold front</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>change to large amount of convective precipitation</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>replace preceding the occurrence of with before</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>remove comma after SI</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>replace brings with lifts, remove masses</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>remove to higher altitudes</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>change mesoscale deep convection to organized deep convection, add comma after events, remove along</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>remove content, remove deep</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>replace question with research topic</td>
</tr>
<tr>
<td>2</td>
<td>28 – 29</td>
<td>Using either... or like this indicates that Africa or extratropical remnants of Atlantic tropical cyclones over the Atlantic are the only sources of moisture, but other sources are possible as well as a combination of sources. I suggest to rephrase this a bit to account for these possibilities or at least not exclude them.</td>
</tr>
<tr>
<td>2</td>
<td>29+</td>
<td>Change sentence to More recent studies (e.g. Lee et al., 2016 and 2017), pointed out a significant moisture contribution, one quarter of the total integrated water vapor, from North Africa...</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>remove the s at the end of isotopes</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>replace constraints with insights</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>change at surface to at the surface</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>remove comma after evaporation</td>
</tr>
<tr>
<td>4</td>
<td>15, 17</td>
<td>repetition of the free troposphere of...</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>change in the low levels to either in the lower troposphere or simply at low levels</td>
</tr>
</tbody>
</table>
What exactly is meant by *initiated over Algeria*? Is this where convection first occurred?

5 13 replace *large* with *high*

5 14 add *s* after *temperature*

6 5 replace *sense* with *context*

7 15 replace *written as an output to extracted from the model or just change to written out*

7 20 insert *specific* before *humidity*, remove comma after *humidity*

8 4 add *s* after *ratio*

8 10 add *s* after *condition*

8 17 insert *region* after *SI*

8 23 replace *a reasonable* with *good*

8 25 add *s* after *observation*

9 2 – 6 The two parts of the sentence *The moisture structure (...) has been further studied...* are extremely separated and the sentence becomes difficult to read. You could rephrase it to something like: *The moisture structure upstream of the HPE studied by Lee et al. (2016) has been further analyzed. Three features are highlighted below: 1) the presence of ...*

9 7 add commas before and after *located over south-eastern France*

9 8 The threshold of 1002 seems arbitrary, this might be a relic from back when the area of MSLP < 1002 hPa was the only shaded part of Fig. 3.

9 10 remove comma after *air*

9 11 remove commas before and after *q*, remove *thus*

9 15 – 16 change to *(...) is located ahead of the trough (red area in Fig. 3b).*

9 16 change to *Comparing the maps of q and δ¹⁸O (crescent enclosed by a dashed line in Fig. 4a-b) reveals an additional...*

9 28, 29 repetition of *the hourly evolution of*

10 3 move *slightly* to after *increase*

10 7 is it the upper level trough or the cold front? Those are two different things.

10 12 remove both, *the* and *level*, at the end of the sentence

10 13 remove *Then* at the beginning of the sentence, add a comma after *UTC*

10 14 which western edge?

10 27 insert *at* after *SI*

11 2 insert *the* before *two*

11 Multiple instances of *history* where *evolution* might be the better word (e.g. lines 7 and 11)

11 10 change title to *Phase one: the convective phase*

11 13 – 15 change to *The 3-day backward trajectories in Fig. 7 indicate that the air parcels arriving at SI in the 800 – 700 hPa layer originated over the North Atlantic.*

11 16 replace *are mostly* with *remain*

11 17 add comma after *SI*, remove *rapidly*

11 20 change *as well as* to *and*

11 22 change *mixing* to *they mix*
remove occurs, change the median q value to the median of q

change to (...) before their arrival, showing that q and δ\(^{18}\)O\(_v\) increase rapidly in the last 12 hours before the parcels arrive over SI. Between 60 and 12 hours before their arrival (Fig. 8a, b), q and δ\(^{18}\)O\(_v\) are still relatively small, at around 2–6 g kg\(^{-1}\) and between -25 and -19 %, respectively. (Is this really in the dry pocket of upper-level trough? The trough itself should also be somewhere else this long before the event...)

change to for conditions in the Mediterranean

blue line I do not see a blue line in the figure, does this refer to the dashed line?

gray to purple - shouldn’t this be green to purple?

color to Horizontal SWI distribution

remove feature, remove a region of enhanced convective activity and

change multiple convective cells to a convective line, which extends (...) and is located ahead of the surface cold front. Westerly and north-westerly winds prevail at 542 m ASL while south-westerly wind is dominant at 2455 m ASL.

Within the precipitation area, lower δ\(^{18}\)O\(_v\) values (< -16%) than in the vicinity are found at 542 m ASL while locally higher δ\(^{18}\)O\(_v\) values are found at 2455 m and 5565 m ASL (Fig. 10d, f), indicating the presence of strong and deep convective mixing. This convection causes the vertical transport of SWI-depleted moisture ...

remove large

of

replace at with along

change to Additional moisture is then...

add s after hour, remove the ... values

change strongly increase to increase strongly

remove third zero

add comma after altitudes

the vapor take-up isn’t over North Algeria, it’s over the Mediterranean sea

end sentence after (Fig. 11a–b) and remove and before the median q, change to the median of q

change precipitation onset to the onset of precipitation

repetition of moist and SWI-enriched

add s at the end of parcel, add comma after particular

change to Horizontal SWI-distribution

this is still hardly visible at 5500 m, all shades of blue look almost exactly the same in print

the black line shows very little decrease, it’s visible for the others though

multiple repetitions of moisture plume over North Africa or similar in this line

replace becomes more depleted with decreases

replace that with which
<table>
<thead>
<tr>
<th>page</th>
<th>line(s)</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>24</td>
<td>I thought P2 was dominated by large scale ascent, not convection</td>
</tr>
<tr>
<td>14</td>
<td>24 – 28</td>
<td>This paragraph seems like it belongs to section 4.2.1, not 4.2.2</td>
</tr>
</tbody>
</table>