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

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Overview

The reviewed article is a thorough case study performed using COSMOiso. While the analysis of the simulation results is highly detailed, the title and abstract of the manuscript lead the reader to expect a comparison to observations. However, the only observations used are precipitation measurements. Considering the emphasis on isotope modelling, I would have expected at least some measurements of this nature. For that reason, the purpose of the manuscript as a whole, and especially the long and detailed analysis of isotope distributions within the manuscript, is not clear.

The main question is: what additional insight is gained from the use of a model-only isotope analysis. This problem is further underlined by the presented trajectory analysis, which seems to provide the same information which is derived from the isotope concentrations. For a recommendation for publication, the authors need to better outline the purpose of the study, as well as their reasoning for using COSMOiso and its advantages compared to a trajectory analysis or even just passive tracers.

Assuming these problems can be addressed, a number of other issues remain. Below is a detailed listing of major and minor comments which should help the authors to improve their manuscript substantially.

Major Comments

1. Section 4 is the core of the manuscript. However, even considering that, it seems out of proportion. It is not only very long but also difficult to read and descriptive over long spans. This section would greatly benefit from being shorter and more concise.

2. Parts of the conclusion repeat contents of section 4 in too much detail, shorten and be much more concise and clear.

3. The authors need to discuss their results in a critical way which includes an explanation of the insights gained by using COSMOiso over a normal mesoscale simulation, which would be possible at a much higher resolution too. This discussion can be part of the last section *Conclusions and Discussion*.

4. Multiple figures are difficult to read, be it due to bad coloring or their size. The authors could greatly improve the manuscript's readability by making sure that figures use more contrasting color

tables, fewer contour levels and that the figure size and shape make better use of the available space. I mention specifics for certain figures throughout the minor comments, but the other figures can also be improved following those same guidelines.

5. Figures are often referenced out of order, try to keep this to an absolute minimum. This will likely require some restructuring of the text.

Minor Comments

page	line(s)	comment
3	1	*large amounts of water vapor* how large?
3	10	*observations of the most stable water isotopes alone can be limited* this indicates that "normal" observations only look at this isotope, but I assume that the sentence refers to classical observations which simply look at the total moisture without any regard for different isotopes. This should be more clear.
3	14, 15	replace *in the other phase (vapor)* with just *in vapor*
3	19 – 24	Please specify what *high* and *low* are in this context by giving typical values
3	29	remove commas
4	16	change to *used **a** stable isotopic* or *used stable isotopic signal**s***
4	20	add comma after *mesoscale*
4	25 – 27	move the part *that occurred (...) Mediterranean Experiment (HyMeX ...)* to a separate sentence
5	1 – 5	This description is difficult to follow if one is not familiar with Lee et al. (2016). This should be moved to section 3, where it can make use of Figs. 1 – 3 for a thorough but concise description of the event (see also comments on Fig. 1)
5	3	remove *wind* after *mistral*
5	4	change *convection activity* to *convective activity*
5	8	add *and* after the comma
5	10	change to *However, the origin and transport pathways of moisture have not been studied to date.*
6	2	specify that this is a *deep* convection scheme, since the resolution of the model has not yet been mentioned at this point
6	3	please add a very brief and concise description of what these physics and isotope parametrizations do, one to three sentences should suffice
6	11	please add some details about this model. Does it run operationally? Is it an analysis? Does it run only for specific cases?
6	12 – 16	Why is a resolution of 7 km used? Is this to be able to differentiate between convective and other precipitation by using the convection scheme's precipitation? Resources? Other reasons? Please specify.

page	line(s)	comment
6	22	5 day trajectories in a 5 day simulation? So just back to the start of the simulation or until they leave the domain?
7	6 – 8	Why are these values chosen?
7	20	Spell out *two* in the section title
7	23	hour is abbreviated with just *h*
Fig 1.		Some dots have edges, others have none. Remove all edges and make sure the higher precipitation measurements are plotted on top of the lower values to keep them clearly visible and not hide maxima. The Figure is very small and the comparison is difficult to read. In Fig. 1b all contour colors from 5 to 25 mm look almost exactly the same in print, please use a color table which shows the differences more clearly. Fewer levels might help to achieve better contrast, do you really need 24 different ones?
7	26	*a large precipitation* rephrase
7	24 – 27	This sentence is too long and convoluted, simplify by moving the total precipitation amount to a separate sentence
8	8	remove comma after *France*
Fig. 3		Change the colored contours of MSLP to lines, chose a good interval (not too dense) and smooth the field a bit if necessary. Add colored contorus of 500 hPa geopotential to show the position of the trough. Move the vectors from the left panels to the right panes, they contain information of the same level.
8	11, 12	don't use *very* in scientific text, be specific
8	13	change *high θ values ($\geq$330 K)* to *values of $\theta \geq$330* K
8	16, 17	Could convection be causing the cool areas in the 850 hPa θ map over TY?
8	17	It is never explained that the model does, in fact, not produce two peaks. They are only visible when separating precipitation from the convection scheme and precipitation produced by microphysics.
8	18	the trough is never shown, add reference to Fig. 3 after adding the 500 hPa geopotential as suggested
8	23	*strong cyclonic flow* there is only one arrow within the box, curvature is hard to see
9	12, 13	*very low* and *large* are not helpful in this context, just use the values. However, a short explanation on why the threshold between these two values is important would be helpful.
9	26	the front is not really close to SI
10	27	*mostly very dry* use values instead, be specific
11	2	remove *the* before *q* and $\delta^{18}O_v$, remove *values* after $\delta^{18}O_v$
11	6	change to *The median q value (...) factor of 2.5*
Fig 7		Figure has lots of white space and the way the map is shown causes even more. Try to reduce this to make the important parts a bit larger.
11	12	replace *the average q* with *q is about 9 g kg^{-1} on average*
11	14	It is never explained what a Rayleigh line is

page	line(s)	comment
11	19 – 21	This sentence is complicated. Also, why?
11	28	replace *many* with *multiple*, change *convection* to *convective*
12	2	usage of low/high seems inconsistent looking at the numbers
12	13	change to *with values of* $\delta^{18}O_v$ *larger than*; replace *toward* with *around*
12	18 – 19	rewrite sentence
12	25	change to *convective mixing injects SWI-enriched moisture into higher altitudes*
Fig. 8		explain colors in the caption, some dots have edges and others don't, figure is small, you could change the aspect ratio to fit the page width for better readability. This also applies to the other figures of this type (9 and 12).
Fig. 10		panel titles say *vapour* and *rain water*, change them to clearly indicate that they show $\delta^{18}O_v$ **for** vapour/rain water. Also, model levels are not at a constant height. Does this have any effect over mountains? if so, expalain which one? Better alternative: plots for certain altitudes above sea level, e.g. 500, 2500, and 5000 m, instead of model levels.
13	2	replace *over* with *from*
13	3	Threshold of 5 g kg^{-1} is not visible in the figure
13	7	replace *for instance* with *and*
13	7, 8	Use a non-breaking space between multiple units, in LaTeX to avoid line breaks between them. This can be done by using ~ instead of a space like this: 9~g~kg or in MS Word by using Ctrl + Shift + Space
13	20 – 21	rephrase, also, do not use *precipitation cell* unless explicitly referring to a single convective cell
13	24	The depletion is hardly visible at 5500 m.
14	1 – 5	going back to earlier Figures is tedious and disrupting, try to avoid if possible by restructuring the text
14	6 – 8	rephrase sentence
14	9	replace *entrainment* with *mixing*, entrainment is usually used in the context of convective updrafts
14	15	replace *convective* with *convection*
14	20	the three paragraphs starting here are especially long and too descriptive, be more concise. Do not simply repeat details from previous sections in the conclusions.
15	4, 5	do not use formulations like *totally different* in scientific texts