RC3

I believe the topic is relevant, and I think the paper might merit the chance to be published eventually, but it definitely needs major revisions.

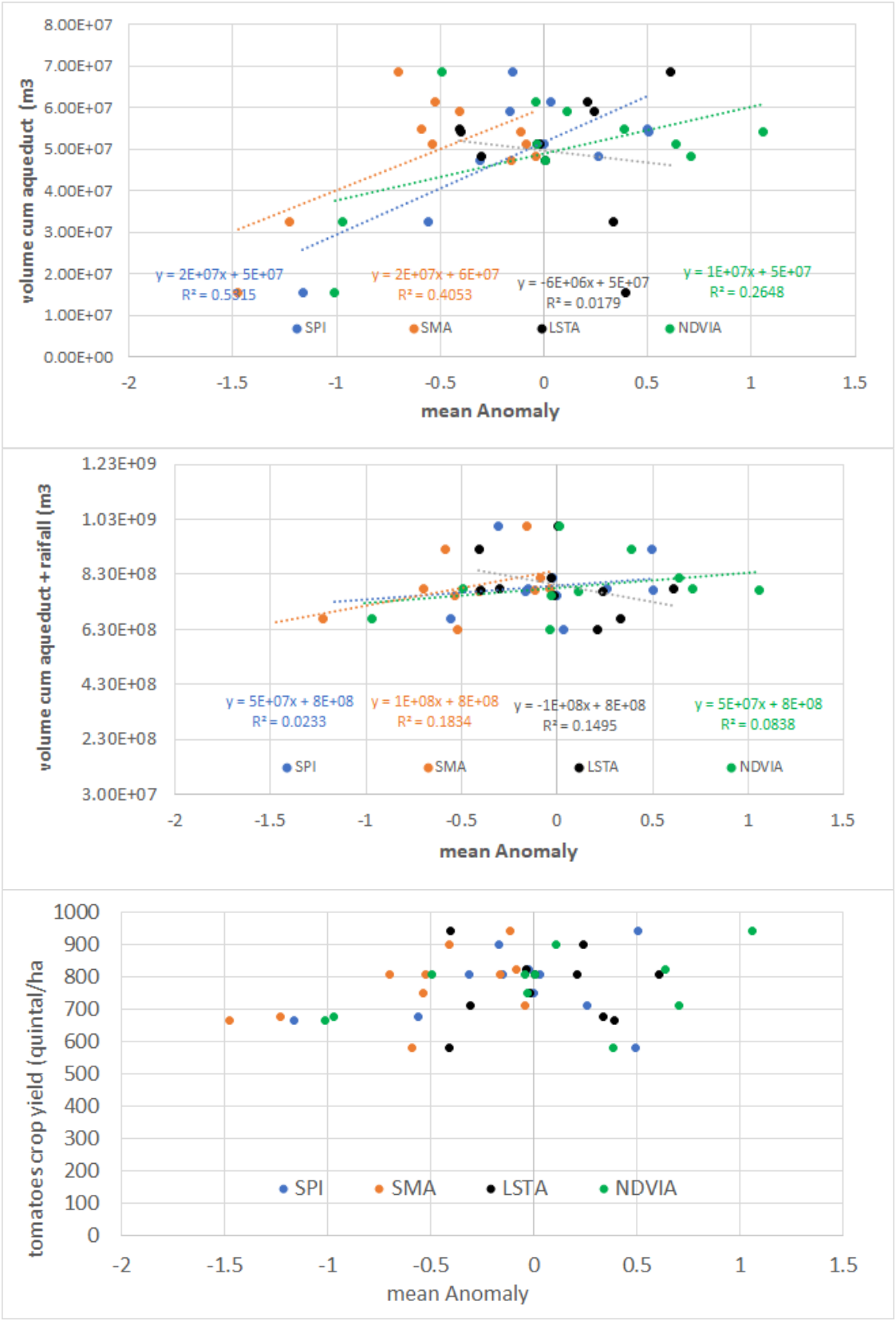
Some general comments

- I believe the purpose of the paper is lost in divagations due to the reporting style and contents. The ADMOS indicator results should be more explained, in particular regarding its capacity to reproduce impacts on yield or its covariation with irrigation. Since the indicator values and thresholds are arbitrary, it is essential to see if such thresholds are capable of marking when impacts on crop yields are to be expected- which seems not the case, or when irrigation inputs are necessary, and in what order of magnitude. It is not clear to me in the end it is possible to use ADMOS to recommend better water management for agriculture.

Answer: thanks for this comment, on which we agree with you that such a comparison would be a valuable addition to the workflow of the whole paper, to understand the effectiveness of the ADMOS index in respect to single anomalies indicator for water management. ADMOS is conceived as a monitoring tool, to be employed in order to follow more closely the evolution of possible drought dynamics. The index might be useful in a on-demand irrigation scheme (as the Capitanata case study), to know the evolution of water availability as well as crops conditions and to infer the possible increase or decrease of irrigation water requests from the farmers allowing to better manage the water at Consortium scale.

- Since several indices have been calculated to compose the ADMOS, I was expecting a separate comparison between them and the irrigation and yields. Maybe them separately have better prediction capacity than the ADMOS itself, but it was not showed. The conclusions say that you prove that "droughts cannot be described by one single indicator but there is the need first to select the correct physical index for detecting a drought type and secondly to use different drought indices to identify specific conditions", but I don´t see how you compare the ADMOS predictive capacity (for irrigation or crop yields) and the predictive capacity of all your anomalies series for P, SM, temperature or VI.

Answer: we agree with you that such a comparison would be a valuable addition to the workflow of the whole paper. We will add these comparisons to the final version of the work but, in the meanwhile, we attach here some plots, conceptually similar to those in Figure.12 and 13, but featuring the single anomalies (average value in the crops season) instead of the ADMOS, over the Capitanata test case. The strength of ADMOS is particularly relevant when you compare the single anomalies with the cumulated irrigation volume, where you obtain a positive dependency (at higher SPI values you would expect to use lower irrigation water). Also with SMA from remote sensing uncertainties in the correlation between SM dynamic and irrigation events. Moreover, comparing the determination coefficients (R2) with those from the figures in the manuscript, the correlation between cumulated volume from the aqueduct and single anomaly is everywhere weaker with respect to the ADMOS. This difference is even wider when considering all water inputs (aqueduct and natural rainfall), with the correlations falling below 0.20. Finally, when looking at the final yield (third figure, to be contrasted with fig.13 from the manuscript), a similar behaviour is observed if considering the ADMOS or single anomalies.


volume cum aqueduct (m3
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
y = 2E+07x + 5E+07
R² = 0.5915
y = 2E+07x + 6E+07
R² = 0.4053
y = -6E+06x + 5E+07
R² = 0.0179
y = 1E+07x + 5E+07
R² = 0.2648
SPI
SMA
LSTA
NDVIA
-2
-1.5
-1
-0.5
0
0.5
1
1.5
mean Anomaly
volume cum aqueduct + raifall (m3
1.23E+09
1.03E+09
8.30E+08
6.30E+08
4.30E+08
2.30E+08
3.00E+07
y = 5E+07x + 8E+08
R² = 0.0233
y = 1E+08x + 8E+08
R² = 0.1834
y = -1E+08x + 8E+08
R² = 0.1495
y = 5E+07x + 8E+08
R² = 0.0838
SPI
SMA
LSTA
NDVIA
-2
-1.5
-1
-0.5
0
0.5
1
1.5
mean Anomaly
tomatoes crop yield (quintal/ha
1000
900
800
700
600
500
400
300
200
100
0
SPI
SMA
LSTA
NDVIA
-2
-1.5
-1
-0.5
0
0.5
1
1.5
mean Anomaly

- Also, it is very difficult to understand the spatial and temporal aggregation scales for the indices and the ADMOS indicator itself. It seems it is calculated daily, but then the yields are annual for the entire consortium, not sure though. What about the irrigation values? They don´t even appear in the data list. How often are them recorded? How are them aggregated over time?

Answer: we do agree that bigger clarity is required in the presentation of these topics, and will improve the relative excerpts of the article. To answer your doubts, ADMOS is computed daily, and the values that are compared to the consortium-level irrigation water volumes are the annual cumulated ADMOS values, summed up day by day to identify a value representative of the whole year. For what concerns the irrigation values, they are registered by the irrigation consortia day by day (for the Chiese case, their distribution is planned in advance, while for the Capitanata, the on-demand irrigation means that the volumes are strictly measured to determine the amount to pay for each farmer). The annual value shown in the last figure is obtained by summing the whole annual time series.

- On the other hand, the paper devotes too much space (6 full pages, and 4 chapters, 3.1 to 3.4) to debate the differences between each product (RMSE, r) in each of the variables, when it is not the essential result and could be solved with a summary table and a paragraph of explanation.

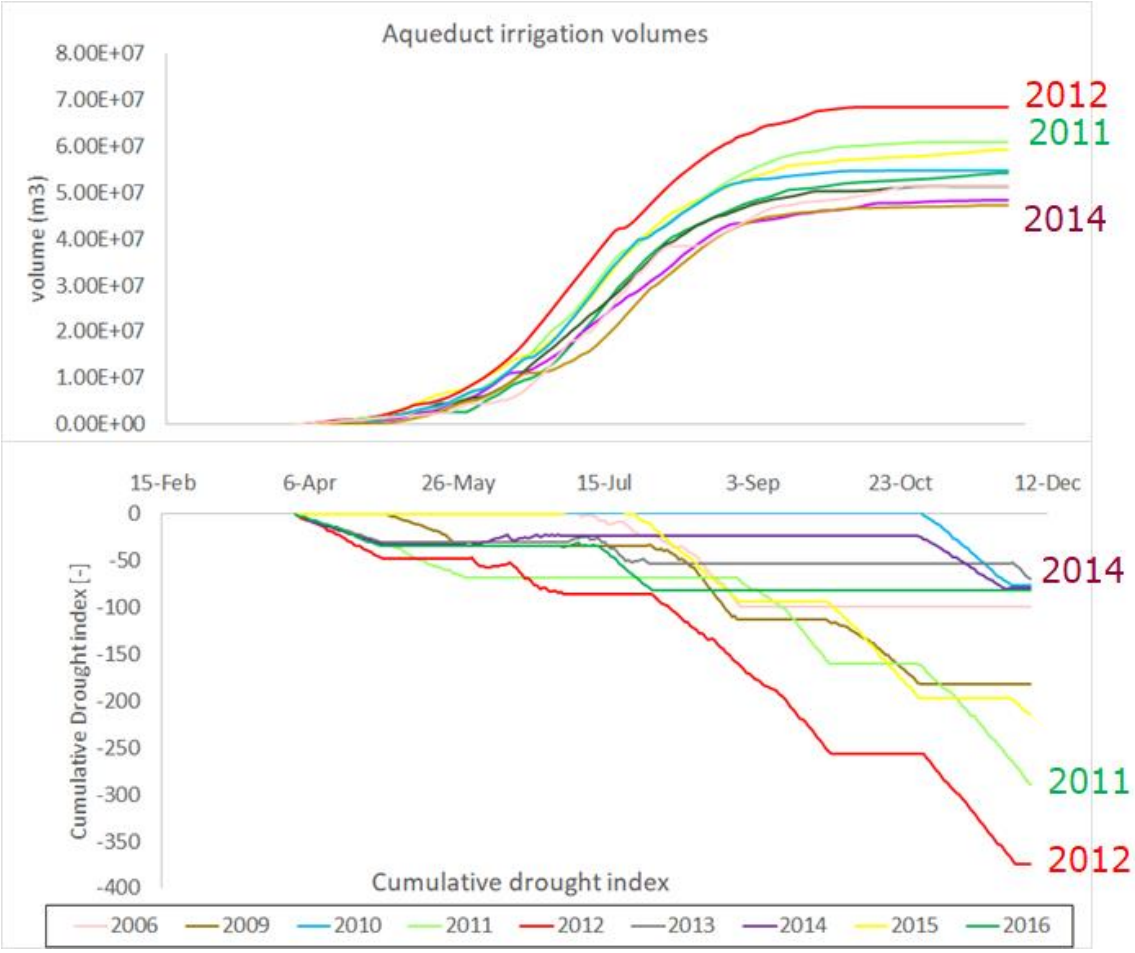
Answer: Yes, thanks we agree with your comment. We then plan to reduce the number of figures, by deleting Figure 7. which is indeed summarized in table.3, as well we will delete Figure.5 and we will discuss the monthly correlation variations in the text.

- I have doubts if- from a statistical point of view- it is recommendable to accumulate an indicator (ADMOS) whose values are categories and not quantifications. For example, accumulating two time steps with ADMOS -1 is -2, but it is not necessarily equivalent to another time step with -2, and still they are added up. That might explain that in summer there are peaks in the accumulation. It should be better justified why it is computed like this.

Answer: thanks for your observation. It is true that, being categories, the single values of the ADMOS index seem ill-suited to a cumulation. However, we feel that the main aim of ADMOS is not characterizing the single drought (whether it is developing as a precipitation, soil moisture, thermal or vegetation drought), but simply provide an idea of the total magnitude of it.

- In any case, does a value of cumulative ADMOS at certain point means that at that moment a certain irrigation volume should be applied? In the conclusions, the papers says "This ADMOS might help irrigation districts managers and farmers to activate the preventive protection actions to try to avoid water volume and crop yield losses.", but after reading the study I don´t really see how, it would merit an explanation.

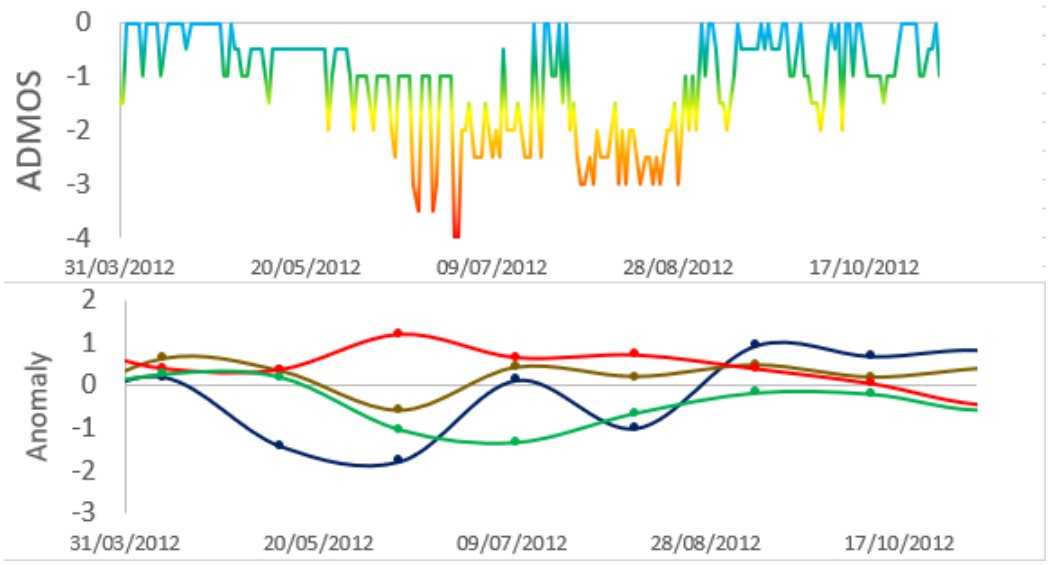
Answer: Thanks for the comment, yes as you can see in the following figure the increase of cumulated volume really used for irrigation during the season as a clear correspondence with the negative increase of the ADMOS index. So that it might be useful for monitoring water requests.



- Also, the potential lags / delays are not taken into consideration for comparing the evolution of the different variables. Only SPI1 is calculated and confronted with the situation at the same time in other variables, presumably at the daily level, but not sure you can capture the propagation of the anomalies like this. For example, time-steps with very high negative anomalies in SM or Vegetation Index can be concealed by the fact that that day in particular it rained a lot, the ADMOS would show "surplus of water", but the system has not recovered yet. There is not a way to know if ADMOS then marks real issues in terms of irrigation needs or yield losses at the daily level. With more granular data on these two impacts, tests could be made.
- More generally, I do not really see how the ADMOS is helping identify the main agricultural drought problems in the pilots used. More examples, maybe using a particular event, would help strengthening that point.

Answer: we provided here an example that could also be added to the main manuscript as an operative demonstration of how ADMOS could be helpful in tackling drought monitoring/identification issues. In the sub-figure below, the four analysed anomalies (SPI, SMA, LSTA, VISA) are shown during the 2012 agricultural season. By looking at their evolution, it would seem that a negative anomaly in precipitation (blue line) during May was followed by a negative one in soil moisture (brown) and vegetation index (green) and a positive one in LST (red) during June and July. At the time, SPI seems to have recovered at milder values. What ADMOS manages to do is merge all this information together in one single index, providing a complete overview of the status of the entire soil-plant ecosystem. Finally, for what concerns the tricky "surplus of water" question, we should have clarified that positive ADMOS values were never featured in the computation of the cumulated value. This was done (i) because ADMOS is not meant to identify water-abundance conditions and (ii) because single heavy-rain days could "nullify" the build-up of the previous days with a positive value (which is exactly

the case you referred to). In order to avoid further confusion, we removed the "surplus of water" conditions (positive SPI-1) from the main methodological table.



- Last, on a different note, the used references do not seem always the most relevant to justify the points the authors make, sometimes it is just general drought literature, not even focused on reviewing similar efforts.

Answer: thank you for the observation, we received a similar comment from another reviewer. We have already updated some of the references during this revision process and will revise the references entirely for the final version of the manuscript.

<u>Some specific comments</u>

- 450- "All the curves have a common trend: from the begin of the year till March the curves have gentle slopes, then from March to October they are very steep due to drought conditions, and at the end of the year they return flat." I think this reveals that the drought indicator is more marking stress than drought, as it points to systematic intensification in summer

Answer: we will add a comment on this in the text, but the ADMOS index is capturing also winter drought periods, not only summer. This is now clearly visible from the Figure we added here in a previous comment on the cumulated ADMOS and volumes for Capitanata Consortium, where a steep increase in ADMOS is visible during November of 2011 and 2012.

- Figure 9 and 10. "Synchronicity among the different variables' anomalies in… "- I don´t think the color code and the graphs are easy to read and interpret.

Answer: the plots will be improved to eliminate any possible ambiguity.

- 515- "Following the principles of CAP to improve irrigation management"- Spell CAP.

Answer: it is the Common Agricultural Policy, will be added to the manuscript final version.

- 540- “This methodology improves the traditional analysis, which are generally analysed by considering only soil moisture anomalies”. Many drought analyses rely on other variables.

Answer: we agree with your comment, we will rephrase specifying that ADMOS is more tailored for irrigated agricultural area

- The writing is confusing in many parts and there are several typos or incongruences, it needs a language revision.

Answer: the writing will be revised all over the manuscript for the final version.