We would like to thank **Markus Donat** for his positive comments about our manuscript.

- page 3626, line 5: provides the first regional assessment of trends on its southermost shores – stations in this region have also been previously investigated by Donat et al. 2013 (see http://onlinelibrary.wiley.com/doi/10.1002/joc.3707/abstract)

Changed by: "..this study provides a regional assessment…".
We tried to include in the reference list of our manuscript (submitted May 2, 2013) all the papers on the same topic published for this region, of course the recently published (May 6, 2013) paper of Donat et al. 2013 has been now added to the reference list of the revised manuscript.

- page 3627, line 21: no such regional trend analysis exists for North Africa – see previous comment

Changed by: "However fewer studies have considered the southern or eastern parts of the Mediterranean basin…(Donat et al., 2013)"

- p 3628, l 14-30: it might also be worthwile to extend this review with the previous findings for the Arab region

Here we do not consider the "Arab region", which is rather a socio-political entity than a climatic region. Our focus is the Maghreb countries in the Northern part of Africa under a semi-arid Mediterranean climate.

We added page 3628, line 8:
"Driouech et al. (2012), Schilling et al., (2012) and Donat et al. (2013) reported for Morocco a long term trend towards drier conditions but also for a few stations a possible increase in precipitation totals after 1980."

- p 3630, l 8: form ! from ?
Changed

- p 3630, l 10: went under ! underwent?
Changed

- p 3630, l 11: not clear what unfeasible precipitation values means – unphysical?

Yes, for instance if daily precipitation = 2000 mm it is an unfeasible and unphysical value.

- p 3630, l 16: most of the precipitation during late fall and winter – there is a verb missing in this sentence
Changed

- p 3630, l 23: rainiest and most populated area – should specify the context here; I guess this relates to the African continent and is no global statement?

Added:" the rainiest and most populated areas of Algeria, Morocco and Tunisia".

- p 3633, Section 3.2: It should be clarified here to which kind of data (accumulations?)

the homogeneity test was applied. Monthly/annual totals? Or to the indices defined in 3.1?

Added: “Here the Pettitt test is applied to the time series of the indices defined in section 3.1.”

- p 3636, l 14-24: It is not clear to me how the variogram analysis relates to the research question of this study. Maybe this can be clarified.

The variogram is a function describing the degree of spatial dependence of a process. Since in this study, unlike in many others performing trend analyses on a large sample of stations, we take into account the spatial dependence between the different stations, the variogram is the appropriate tool to quantify and display this spatial dependence for each of the precipitation indices considered. For instance, here the de-correlation distance for the different precipitation indices is given by the ranges of the fitted variograms.

Reference :
Wackernagel H. 1995. Multivariate Geostatistics. Springer-Verlag: Berlin, Heidelberg, Germany.

- p 3637, l 6: “can represents” - please check language/correct
Changed

- p 3637, l 17: I wonder about the consistency of approaches here. On the one hand, Mann-Kendall/Sen slope estimates are used for trend analysis (making no assumption about the distribution of the variables), but on the other hand here least-square fit is used for detrending. This might not be the most appropriate approach for some of the extreme indices?

Indeed the Mann-Kendall test is devised for detecting a monotonic trend that is not necessarily linear. We compared ordinary least square regression (the method used in Donat et al., 2013), LOESS (Cleveland 1979) or robust regression to remove the trends, and the Pettitt tests results for the two indices (R1mm and PRCPTOT) after detrending were very similar. That is why, for the sake of simplicity, we mention only the OLS detrending, as in Donat et al. (2013). It must be noted that detrending has been applied to R1mm and PRCPTOT indices only, not extreme indices. The most important point that must be stressed is that, whatever the method used to remove the trends, the Pettitt test results can be greatly influenced if a trend is present and not considered. See also our response to reviewer n°2.

Cleveland WS. 1979. Robust locally weighted regression and smoothing scatterplots. Journal of the American Statistical Association 74: 829–836.

- p 3637,l 27: FQR ! FDR ?
Changed

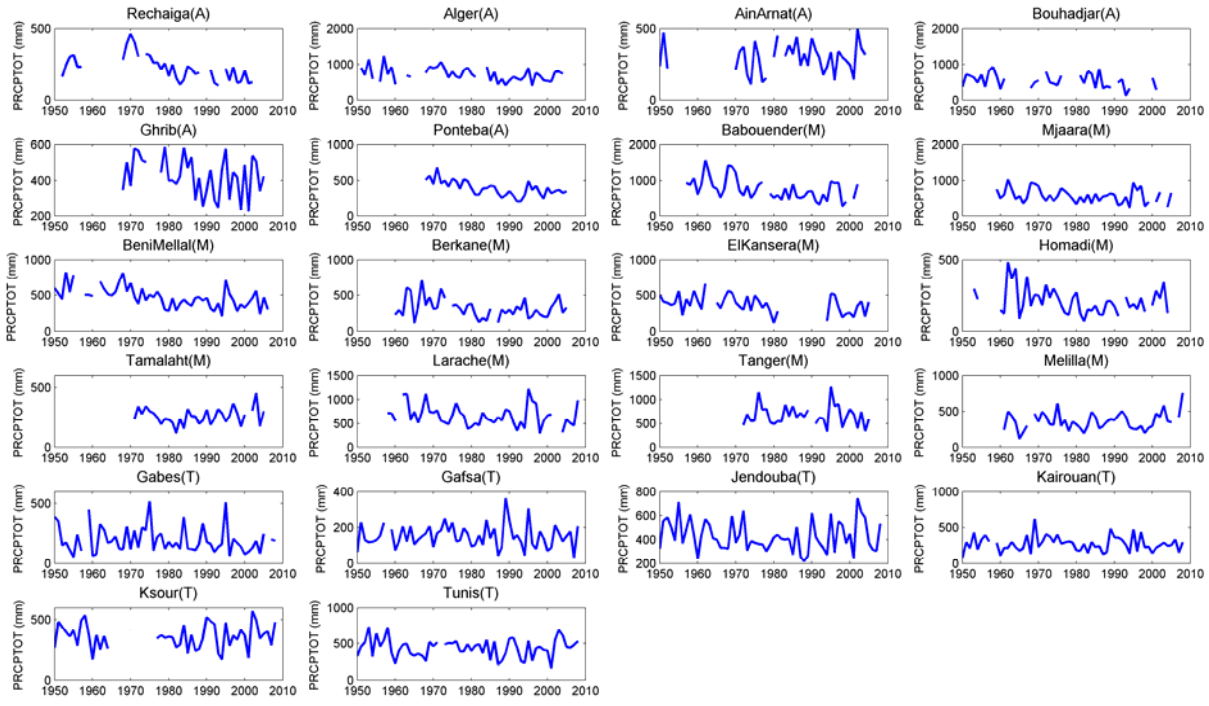
- p 3638, l 3: number of dry days(R1mm) – seems to clash with the definition of R1mm in Section 3.1 (ratio of wet days)
"an increase of the number of dry days"
replaced by
"an increase in the ratio of dry days"

- p 3638, l 17: R95pTOT not defined in Section 3.1 ?
Yes it is. Page 3632, line 1:
"6. Fraction of the annual total precipitation above Prec95p (R95pTOT)."

- p 3638, l 5-10: Discussion of trends: The results by Donat et al. (2013) suggested that there was a shift from relatively wet conditions in the 1960s to drier conditions in the 1970s/1980s, with slight increases after 1980. This is also found in (partly independent) gridded observational datasets (see e.g. HadEX2 available on www.climdex.org, see also attached figure for this region).

In Donat et al 2013, page 10, figure 5 show the trends in the indices PRCPTOT, R10mm and CDD. For PRCPTOT, during the second period they considered (after 1980) it can be seen that there is a significant positive trend only in one station in North Morocco and one station in central Algeria (=2 stations in total). For R10mm, they found only one significant positive trend in central Algeria, when for CDD no trends are significant in Morocco or Algeria. On the opposite, for the same indices they found significant trends in several stations in Mauritania, quite far from the Mediterranean domain. Considering that in Donat et al. 2013 the dependence between the stations is not taken into account (= the issue of repeating several time the same statistical tests on dependent samples, that could trigger a larger number of significant trends just by chance), it is very likely that these detected trends (in one station in Morocco and one station in Algeria for PRCPTOT) are only local and not significant at the regional scale. As a consequence, their statement that "in the western part of the Arab region, there is a tendency towards wetter conditions" is rather exaggerated and not fully supported by their results. At least it does not apply to the Maghreb region, the focus of our study.

However Schilling et al. (2012) have also reported, from previous work of E. Hertig, a few positives anomalies in precipitation in north Morocco after 1980. For the sake of transparency and for a better discussion of our results, we added in the revised manuscript the time series of annual precipitation (PRCPTOT) for all of the stations considered in our study:



As mentioned in our manuscript, there are no significant change points detected for PRCPTOT (and also for the other indices), except in Berkane if considering a 10% significance level (from the Pettitt test). However a qualitative examination of the plots show that potentially a slight increase in PRCPTOT exists after 1980 for some stations in North Morocco: Berkane, Homadi, Tamalaht, Mellila, but it must be noted also that some hydrological years during that period (in particular 1995/1996 and 2009/2010) were particularly wet, therefore these apparent trends (not significant) could possibly be caused by these exceptional years.

As a consequence, we added in the section 4.2:

"As reported by Schilling et al. (2012) or Donat et al. (2013), the recent years after 1980 have seen positives anomalies in precipitation amounts for some areas in northern Morocco. Indeed for the stations of Berkane, Homadi, Tamalaht, Mellila a slight increase, not statistically significant, in PRCPTOT can be observed after 1980 (Figure 7). However, some hydrological years such as 1995/1996 and 2009/2010 have been very wet in this area, this could be one explanation for this apparent increase over the recent years. It is unclear, due to the low station density and the lengths of the available time series, if this is a regional pattern or a local behavior at some stations."

Finally, it must be noted that the relevance of gridded data products (CRU, EBOS, HadEX..) is questionable in the areas of low density networks, as it is the case in most developing countries where the access to station data is usually difficult. Gridded datasets can be extremely useful for North America or Europe, but they can be highly heterogeneous for other areas. How many stations are behind the grid points? For example ECA&D /EOBS datasets should be used with care in North Africa, indeed as shown on Figure 1 in Haylock and al. (2008), only 18 stations are available with precipitation in Morocco, 4 stations in Algeria and 14 stations in Tunisia.

Haylock, M.R., N. Hofstra, A.M.G. Klein Tank, E.J. Klok, P.D. Jones and M. New. 2008: A European daily high-resolution gridded dataset of surface temperature and precipitation. J. Geophys. Res (Atmospheres), 113, D20119, doi:10.1029/2008JD10201

In this context, I am wondering if the long-term decreasing trend reported here for PRCPTOT is mainly caused by such a shift?

If a significant shift was present, it is likely that a downward trend up to 1980 and an upward trend after 1980 will cancel out and no significant trends would have been detected.

- p 3638, l 25: this is the case of the NAOi and MOi – clarification is needed here if also the precipitation indices (e.g. PRCPTOT) were detrended for this analysis

Yes, since computing a correlation between two monotonically increasing (or decreasing) functions would not make much sense. In that case, a significant correlation would likely be detected. The trend in NAO or MO is well documented by several studies (Hurrel 1995; Osborn, 2011; Mariotti and Dell'Aquila, 2012). Here our goal was to analyze the co-variability of the climate and the precipitation indices: can the inter-annual variability of the precipitation indices be explained by the variability in NAO, ENSO, MO or WEMO indices?

Osborn TJ (2011) Variability and changes in the North Atlantic Oscillation index. In Hydrological, socioeconomic and ecological impacts of the North Atlantic Oscillation in the Mediterranean region (eds. Vicente-Serrano SM and Trigo RM), Springer Dordrecht, Heidelberg, 9-22, (doi:10.1007/978-94-007-1372-7).

- p 3639, l 5-13: I would appreciate some physical interpretation of these relationships, which are presented as purely statistical relations here.

Similarly, it is obviously not the concern of Donat et al. (2013) as they wrote (Section 4, page 8): “The physical mechanisms behind these teleconnections are not studied here but require further investigation”. Therefore I am questioning the relevance of such a comment here.

The relationship between precipitation in the Mediterranean basin and large scale circulation is well documented in many studies, see: Lionello et al., 2012; Hoerling et al., 2012; Mariotti, and Dell’Aquila 2012 (all in the reference list). The positive winter NAO is related to below-average precipitation rates over large parts of the western and northern Mediterranean region, with opposite deviations for the negative winter NAO. Our goal here is not to identify potentially new physical mechanisms but to evaluate at the regional scale the inter-annual predictability of precipitation indices based solely on large scale circulation such as the NAO, MO, MO or Wemo.

Nevertheless, this section has been partly reworded in order to add more information, see also the answers to reviewer n°2:

“This is the case of the NAOi and MOi, which are showing a long term positive trend in particular since the 1970s (Hurrel 1995; Mariotti and Dell’Aquila, 2012). Since the negative phase of these indices is associated with frontal conditions that are triggering rainfall in the Mediterranean basin, the more frequent occurrence of positive phases after 1970 may be the explanation of the drying trends reported in the previous section.”

“These field-significant correlations supports the findings of other studies (El Hamly et al., 1998; Knippertz et al., 2003; Born et al., 2010) demonstrating the impact of the NAOi or MOi on precipitation amounts mainly in Morocco.”

- p 3640, l 1: first assessment of trends... - please see earlier comment and rewrite taking previous literature into account

Changed to:
“This study provides a regional assessment of trends in precipitation indices over Maghreb countries”

- Figure 2: an explanation of the green-yellow-red colours would be useful. Maybe a colourbar might help to indicate data ranges.

Added to the figure