Manuscript: "Variability of extreme precipitation over Europe and its relationships with teleconnection patterns"
doi: 10.5194/hessd-10-12331-2013

Response to the Anonymous Referee #2:

> *This is a very interesting and well written paper. A sound scientific approach has been followed. I recommend publication in HESS after minor revision.*

Response: We thank the referee for the comments and the time devoted to our paper. We have revised the manuscript taking into account the referee's suggestions. Please, see below our point-by-point responses.

> *A number of times throughout the paper precipitation extremes were referred to as "hydrological extremes" (e.g. page 12347 lines 2, 16, 28; page 12349 line 5). I suggest to replace hydrological extremes by precipitation extremes, given that hydrological variables are affected by other meteorological variables, such as temperature and evapotranspiration, next to precipitation.*

Response: Following the referee recommendation, we have changed "hydrological" by "precipitation" in several sentences along the manuscript.

> *Page 12349 lines 10-11: ": : : especially with regards to crops.": This is just one example. Few more (even more relevant?) examples can be given: e.g. floods, erosion, water supply.*

Response: This sentence the referee mentioned (lines 10-11, p.12349 in the discussion paper):

"Detecting changes in extremes may help to improve the adaptation to a warming climate, especially with regard to crops."

has been rewritten to:

"Detecting changes in extremes may help to improve the adaptation to a warming climate, especially with regard to floods and soil erosion which could strongly affect crops and water supply."

> *Page 12339 lines 17-18: OK but do these associations remain stable under changing climatic conditions? What about the increase in precipitation intensities due to the increase in water holding capacity of the atmosphere when temperature rises? This is an example of a physical process controlling the change, which is not related to teleconnections.*

Response: The sentence the referee mentioned (lines 17-18, p.12339 in the discussion paper):

“Thus, if the precipitation variability can be associated to teleconnection patterns, they would be useful to project extremes changes under other climatic conditions.”

has been rewritten to:

“Projections of the changes in precipitation extremes are associated with local variations mainly due to the increase of water vapor as the warming increases. However, the projections of extreme precipitation for larger areas can be related to the fluctuations of large-scale modes of variability.”

> *The readers should add and refer also to the most recent literature on similar investigations that also detected north-south variations in precipitation changes and changes in hydrological extremes across Europe. Next to the changes, (multi)decadal oscillations in precipitation and hydrological extremes exist. This suggests that the (trend) results as reported in this paper might be strongly affected by the period selected (1950-2010 in this study). Some suggested references:*
> *Willems, P., 2013. Multidecadal oscillatory behaviour of rainfall extremes in Europe. Climatic Change, 120(4), 931–944*
> *Hannaford, J., Buys, G., Stahl, K., Tallaksen, L.M., 2012. The influence of decadalscale variability on trends in long European streamflow records. Hydrology and Earth System Sciences Discussions, 10, 1859-1896*
> *Stahl, K., Hisdal, H., Hannaford, J., Tallaksen, L.M., van Lanen, H.A.J., Sauquet, E., Demuth, S., Fendekova, M., Jódar, J., 2010. Streamflow trends in Europe: evidence from a dataset of near-natural catchments. Hydrology and Earth System Sciences, 14, 2367–2382*
> *Stahl, K., Tallaksen, L.M., Hannaford, J., van Lanen, H.A.J., 2012. Filling the white space on maps of European runoff trends: estimates from a multi-model ensemble. Hydrology and Earth System Sciences, 16, 2035–2047*

Response: This outstanding point that the referee has made lead us to add some comments in the text.

In the section ***5. Conclusions*** (line 10, p.12348 in the discussion paper)

“Similar dipolar structures are found in recent studies such as Willems 2013, which also have an effect on the anti-correlated trend patterns found in river flows (Stahl et al. 2010, 2012; Hannaford et al. 2012).”

In the section ***5. Conclusions*** (line 3, p.12349 in the discussion paper)

“One of the emerging questions from this work deals with the variability of trends in time. Hannaford et al. (2012) claims that the magnitude and even direction of short-term trends are heavily influenced by interdecadal variability. Willems 2013 analysed the trends over the past 100 years in European precipitation gauges and demonstrated that the precipitation oscillation peaks are explained by persistence in atmospheric circulation patterns over the North Atlantic during periods of 10 to 15 years. For this reason, the results of the study can strongly be affected by the considered period (in this case 1950-2010). One should be aware of this oscillatory behaviour and do not use the extrapolation (past or future) of the trends since this could be misleading.”

> *Some minor comments:*
> *Page 12337 line 8: typo “below”*
> *Page 12341 line 20: change “significant level” to “significance level”*

Response: Corrected.