Hydrol. Earth Syst. Sci. Discuss., 12, C5697–C5700, 2015
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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Synchrony of trend shifts in Sahel summer rainfall and global oceanic evaporation, 1950–2012" *by* A. Diawara et al.

Anonymous Referee #2

Received and published: 18 December 2015

Overview: Using reanalysis and observation-based datasets, authors examined the summer precipitation changes defined as the trend difference between 1950-1984 and 1985-2012 periods. In Sahel region, precipitation shows a drying trend for 1950-1984 but a wetting trend for 1985-2012. The similar trend shift is also found in latent heat flux anomalies averaged over the global ocean. Authors also pointed out that this trend shift in latent heat flux anomalies is consistent with a SST trend shift in the northern hemisphere and a wind speed shift in the southern hemisphere.

This result may have an important implication for global hydrological cycles that may also influence the Sahel rainfall variability. The good point in this manuscript is that authors clearly described what they did. However, I feel that this manuscript have to present their findings more logically. Although I can understand "what" they did, I can

not understand "why" they did it. Why does this manuscript examine the trend shifts in Sahel summer rainfall? Why did author take the Sahel region illustrated by the black box in Fig 1 and the period for 1950-1984 and 1985-2012? Why do we need to focus on the evaporation averaged over the "global" ocean instead of the "regional"? I would like to encourage them to revise this manuscript with more logical way instead of a description. The following is more detailed point that might be helpful to revise this manuscript.

Major points

1. A logical presentation:

First, I can not understand what is the main goal of this manuscript and what is the scientific question that authors want to clarify in this manuscript. In introduction, authors pointed out the local and remote SST effects on decadal rainfall variability over Sahel region. Based on these previous studies, authors described the current problem of previous studies: "the exact linkage between the multi-decadal variation of Sahel rainfall and the global ocean is unclear" on Line 10 Page 11271. So we expect that this manuscript will reveal the exact linkage about multi-decadal rainfall variability. However, this manuscript examined the "trend shift" instead of multi-decadal variability. I confused why this manuscript focused on the trend shift and why did they choose trends for those specific periods.

Second, I have no idea why they assumed that "moisture transport from different parts of the world ocean may have some effects on precipitation over Africa", as described on Lines 13-15 Page 11271. According to the moisture balance equation, the precipitation anomalies balance the moisture divergence and evaporation anomalies. This equation is based on the local process and I hesitate to assume that the evaporation variability in the Pacific affects to the Sahel rainfall. The tropical Pacific SST variability could induce changes in atmospheric circulation, which may influence the moisture flux divergence over Sahel region. So I can agree that the global SST variability plays some roles for

Sahel rainfall variability. However, it is not make sense for me that the evaporation in the tropical Pacific affects Sahel rainfall variability via moisture transport.

Finally, there is no scientific evidence to explain the possible physical linkage as summarized in schematic diagram in Fig 8. According to this manuscript, the SST trend shift induces the trend shift of latent heat flux in the northern hemisphere whereas the wind speed trend shift contributes to trend shifts of latent heat flux and SST in the southern hemisphere. In other words, this manuscript assumes that changes in all of those variables are in phase. However, the latent heat flux anomalies (and wind speed anomalies) contribute to "tendency" of SST anomalies, which means that the SST anomaly change would be out of phase compared to changes in wind speed or latent heat flux anomalies. More logical explanation for this manuscript would be needed.

2. Atlantic Multidecadal Oscillation (AMO):

I think that the results in this manuscript are closely related to the Atlantic Multidecadal Oscillation (e.g., Zhang and Delworth 2006). I think that timeseries in Fig 2 would have a higher correlation with the AMO index. At least, authors need to present what is a new finding in this manuscript compared to the previous literature particularly about the AMO impact.

Reference: Zhang, R., and T. L. Delworth (2006), Impact of Atlantic multidecadal oscillations on India/Sahel rainfall and Atlantic hurricanes, Geophys. Res. Lett., 33, L17712, doi:10.1029/2006GL026267.

3. Hydrological field in reanalysis dataset:

In this manuscript, precipitation and latent heat flux datasets are based on reanalysis products: NOAA precipitation reconstruction, NCEP, JRA-55, and ECMWF. Although I found the sentence "the differences do not significantly influence our conclusions" on Line 14 Page 11272, there was no evidence to support that in this manuscript. In particular, uncertainty of precipitation over the Sahel region would be large. So I would

like to recommend more careful analysis and approach to support the robustness in this manuscript.

Minor concerns

1. Lines 22-23 Page 11270 "Many studies have shown that rainfall varies greatly in the Sahel": This sentence is unclear. Does Sahel have the largest precipitation variance over land? What timescale do you want to say?

2. Line 9 Page 11271 "long-term climate trends are generally related to the state of the ocean": This sentence is unclear. We may say that a long-term temperature trend is generally related to atmospheric CO2 increase. But I don't know what kind of long-term climate trends authors want to say.

3. Lines 13-15 Page 11271 "It is reasonable that ..." As I described in my major comment, this is not reasonable for me.

4. Line 18 Page 11272 "defined as the region ..." Why do authors define this region? It may be good idea to show the standard deviation or variance for precipitation.

5. Line 10 Page 11274 "SST decreased until 1984" From the spatial map of SST trends difference, I can not see the SST decreasing until 1984.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 11269, 2015.