

## ***Interactive comment on “Drier spring over the US Southwest as an important precursor of summer droughts over the US Great Plains” by Amir Erfanian and Rong Fu***

**Anonymous Referee #2**

Received and published: 4 June 2019

This paper aimed to address the processes that lead to two summer droughts over US GPs in 2011 and 2012. The authors conducted a moisture budget analysis with two re-analysis products to show that zonal advection of anomalous moisture by mean winds is the dominant process that preceded and contributed to the two summer droughts.

While the moisture budget is suitable for the authors' aim, a major concern appears as to whether the resolution of the data used is high enough to close the budget. If the error term is comparable to the main terms (P-ET and moisture flux convergence), a further breakdown into different terms (advection, mass convergence, etc.) will be meaningless. This seems to be the case in the current manuscript. For example, as

C1

indicated around Line 285, the imbalance in the budget is as large as 1.5mm/day over the US central plains, and is comparable to the maximum P-E deficit of 1-3mm/day (~Line265) and the breakdown terms shown later. This large error is clear in Fig. 5 (e&f vs a&c) over the US GPs. To solve this issue, the authors should either show that at the current resolution the error terms are indeed much smaller compared to the breakdown terms presented in Fig. 6-7, or if that's not the case, try to use higher resolution data to reduce the error. In either case, it's necessary to include the error terms in Fig. 6-7.

Some minor issues: Section 2.1: the moisture budget equations are not clearly derived. The authors started by combining continuity and moisture equations to get the commonly used flux form of moisture equation (1), but then broke it down to the advection form in (2) to suit their aim, which seems circular and confusing. I urge the authors to rederive these equations (1-6), maybe by following some papers cited (such as Seager and Naomi 2013).

Line124: "the transient and stationary terms refer to the monthly mean and six-hourly departure " should be "the stationary and transient terms refer to the monthly mean and six-hourly departure"

Line 268/293/etc: the usage of "moisture flux convergence" is confusing, and doesn't seem to follow the convention. When  $P-E > 0$ , the moisture flux divergence term in equilibrium should be negative and by convention is interpreted as "moisture flux convergence". Please clarify.

Line 388: 'coverability' → covariability

---

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-154>, 2019.

C2