Biogeosciences Discuss., 10, C8231–C8234, 2014
www.biogeosciences-discuss.net/10/C8231/2014/

Biogeosciences Discussions
Open Access

Interactive comment on "Impacts of extreme precipitation and seasonal changes in precipitation on plants" *by* M. J. B. Zeppel et al.

Anonymous Referee #3

Received and published: 25 January 2014

Review of "Impacts of extreme precipitation and seasonal changes in precipitation on plants" by Zeppel et al. TAAC-D-13-00382

Synopsis: This is a well written manuscript that reviews prior studies of the impacts of redistributions of annual precipitation on plant productivity various biomes. In particular the authors consider changes in the seasonal distribution of precipitation as well as what they refer to as "extreme precipitation". The article reviews numerous studies that have examined aspects of this topic, and identifies key knowledge gaps that are necessary steps for resolving the coupled impacts of vegetation, carbon and water resources given projected changes in precipitation redistributions for many parts of the globe under anthropogenic change. I highlighted a few items the authors might consider addressing including a couple items that warrant clarification or further ex-

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

planation, as well as considering putting the discussion of changes in precipitation seasonality into a climatic water balance context.

Major Considerations:

1. Precipitation extremes can be defined in a number of ways. I believe the authors are focusing on timescales associated with individual weather systems, but this is not completely clear. It might be useful to discuss the different timescales of hydrologic extremes (e.g., multidecadal drought/pluvial, interannual, etc.) and responses of plants as a backdrop for the main focus of the article. While beyond the scope of the review, the authors might mention the potential for a confluence of extremes (e.g., multiyear drought + extended growing season dry spell) resulting in nonlinear impacts to ecosystems. Also, it might be worth to include the findings of Dreesen et al. (2014) who have examined the impact of repeated extremes on vegetation.

2. It might be useful to consider contextualizing projected impacts of precipitation extremes, and in particularly seasonality, using climatic water balance and the parameters actual evapotranspiration and climatic water deficit as these will be connected to soil water content. Presumably some of the changes in precipitation seasonality discussed, such as increased/decreased spring/summer precipitation might result in more water biologically available for plants during the growing season. However, the climatological seasonality in precipitation will play a significant role in determining the impacts. You might caveat that it challenging to definitively say that reduced spring precipitation may be detrimental to ANPP (e.g.,) unless moisture is a limiting factor during that particular season. For example, in Figure 2, the responses for the sites with higher MAP might be significantly different if precipitation were concentrated during the growing season, or instead during the winter months.

3. I recommend the authors consider some of the latest projections on changes in precipitation extremes as quantified as the magnitude of precipitation extremes and the duration of dry spells discussed in the IPCC WG1 (See Ch 12, WG1, Figure 12.26).

BGD
10, C8231–C8234, 2014

Some regions of the globe may be subjected to both increases in precipitation extremes and dry spell length that might be worth emphasizing.

4. In Section 2.1.1 the example given is of the Colorado Plateau which does not strike me as a boreal or sub-alpine region, but rather a cold desert of the intermountain western North America. Also, the authors report species were sensitive to summer, rather than winter drought. Given the ambiguity of the meaning of "drought", it would be better to be specific.

5. Soil water is also influenced by the phase of precipitation and delayed release of water from snowmelt in certain areas. Given the discussion on climate change and the large-scale changes anticipated in snowfall and snowmelt it might be useful to include a short discussion of snow as it does modify the seasonal availability of water that might otherwise be masked when just examining precipitation seasonality.

Minor Considerations: 1. Abstract, first sentence: The entire globe is not universally projected to see increases in precipitation extremes and longer dry spells. This statement might be relaxed somewhat.

2. Pg 16648, line 17-19: Do you mean to say that the total quantity of "precipitation" rather than "water" remains constant?

3. Page 16652, line 4: Define ROS

4. Page 16655, Line 18: Africa, rather than African?

5. Anderegg and colleagues have done some good work examining the impacts of both short and long-term drought on tree mortality in the western United States. Some of their work has shown short-term extreme moisture deficits that limit shallow water reserves to be particularly important in mortality.

Anderegg, W. R. L., J. Kane, and L.D.L. Anderegg (2013). Consequences of widespread tree mortality triggered by drought and temperature stress. Nature Climate Change. 3: 30–36

BGD

10, C8231–C8234, 2014

Anderegg, L.D.L., W.R.L. Anderegg, J. Abatzoglou, A. Hausladen, and J.A. Berry (2013). Drought characteristics' role in widespread aspen forest mortality across Colorado, USA. Global Change Biology. 19: 1526–1537

Dreesen, F. E., De Boeck, H. J., Janssens, I. A., and Nijs, I. (2014) Do successive climate extremes weaken the resistance of plant communities? An experimental study using plant assemblages, Biogeosciences, 11, 109-121, doi:10.5194/bg-11-109-2014,

Interactive comment on Biogeosciences Discuss., 10, 16645, 2013.