

## ***Interactive comment on “Impact of annual and seasonal precipitation and air temperature on gross primary production in Mediterranean ecosystems in Europe” by Svenja Bartsch et al.***

**Anonymous Referee #1**

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Please see 3 attached images with screen captures of review text.

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Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-491, 2016.

C1

General Comment:

The authors have conducted a statistical analysis of FLUXNET database products to examine the dependence of gross primary production (GPP) on environmental factors in 23 Mediterranean ecosystems. In my opinion, this represents a misuse of the FLUXNET database, and the scientific approach is not valid as a result. The reasons for this opinion are as follows:

- The main variable under consideration (GPP) is not directly measured, but is the result of an undocumented (in this manuscript) flux decomposition technique whose validity is highly questionable in water-limited ecosystems such as those considered here. Flux towers make direct measurements of net ecosystem exchange (NEE), often considered to be the difference between ecosystem respiration ( $R_{\text{eco}}$ ) and GPP:

$$\text{NEE} = R_{\text{eco}} - \text{GPP} \quad (1)$$

Traditionally, the means of decomposing NEE is to

- Assume at night (GPP=0) that  $R_{\text{eco}}$  is directly measured;
- Assume that  $R_{\text{eco}}$  depends only on the temperature (e.g.,  $Q_{10}$ );
- Model daytime  $R_{\text{eco}}$  based on the temperature; and
- Derive GPP from direct measurements of NEE and modelled  $R_{\text{eco}}$ .

Such a flux decomposition algorithm tends to perform poorly in water-limited ecosystems, where  $R_{\text{eco}}$  is often suppressed by drought conditions (and drought may be defined in terms of limited soil water, or excessive air dryness, or both). We have found this to be the case in the Mediterranean, rather generally with the exception of wet winter months. For this reason and until a valid flux partitioning scheme can be derived for Mediterranean ecosystems, the FLUXNET data product GPP should be considered highly dubious in dryland ecosystems, and should not be blindly supposed to be an accurate assessment of plant activity.

**Fig. 1.**

C2

- A second consideration is that equation (1) above fails in many semi-arid ecosystems, and this has been demonstrated amply at el Llano de los Juanes (site number 3 in Table 1). As has been documented by local investigators in numerous publications, NEE is not directly related to GPP and  $R_{eco}$  on half-hour timescales, but is buffered by the accumulation of  $CO_2$  in the underground environment, and dominated by ventilation when such stored  $CO_2$  is flushed by winds or pressure fluctuations . Spanish researchers have worked to document the existence of these additional flux components (1), verify their effects via independent underground measurements of  $CO_2$  stocks (2), confirm their relevance as worthy of accounting in the annual balance, relative to GPP and  $R_{eco}$  (3), and propose flux decomposition methods to model their dependence on environmental variables (4). The neglect of all of this work by the authors of the manuscript under review leads directly to my next criticism.
- The authors appear to have greatly overlooked the knowledge of local investigators regarding their sites. Most of the sites in Table 1 are towers managed by experienced groups with publications regarding these very sites. Generally, the authors of the submitted manuscript have not sited the relevant papers which include site descriptions, and even previous descriptions of ecosystem functioning that would make some of the authors' observations seem less "surprising". Prior to publishing

**Fig. 2.**

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analyses of data from these sites, I suggest that proper conduct in science would be to consult the local investigators, perhaps invite them to collaborate, and at least read/cite their papers where appropriate.

For all of the above reasons, and based on the guidelines set forth by Biogeosciences, I consider that the scientific approach applied in this manuscript is not valid, that the results are not "discussed in an appropriate and balanced way (consideration of related work, including appropriate references)", and therefore conclude that the manuscript should be rejected.

#### References Sited

1. Serrano-Ortiz et al., 2010, *Agricultural and Forest Meteorology*, **150** (3), 321-329.
2. Sánchez-Cañete et al., 2011, *Geophysical Research Letters*, doi:10.1029/2011GL047077.
3. Serrano-Ortiz et al., 2009, *Journal of Geophysical Research*, doi:10.1029/2009JG000983.
4. Pérez-Priego et al., 2013, *Agricultural and Forest Meteorology*, **180**, 194 – 202.

**Fig. 3.**

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