

## **Review**

### **"The 2010-2015 mega drought in Central Chile: Impacts on regional hydroclimate and vegetation"**

by

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This manuscript focus on the prolonged and intense Drought episode that struck Chile between 2010 and 2015. The authors provide a comprehensive characterization of this so called Mega-Drought event from various perspectives (meteorological, hydrological, anomalous climate dynamics, vegetation dynamics) but also considering the long-term context (last millennium), and finally providing some framing within regional warming background. The work is very interesting to read, with plenty of informative figures. The major problems I see are related with the level of novelty of this manuscript taking into account the contents of two other papers by the authors with some overlap in contents. I'm also particularly concerned with the amateurish attitude of the authors in relation to citations with so many missing and wrong references. Thus, I believe the paper can be accepted if the authors improve the manuscript taking into consideration the following clarifications listed below.

#### **Major issues**

##### **1. Level of originality**

Despite the overall good quality of the work presented here I must confess that an interested reader cannot be entirely sure on the level of originality of the contents included in the manuscript, particularly taking into account the two sister publications carry out by these authors, and covering (at least in part) the same Mega-drought event (Boisier et al., 2016 and Garreaud et al., submitted). While I can understand perfectly well that such a major event can be characterized from multiple perspectives, it is not entirely clear the level of superposition (if any) among these three manuscripts. Please provide a clarification on this important issue.

##### **2. References**

The authors were extremely careless with the references. It is unacceptable that you have so many missing and wrong references, including papers by the authors (?). This is quite distracting when a reader is trying to put the scientific questions in context of previous literature. Without guarantying that I've cover all the problems please check the following:

a) The following references are missing. Please add in the final reference list:

- (Page 3): Obasi et al (1994)

- (Page 3): Hao et al (2014)
- (Page 3): Gleick (2015)
- (Page 3): Cooley et al. (2015)
- (Page 3): Cook et al. (2015)
- (Page 3): Masiokas et al (2016) (could be Masiokas et al (2006) ?)
- (Page 4): Fuenzakida et al (2007)
- (Page 4): MOP (2013)
- (Page 4): Garreaud et al. (2017)
- (Page 5): Boisier et al. (2017)
- (Page 5): Cook and Kairiukštis (1990)
- (Page 5): Michaelsen (1987)
- (Page 6): Vicente-Serrano et al (2010)
- (Page 6): Schut et al. (2015)
- (Page 6): Miller (1976)
- (Page 7): Rivera et al. (2001)
- (Page 10): Jones et al. (2009)
- (Page 11): Montecinos et al. (2011)
- (Page 12): Van Lanen et al. (2013)
- (Page 12): Van Loon et al. (2014)
- (Page 12): Bloschl and Montanari (2010)
- (Page 13): Hargreaves and Samani (1982)

b) The following papers are listed in the final reference list but not cited in the manuscript. Are these relevant? If the answer is positive than cite them in the manuscript, where appropriate.

- Bréda et al. (2006)
- Chaves et al (2003)
- Falvey and Garreaud (2009)
- Hatchett et al. (2015)
- Hernández et al. (2016)
- Ji and Peters. (2003)
- Naresh et al. (2009)
- Norte chico, Chile ????
- Shukla et al. (2015)
- Tabari et al. (2012)
- Wang et al. (2014)
- Wu et al. (2007)

## Minor suggestions

**1. (Introduction, 2<sup>nd</sup> parag)** The authors introduce several major droughts that have occurred around the world in the last two decades. Taking into account the amount of people affected and the outstanding implications I would like to suggest to add the Middle East (or Fertile Crescent) drought between 2007-2012 (Trigo et al., 2010; Kelly et al., 2005)

Trigo R.M., Gouveia C., Barriopedro D., (2010) " The intense 2007-2009 drought in the Fertile Crescent: Impacts and associated atmospheric circulation", *Agricultural and Forest Meteorology*, 150, 1245-1257

Kelley C.P., M. Shahrzad, M.A. Cane, R. Seager, Y. Kushnir (2015) "Climate change in the Fertile Crescent and implications of the recent Syrian drought". *Proc. Natl. Acad. Sci.*, 112 (11) (2015), pp. 3241–3246

**2. (Page 5, lines 22-23)** This statement that winter precipitation corresponds to >75 needs a reference to support it. More importantly, this is not consistent with Fig. 1b where winter precipitation for regions south of 33°S represents less than 75%. Please rewrite sentence, adapting to the large N-S gradient of winter precipitation contribution.

**3 (Page 6, lines 32-33)** The marked West-East gradient in precipitation is not so clear at all latitudes as it happens mostly in the central section of Chile. North of 33°S and South of 38°S it appears to be negligible.

**4 (Page 7, lines 23)** I believe this low-order correlation refers to the autocorrelation coefficient? If so please clarify it.

**5 (Page 8, lines 2-3)** If you have continuous precipitation data from 1960 until 2015 why restricting the historical comparison period to the 1961-2000 (40 years) instead of considering 1960-2009 (50 years)?

**6 (Page 8, lines 3,5,9)** Although there are no standard procedures, the SPI acronym is usually employed as such, the temporal scales should be added as indices (or brackets). Please consider adapting the cumbersome SPI-12D to SPI<sub>12D</sub> or even SPI<sub>12</sub>

**7 (Page 11, lines 27-28)** Can you provide some additional information or literature for the Andes regarding the separation of the role played by diminishing precipitation and increasing temperatures in terms of reduced snow pack.

**8 (Page 12, line 11)** Please check if Fig.8 should be Fig.9 here.

**9 (Page 13, line 5)** Please check if Fig.9b should be Fig.10b here.

**10 (Page 13, lines 18-22)** This increment of DTR is consistent with the remaining of South America? Until the AR4 IPCC report in 2007 the DTR was diminishing in most areas of the world, but that has changed in the last decade. Can you provide a little bit more of regional (remaining S. America) and temporal (changes in DTR trend signal) context.

**11 (Page 13, line 25)** Please check if Fig.10b should be Fig.11b here.

**12 (Page 13)** Please check carefully all Figure numbers. Some appear to be lagging by one (e.g. Figure10c means Figure11c, Figure12b means Figure13b).

## **Figures**

**Fig.1d** The scale used is a bit misleading. Every station appears with the same reddish color and it is very difficult to distinguish regions. What is the point of presenting the range of possible values between -1 and 1? Please compress the possible values to the range [0 1] or even [0.5 1]. That will provide a much more informative plot.

**Fig.5a and Fig.5b.** Can you explain how come a few stations present a positive rainfall trend (Fig.5a) or streamflow trend (Fig.5b) in the midst of strong negative trends everywhere else?

**Fig.9** Please provide a clear link between each subpanel letter (a,b,c,d,e) and the corresponding section in the figure caption.

**Fig.10.** Please provide the meaning of the regression dashed lines in the figure caption.

**Fig.12.** If you describe first Fig.12b and then Fig.12a why not provide the information in the logical reverse order, i.e. place the map on the left (becoming Fig.12a) and the scatter plot on the right (becoming Fig.12b)?

Ricardo Trigo