Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-191-AC2, 2017

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "The 2010–2015 mega drought in Central Chile: Impacts on regional hydroclimate and vegetation" *by* René Garreaud et al.

René Garreaud et al.

rgarreau@dgf.uchile.cl

Received and published: 15 July 2017

Original comments in quotes "...."

Reviewer 1 (Dr. Enenkel) Recommendation: Major Revisions Summary

"The study of Garreaud et al. puts the recent perennial drought conditions in Chile into a multi-dimensional historical and thematic context. The strengths of the manuscript lie in the holistic approach, the level of analytical detail, the visualization of drought conditions on a regional/global scale and the link to long-term climate conditions via tree-ring analysis"

Printer-friendly version

Discussion paper

R. Thanks for your overall assessment of our work. We are particularly pleased to see that you recognize the integrative, holistic approach of our work on the Mega Drought. Indeed, we consider this manuscript as an initial work upon which we and other colleagues can build more specific analyses, including the impacts on socio-economic sectors. We are fully addressing your major and specific comments in order improve the quality and readability of our manuscript.

"I agree with my fellow reviewer that, in the context of existing literature about the Chilean MD (even from the author's themselves), the novelty of the manuscript is questionable"

R. Thanks for pointing this out. The paper by Boisier et al. (2016), published in GRL, focuses on the rainfall trends in this region from the late 70's onward and attributes these trends to both natural variability (ENSO+PDO) and anthropogenic forcing. Of course, the current mega-drought contributed to the existence of this trend, and an attribution exercise was done, but the actual mechanism behind the protracted dry condition was not unveiled. We plan to investigate those mechanism in a paper cited in the HESS manuscript as Garreaud et al. submitted. It turns out that such paper was rejected and we are currently working in a new version including some long numerical simulations. In any case, the soon-to-be manuscript (intended for J. of Climate) only addressed the large-scale atmospheric forcing of the central Chile mega drought. In the new version of our HESS manuscript we also plan to cite a handful of published papers on previous droughts in central Chile. None of those past events persisted for more than 3-years. In sum, the new version will explicitly state that our manuscript is the only scientific work addressing the physical, regional aspects of the central Chile mega drought, an event that is unprecedented in itself.

"However, what bothers me more is that the paper implies improved drought preparedness via an "understanding of the nature and biophysical impacts of the MD". Unfortunately, it fails to relate the presented ïňĄndings to any kind of decision-making or socio-economic response. I see potential in the paper if the authors manage to link

the tracking of the MD through the season(s) via different variables and the MD's historical/climatic context to any kind of suggestion for decision-support, such as socio-economic countermeasures (e.g. changes in agricultural practices, consideration of seasonal climate forecasts)".

R. We began (and concluded) our manuscript with the statement "Understanding the nature and impacts of the current multiyear drought will thus contribute to our preparedness efforts to face the projected dry, warm regional climate scenarios". Broadly speaking this is true, but we acknowledge that the material presented in this work -by itself- doesn't make a tangible contribution to preparedness efforts. On this basis, we have reworded such sentences to avoid creating too high expectations in this issue. As you mention, linking the "physical" MD to the socio-economic world is a major task and probably deserve other paper. But we are taking the opportunity and the new version provide some elements on the socio-economic response to the protracted dry spell.

First, we now include a table (Fig. 1 here) showing the evolution of the water shortage decrees during the MD period for the administrative regions that conform central Chile. We did a little discussion on this in the new introduction. These decrees are presented by the National Government and allows to alter the normal water rights system. We note a mismatch between the drought intensity (as per the rainfall deficit) and the decrees -both in space and time. For instance, 2013 was the driest year during the MD and has the lower number of decrees.

We also will add information about the expenditures by the central government in trucks to deliver potable water to rural communities. This information is available on a regional basis for the whole period and is summarized in the attached figure 2 (to be included in the new version). The size of each truck is proportional to the 2010-2015 expenditures for each region normalized by population. Here we see a large economic burden in the regions to the north of Santiago (semi arid sector) and around Concepción (where the water deficit was actually largest). Therefore, in contrast to the water emergency decrees, the actual expenditures to alleviate the MD have a better match with the actual

rainfall deficit. These brief discussions will be added to the final part of our paper.

Finally, we include the reference to a new article (Unpacking resilience for adaptation: incorporating practitioners experiences through a transdisciplinary approach, the case of drought in Chile; by Aldunce et al. 2016 in Sustainability), where the author disuses the usefulness of existing drought measurements in Chile to distill strength and weakness of adaptation measurements at the local level. Interesting, the worst evaluated measure are the water shortage decree.

Additionally to the previous points, we plan to conclude the new version of the manuscript with a list of pending issues. This include a more comprehensive quantification of the social and economical impacts of the MD, that will serve as a basis for suggesting decision-support measures. Even without such quantification, a real time monitoring of drought state appears as a key element, set aside the prospect of interannual prediction of hydrological conditions. Another big issue is the quantification of the use (overuse?) of ground water. In the paper we note a lack of "browning" and even "greening" of the vegetation over parts of central Chile during the MD and that may be the result of intense use of groundwater. The key question is whether or not that resources are being used in a sustainable manner.

"I understand that an in-depth consideration of the manuscript's ïňĄndings related to decision-support or climate-change adaptation is out of scope, but even a superïňĄcial discussion would improve the manuscript's"

R. We thanks again for your suggestion. As you can see we plan to add four elements to our discussion (water shortage decrees, expenditures on water distributed by truck, reference to a new paper documenting usefulness of existing drought measurements) and a listing of pending issues. Granted, these new elements in our paper only address partially the social impacts of the MD, but we hope they will a good addition to this manuscript in HESS.

Main comments "The manuscript needs to be more clearly distinguished from the au-

Printer-friendly version

Discussion paper

thors' other publications" R. Yes...please see our response to the second point of your overall evaluation

"References and figures need to be reviewed (some are missing, some only mentioned in the reference list, but not in the text)"

R. We deeply apologize for the mistake with the reference section. Of course, the revised version will include a full, updated list of references. We also will take the opportunity to correct several typographical, spelling and usage errors.

"Although 2010 was the strongest La Niña year during the MD period 2011, 2013 and 2014 were La Niña years as well. Could these conditions have contributed to the MD's persistence?"

R. Considering the Niño3.4 index, the winter of 2011, 2013 and 2014 were rather neutral. In any case, the relatively cold condition of the Pacific in this period (cold PDO phase) was probably an important forcing of the MD period. Part of this is addressed in Boisier et al. 2016.

General comments "Whenever you talk about rainfall deficits and related percentages please mention the reference period." R. Advice taken. Reference period added.

"Instead of describing selected drought events in the introduction I suggest you provide more general statistics, if available (e.g. from UNISDR; EMDAT might not be a good choice)"

R. Not sure which drought events. We think that mention a few examples of recent past droughts in other subtropical regions is necessary since it gives a background for our event.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-191, 2017.

	2008	2009	2010	2011	2012	2013	2014	MS
Coquimbo	3	0	2	3	1	2	4	15
Valparaiso	3	0	2	5	4	3	5	22
Metropolina	2	0	0	2	2	0	0	6
O'Higgins	1	0	0	1	0	0	0	2
Maule	1	0	0	2	1	1	2	7
Bio Bio	1	1	0	0	0	0	1	3
Total	11	1	4	13	8	6	12	55

Fig. 1.

Printer-friendly version

Discussion paper

Fig. 2.