

Do sun spots influence the onset of ENSO and PDO events in the Pacific Ocean?

Franklin Isaac Ormaza-González and María Esther Espinoza-Celi

Final response.

Dear Editor and Reviewers.

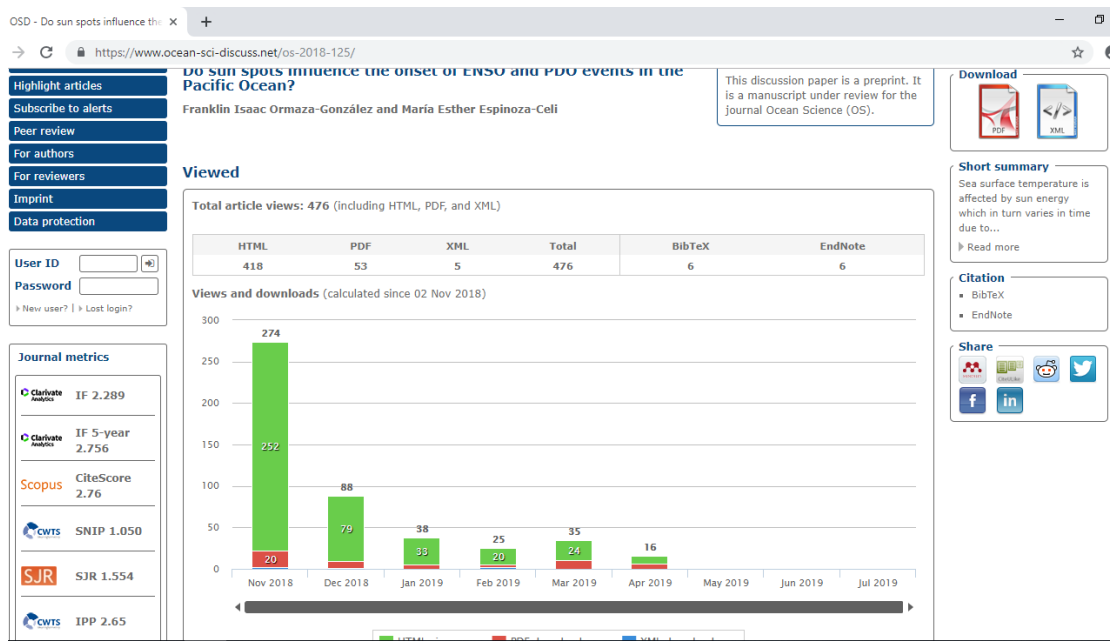
First at all, we would like to express our gratitude for the time and patience you have taken to revised and comment our paper. All your comments and suggestions have been very useful. Secondly, we think we have responded if not all most of them with much respect and argumentatively.

Thirdly, we would like to annotate that the during the time the paper has been under discussion, there has been around 500 reads and above 50 fully downloads (Fig. 1) and nearly 100 views and reading in Research Gate Portal

(https://www.researchgate.net/publication/328700803_Do_sun_spots_influence_the_onset_of_ENSO_and_PDO_events_in_the_Pacific_Ocean/stats). In the discussion space, there was not any comment in favor or against it and its contents. We think this fact gives credit to the manuscript.

We have already submitted two new versions to AR1 and AR2. Thus, complying with referees' request. The latest version with minor modifications we are going to submit after this phase is over.

Fig. 1. Stats records of article views.



Fourthly, we strongly think the paper is contributing to ocean science, in a subject such as the ENSO, which is very important to understand better every day. Right now, there are warm anomalies in area 3.4 that are above El Niño threshold (>0.5C), however the SOI is not fully

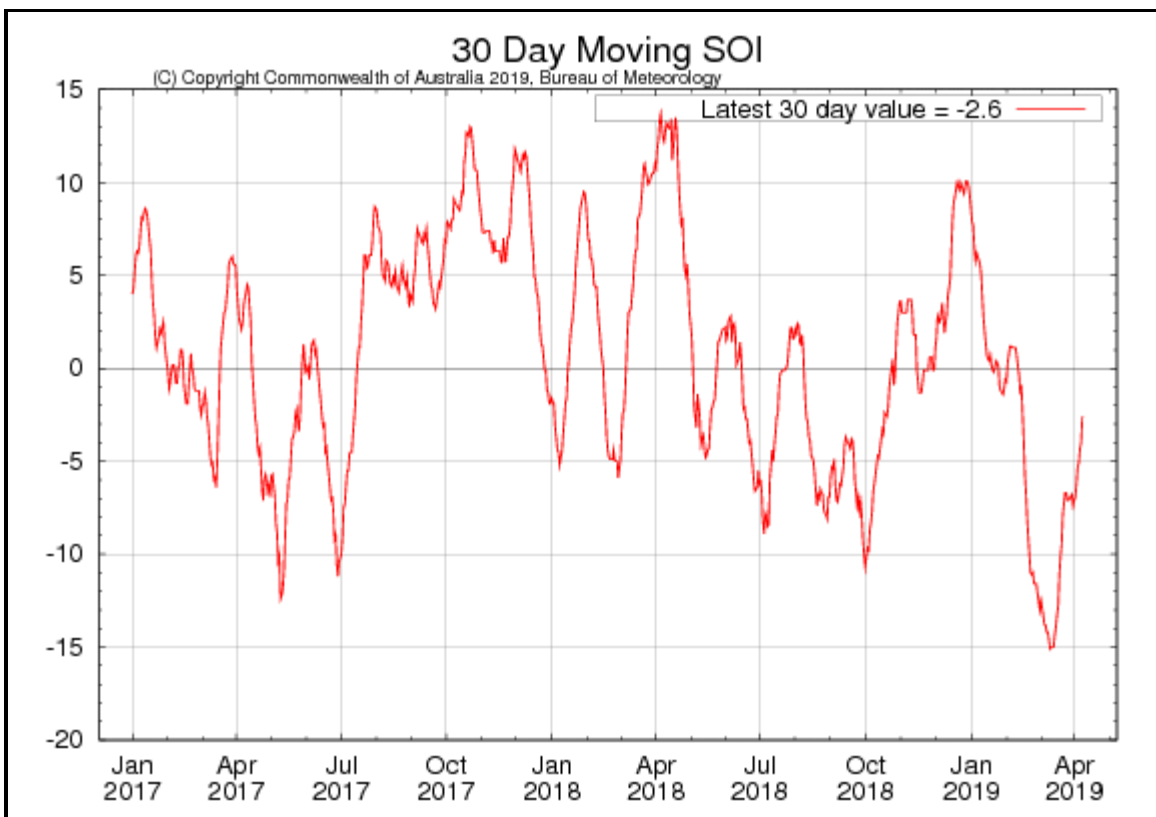
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connected so far to these anomalies (Fig. 2., <http://www.bom.gov.au/climate/enso/>). This index has to be < -7.5 for at least 3 consecutive months. Right now (10/April) the latest value over 30 days is -2.6 and getting close to 0.0 quickly. *Id est*, there is not a fully fledged El Niño. The SOI is correlated with sun spots (Higginson *et al.*, 2004). On the other hand, in 1+2, the SST anomalies have been under 0.5°C on average, last week was even negative, the ZCIT has moved to 3-5N Latitude, signaling the presence of trade wind and Humboldt from the south and Cromwell undercurrent from west. One of the reasons for what said above is that sun spot are at the lowest numbers since decades ago. During February 2019 the Sun has 28 days spotless (<https://spaceweatherarchive.com/2019/03/06/a-month-without-sunspots/>).

Fig. 2. SOI behavior in time. <http://www.bom.gov.au/climate/enso/#tabs=SOI>.



Finally, we cannot have any doubts the sun affects directly the SST of sea water. For some reason Galileo Galilei on June 23 of 1613 draw the first ever sun spots (Fig. 3), although Chinese astronomers u observer had registered since 28 BC or even Anaxagoras probably made an account on them in 467 BC (https://www.jstor.org/stable/227857?seq=1#page_scan_tab_contents). Bertrand Russel (1917) said: When we look at the sun we wish to know something about the sun itself, which is ninety-three million miles away....

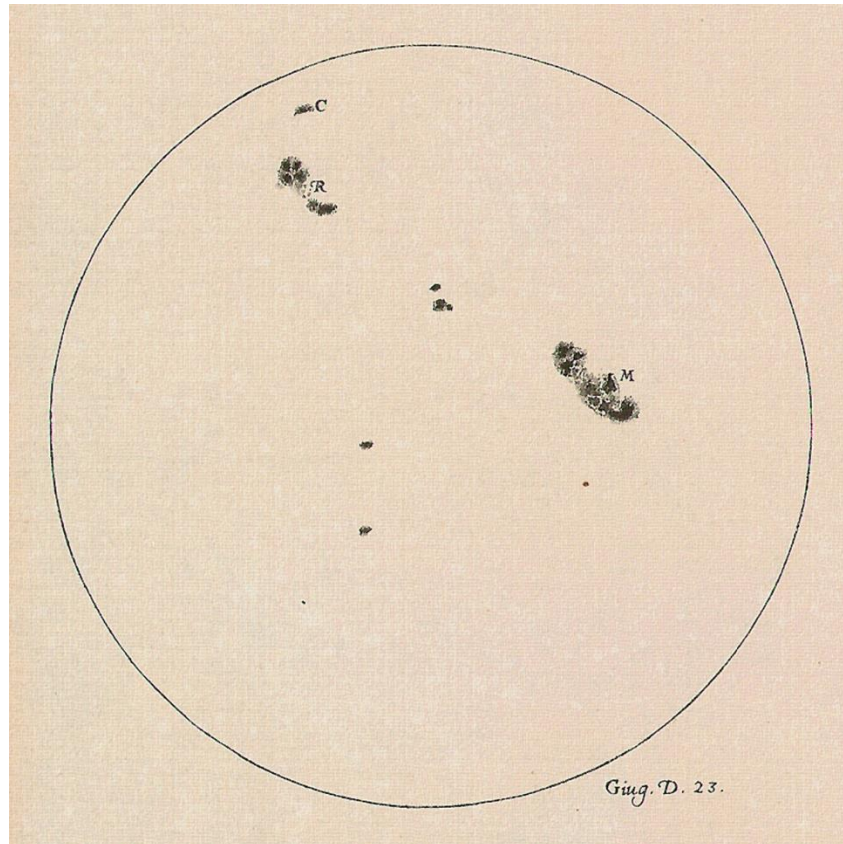
Thank you.

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Fig. 3. Galilei drawing of sun spots on 23 June 1613 showing the positions and sizes of a number of sunspots. See, http://galileo.rice.edu/sci/observations/sunspot_drawings.html.



References

Bertrand Russell (1917), *The Ultimate Constituents of Matter* (An address delivered to the Philosophical Society of Manchester in February, 1915. Reprinted from *The Monist*, July, 1915. Reprinted in his *Mysticism and Logic* (London: George Allen & Unwin Ltd.: 1917). Also reprinted Totowa, New Jersey: Barnes & Noble Books, 1951. Page 100.)

Higginson, M. J., M. A. Altabet, L. Wincze, T. D. Herbert, and D. W. Murray (2004), A solar (irradiance) trigger for millennial-scale abrupt changes in the southwest monsoon? *Paleoceanography*, 19, PA3015, doi:10.1029/2004PA001031

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