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Interactive comment on "On the interconnections among major climate modes and their common driving factors" *by* Xinnong Pan et al.

Dmitry Sonechkin

dsonech@mecom.ru

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If our final research objective consists in the long-term weather prediction and the short-term outlook of the climate change then it is important to know and understand processes in the climate system of larger spatial and temporal scales than those inherent to the cyclonic activities. It is well known that Sir Walker and his colleagues (Berlage and some others) were the pioneers in such studies (detecting the Southern Oscillation in tropics). Much later, Wallace and others discovered the so-called teleconnections in extratropics. After this, it became clear that there is a certain internal order in seemingly chaotic climate dynamics. Now it is the generally accepted to believe that ENSO is the main component of this order influencing climatic processes almost everywhere on the Earth. But there are also (not numerous) indications that some of extratropical

teleconnections themselves affect ENSO. Therefore, the question of what is the root cause of the multiscale climate dynamics remains to be open. By this reason, the topic of the paper being discussed seems to be appropriate. However, it is necessary to remember that, according to the second law of the thermodynamics, no order occurs in a dynamical system if there are no external factors affecting this system. In connection with this, the conclusion of the paper being discussed that effects of all individual climatic processes on each other can be reduced to the influence of only two of them: the quasibiennial oscillation (QBO) in the lower stratosphere and ENSO. Of course, a reference is done to the solar activity which is one of the external factors possible affecting the climate system. It is because the paper authors found four main peaks in the power spectra: of a set of the tropical and extratropical teleconnection indices: 2.32, 3.90, 6.55, and 11.02 years. In fact, a different interpretation of these peaks can be given. The period of 2.32 years (28 months) is exactly equal to the doubled main period of the so-called Chandler wobble in the Earth's pole motion. It seems to be appropriate to consider the Chandler wobble as the prime cause of QBO, and so an indirect cause of other teleconnections. The periods of 3.90 and 6.55 are not the main periods of ENSO. According to numerous calculations, the most pronounced period of ENSO is 3.5 years (42 months). It is exactly the trebled (the subharmonic 3:1) Chandler wobble period. Besides, there exist several other ENSO peaks in the range between 2 to 7 years. Some of which are equal to other subharmonics (e.g. 2:1, 4:1) of the Chandler wobble period, i.e. $\sim$2.4 and $\sim$4.8 years. The period of $\sim$6.2 years (instead of 6.5 of the authors) seems to be equal to the superharmonic 1:3 of the Luni-Solar nutation (the main period = $\sim$18.6 years). Thus, the Luni-Solar nutation seems to be another prime cause of ENSO and others. Thus, both afore-mentioned external factors must be indicated in the paper discussed as the prime causes of the macroscale climatic processes instead of QBO and ENSO. One can mention that the most recent and careful computation of the ENSO power spectra is published in Serykh I.V., Sonechkin D.M. "Nonchaotic and globally synchronized short-term climatic variations and their origin". Theor. Appl. Climatol., 2019, DOI 10.1007/s00704-018-02761-0. Moreover, in this pa-

per pactically the same set of power energy peaks is found in the power spectra of other teleconnections which form (together with ENSO) a global scale spatial structure called the Global Atmospheric Oscillation (GAO) in Serykh I.V. et al. “Global Atmospheric Oscillation: an integrity of ENSO and extratropical teleconnections”. PAGEOPHYS, 2019, https://doi.org/10.1007/s00024-019-02182-8.

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