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Interactive comment on "Response of seasonal soil freeze depth to climate change across China" *by* Xiaoqing Peng et al.

Anonymous Referee #2

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This is a valuable contribution, discussing soil freeze depth and its trends over China over several decades. The study is certainly worth being published in TC after the following comments have been considered.

You don't mention your paper "Response of changes in seasonal soil freeze/thaw state to climate change from 1950 to 2010 across China" in JGR, 121(11), pp.1984-2000, 2016. You should make very clear the differences to this paper and compare in detail the results and conclusions, i.e. build this paper on the previous one.

Check for typos and grammar!

Line 35: how can permafrost area (23%) and seasonally frozen ground (>80%) be more than 100%?

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Discussion paper

Section 2.1.3. Mention/discuss why no reanalysis data sets were used instead of MM-GAT? Reanalysis data could allow for some additional/alternative tests of meteorological parameters and their trends.

Section 2.16. What about other potentially important environmetal data (geology, wetness, other meteorological data, albedo, cloud cover . . .)? See also previous comment. It is not obvious why NDVI should be the most important other influence to SFD.

Line 128: wouldn't the usage of a reference level other than sea level, i.e a level closer to the real elevations (for instance, mean elevation of regions) be less sensitive to uncertainties in the estimated lapse rates? In particular for the Tibet Plateau, where most of the SFDs > 0 are found? Uncertainties would not be extrapolated but only interpolated.

Line 227: You list a number of reasons for the spatial SFD variability, but given no indication that they in fact could lead to the observed variations. Some influences, such as albedo, could actually be tested.

Mention and discuss the relation of soil freezing and permafrost from your data, as you mention permafrost at several places.

Fig. 1, 4a, 7: what is the inset to the lower right? It does not contribute. Remove.

Fig 4: your panel sequence is a, c, b, d? Why not a, b, c, d?

Fig 6: very hard to see differences. Better show anomalies with respect to the mean SFD?

Fig 10: I think the relation between SFD and NDVI needs more discussion. Why is it correlated on a year to year basis? You mainly discuss influences of vegatation on SFD, but couldn't both SFD and NDVI variations simply reflect the same drivers? Temperature -> Growing season? Temperature/precipitaion -> Water availability? I think it doesn't hold to just say Âń. . .the detailed physical mechanism will require further future workÂż You need to discuss at least the fundamental mechanisms, otherwise

showing the NDVI doesn't make much sense.

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