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Discussions

Interactive comment on "Analysis of Spatiotemporal variations in mid-upper tropospheric methane during the Wenchuan Ms8.0 earthquake by three indices" *by* Jing Cui and Xuhui Shen

Jing Cui and Xuhui Shen

jingcui_86@yahoo.com

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Advices: A crucial question in this field of research refers to how can we link an individual precursor with a distinctive stage of the EQ preparation. In this direction, we focus on the result presented by the authors that "a large anomalous area was centered at the epicenter area eight days before the earthquake occurred". ËŹ The generation of such a seismic anomaly requires physical and chemical transformations which occur in a spatially extended preparation (activation) zone of an impending EQ. Earthquakes exhibit in general complex correlations in time, space and magnitude. It is widely ac-

cepted that the observed EQ scaling laws indicate the existence of phenomena closely associated with the proximity of the system to a critical point [1]. Therefore, such a requirement is satisfied during the appearance of the "critical window", i.e., the epoch during which the short-range correlations have evolved to long-range ones in an extended area, where the "critical radius R" is given by the empirical relation $\log R \approx 0.5M$, where M is the EQ magnitude [2]. Notice, based on the recently introduced concept of the "natural time" by Varotsos and his colleagues [3] it has been shown that the foreshock seismic activity that occurs in the region around the epicentre of the upcoming significant shock a few days up to one week before the main shock occurrence, behaves as critical phenomenon. Therefore, the hypothesis that the large anomaly in methane eight days before the earthquake occurred corresponds to the critical point- window of the earthquake preparation process cannot be excluded. Accumulated experimental evidence supports the aforementioned hypothesis as follows: The EQ preparatory process has various facets which reflect correspondingly different precursors. Importantly, precursors emerge during the same period, A few days up to one week before the main shock occurrence, while they behave as critical phenomena, as well. Characteristically, such as precursors are: (i) ULF magnetic field variations recorded by ground-based magnetic observatories before significant EQs, e.g., [4,5] (ii) MHz fracture induced MHz EM anomalies [6]. The generation of such a seismic anomaly also requires physical and chemical transformations which occur in a spatially extended preparation (activation) zone of an impending EQ. Characteristic precursors are athe short-lived seismo-ionospheric EM precursors and EM anomalies rooted in preseismic LAI-coupling [7,8]. Pulinets et al. [7] have provided strong evidence for the occurrence of ionospheric precursors well before the main shock: ionospheric precursors within 5 days before the seismic shock were registered in 73% of the cases for EQs with a magnitude 5, and in 100% of the cases for EQs with a magnitude 6. The aforementioned results seem to support the hypothesis that the observed anomaly in terms of spatiotemporal variation in methane is rooted in the stage of critical pointepoch of the earthquake preparation process.

Reply: Thanks for the reviewer. This is a good advices, we have consider this, but do not know how to explain. We just compare our result with the non-earthquake year and try to explain this by the crust dynamics. We accept the reviewer's advice and add these advices in the Discussion part. The changes marked with red color in the Page 13- 17 of the changed-marked-manuscript (shown as supplement). The reference also have been quoted with yellow color in the changed-marked-manuscript.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-342/nhess-2018-342-AC2-supplement.pdf

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