

## ***Interactive comment on “An empirical model (CH-Therm-2018) of the thermospheric mass density derived from CHAMP” by Chao Xiong et al.***

### **Anonymous Referee #1**

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In this work, the authors presented an empirical model, named CH-Therm-2018, of the thermospheric mass density derived from 9-year accelerometer measurements at altitude from 460 to 310 km, from CHAMP satellite. This paper is well written, and well organized. However, the referee did not get the point of this study. In other words, I did not see new findings of this work.

### Comments:

1. The authors should be addressed the purpose of this work to develop a new empirical model since there are a few models from CHAMP or GRCAE data. Most of the features were mentioned or reported in the previous works, especially in Liu et al. (2013). See more references attached. For me, it is more and less like a student exercise.

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2. The CHAMP thermospheric densities derived from different groups show different biases. If the authors did not evaluate these datasets first, the model could be useless.
3. The authors mentioned that they used similar equation as Liu et al. (2013) did. Actually, it is totally different. Liu et al. (2013) used multinomial series, so that they got thousands of coefficients.
4. Although there are 9 year dataset, the data are very sparse if the authors consider so many factors, including latitude, longitude, solar activity, geomagnetic activity, altitude, and so on. How to avoid the overfitting issue? How can use the constant scale height to fit the altitudinal variations without a large dataset?
5. The authors developed two models for low and high solar activities. It is odd for me.
6. It seems that the CH-Therm has a better performance as compared with MSIS. This is expected. When they compared the SLR data, the CH-Therm is even worse than the JB model.
7. "CH-Therm-2018" should be removed from the title.

Ref:

Weimer, D. R., Sutton, E. K., Mlynczak, M. G., & Hunt, L. A. (2016). Intercalibration of neutral density measurements for mapping the thermosphere. *Journal of Geophysical Research: Space Physics*, 121, 5975–5990. <https://doi.org/10.1002/2016JA022691>.

Calabia, A., & Jin, S. (2016). New modes and mechanisms of thermospheric mass density variations from GRACE accelerometers. *Journal of Geophysical Research: Space Physics*, 121, 11, 191–11, 212. <https://doi.org/10.1002/2016JA022594>.

Ruan et al. (2018). An exospheric temperature model based on CHAMP observations and TIEGCM simulations. *Space Weather*, 16. <https://doi.org/10.1002/2017SW001759>

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Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2018-25>,

2018.

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