



EGUsphere, author comment AC1  
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## Reply on CC1

Zhenxia Liu et al.

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Author comment on "An improved method of the Globally Resolved Energy Balance Model by the Bayes network" by Zhenxia Liu et al., EGU sphere,  
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Thank you very much for your interest in our work and for your helpful and sound comments.

To the first question, this manuscript determines the correlation between different climate elements by referring to the GREB model. The dynamical equations in the article are cited from Ref. 1, where the physical meaning of the whole GREB model is clearly defined, so the conceptual definition of the GREB model is not what this manuscript will explore.

To the second question, as reviewer said, *running models based on climate science* is a more direct way to perform climate simulations, but the number of factors affecting climate processes and our current lack of comprehensive knowledge of them make existing models either difficult to effectively simulate their evolution or too complex, and sensitive to initial values and boundary conditions (Ref. 2, Ref. 3, Ref. 4). The idea of this manuscript is to use the existing climate models to construct a Bayes network (this means that the *amount of guessing* in the manuscript is constructed based on the existing climate science model, in section 2.1 of the manuscript). Then, the network is trained with real observation data (In section 3.2 of the manuscript), and finally the simulation of climate processes is realized. Although this manuscript is based on the statistical idea of Bayes network, it is not a complete gray box model. The network is constructed by considering the basic laws in climate science and applying the real observation data. Therefore, the research of this paper can be considered as an improvement to the climate models. And at the same time, the research of this manuscript also proposes a basic idea of combining dynamical and statistical models. From this perspective, it is reasonable and predictable to make better results than climate models by using the thesis method.

I hope to contact you further if you have any suggestions!

Ref. 1 Dommenges, D. and Flöter, J.: Conceptual understanding of climate change with a globally resolved energy balance model, *Climate Dynamics*, 37, 2143-2165, [10.1007/s00382-011-1026-0](https://doi.org/10.1007/s00382-011-1026-0), 2011.

Ref. 2 Alley, R. B., Emanuel, K. A., and Zhang, F.: Advances in weather prediction, *SCIENCE*, 363, 342-344, [10.1126/science.aav7274](https://doi.org/10.1126/science.aav7274), 2019.

Ref. 3 Fan, J., Meng, J., Ludescher, J., Chen, X., Ashkenazy, Y., Kurths, J., Havlin, S., and Schellnhuber, H. J.: Statistical physics approaches to the complex Earth system, *PHYSICS*

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10.1016/j.physrep.2020.09.005, 2021.

Ref. 4 Zou, Y., Donner, R. V., Marwan, N., Donges, J. F., and Kurths, J.: Complex network approaches to nonlinear time series analysis, PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS, 787, 1-97, 10.1016/j.physrep.2018.10.005, 2019.