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Comment on angeo-2022-22

Anonymous Referee #2

Referee comment on "The solar induced 27-day modulation on polar mesospheric cloud (PMC), based on the combined observations from SOFIE and MLS" by Shican Qiu et al., Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2022-22-RC2>, 2022

Review of "The solar induced 27-day modulation on polar mesospheric cloud (PMC), based on the combined observations from SOFIE and MLS" by Qiu et al.

The paper focuses on the investigation of 27-day oscillation of PMC based on satellite observations of IWC and temperature. The author conducted comprehensive data analysis and confirmed the correlation between the PMC variations with the solar activities, represented by the Y10 index. The presentation is reasonably clean the conclusions are solid. The data analysis algorithm follows Thurairajah et al., 2017 with more SOFIE data, coupled with MLS observations. However, the role of MLS data are not clearly addressed in the paper. Shouldn't the simultaneous IWC and temperature measurements by SOFIE provide enough data already to establish their correlation? Involving a different instrument can cause unwanted bias in the results due to distinct sampling schemes, such as resolution and sensitivity issues, and may not help the investigation. If the author insists to include MLS data, the paper should articulate the motivation and, at least, provide some discussion on the consistency between the two instruments' measurements. Note that the MLS IWC covers range starting from upper troposphere. Does the troposphere cloud ice affect the overall PMC results in the paper? In addition, the objectives of this study are vaguely stated. The paper also lacks the discussions of the results. What do these new results help to understand the underline mechanism of the 27-day oscillation of PMC. The current version reads like an experimental report, simply repeating the analysis with more data and listing the outputs of the calculations. Overall, what are the new discoveries in this study and their contributions to the PMC dynamics and chemistry?

Minor comments:

- Page 2, line43-45. This sentence reads somewhat strange. Please consider to rephrase.
- Page 2, line 50 "...solar radiation will increase the mesopause temperature by heating". This statement is questionable. The MLT temperature variations are mostly controlled by the dynamics and chemistry.

- Page 3, line 60-62. This statement need more clarification, I think. Is this a hypothesis based on observations or some model simulations?
- Are the temperature in Figure 1 SOFIE temperature or MLS temperature?
- Page 6, line 162-164. This statement is only true when the temperature is low, I think. The equation is fine here, because the summer mesopause temperature is low. However, it would be good to set a limit.
- The MLS data site in the Data availability does not seem to demonstrate the data resource. At least it is not quite clear.