

Authors reply on coeditor comment 26 january 2024

Dear Dr. Oldeman,

Thanks for your constructive and helpful modifications in response to the reviewers. I have only one minor request before accepting the paper (which should take less than one hour) which concerns the discussion of the processes responsible for the surface temperature changes. The equation you use to do this (from Heinemann et al 2009) doesn't balance energy; e.g., the turbulent heat fluxes are not accounted for, nor are changes in the partitioning of heat transport divergence in the atmosphere and ocean which would affect surface temperature without directly changing the emissivity of the atmosphere. Rather, it is best described as "a model for diagnosing surface temperature assuming a gray atmosphere without turbulent heat fluxes." Nonetheless, Heinemann et al shows that it works fairly well to reproduced changes in temperature simulate by a climate model -- so I am fine with you applying it here. However, I would like to see a few words in the main text about the equation applied (perhaps including a phrase like the one in quotes above).

David

- We agree that the 'model' used is a tool to diagnose surface temperatures based on a simple energy budget analysis (ie shortwave and longwave radiation following from the climate model), but doesn't really balance energy. Taking your useful feedback, we propose to add the following sentence in the paragraph:
- "We diagnose surface temperatures with shortwave and longwave radiation, using a simple model assuming a gray atmosphere without turbulent heat fluxes (following Heinemann et al. (2009) and Baatsen et al. (2022), results shown in Supplementary material Figure S10)."

PS. In lines 546-7 of the revised text, did you mean an increase in atmospheric emissivity due to increases in cloud fraction (and perhaps water vapor)? A decrease in atmospheric emissivity would cool the surface by allowing more greater fraction of the longwave emitted from the surface to reach the top of the atmosphere. I think the confusion here is because of the non-standard way emissivity is defined in Heinemann et al.

- You are correct, to remove any confusion and to be consistent with the phrasing in the rest of the paragraph, we will change this into: "... is related to **changes in** emissivity from increased evaporation ..."