



# The effects of leaf stomatal closure on humidity in a prominent climate model

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## Introduction

Climate models have shown an overall increase in atmospheric humidity as the planet warms. However, there have been several regions over recent years that show a decrease in humidity (Simpson et al. 2024; McKinnon et al 2021). Our study aims to find the basis for these areas of decreasing humidity, by examining plant behavior in the Community Earth System Model (CESM). We utilized 2 components of the CESM, the Community Atmosphere Model and the Community Land Model. For this project, the climate model was run by Drs. Claire Zarakas and Abigail Swann of the University of Washington, as a part of a study in progress.

As CO<sub>2</sub> increases, it causes leaf stomata to close (e.g., Mankin et al 2019), in addition to warming the planet. We analyze how stomatal closure affects atmospheric variables, such as humidity and temperature, through latent and sensible heat flux changes (Figure 1).

## References

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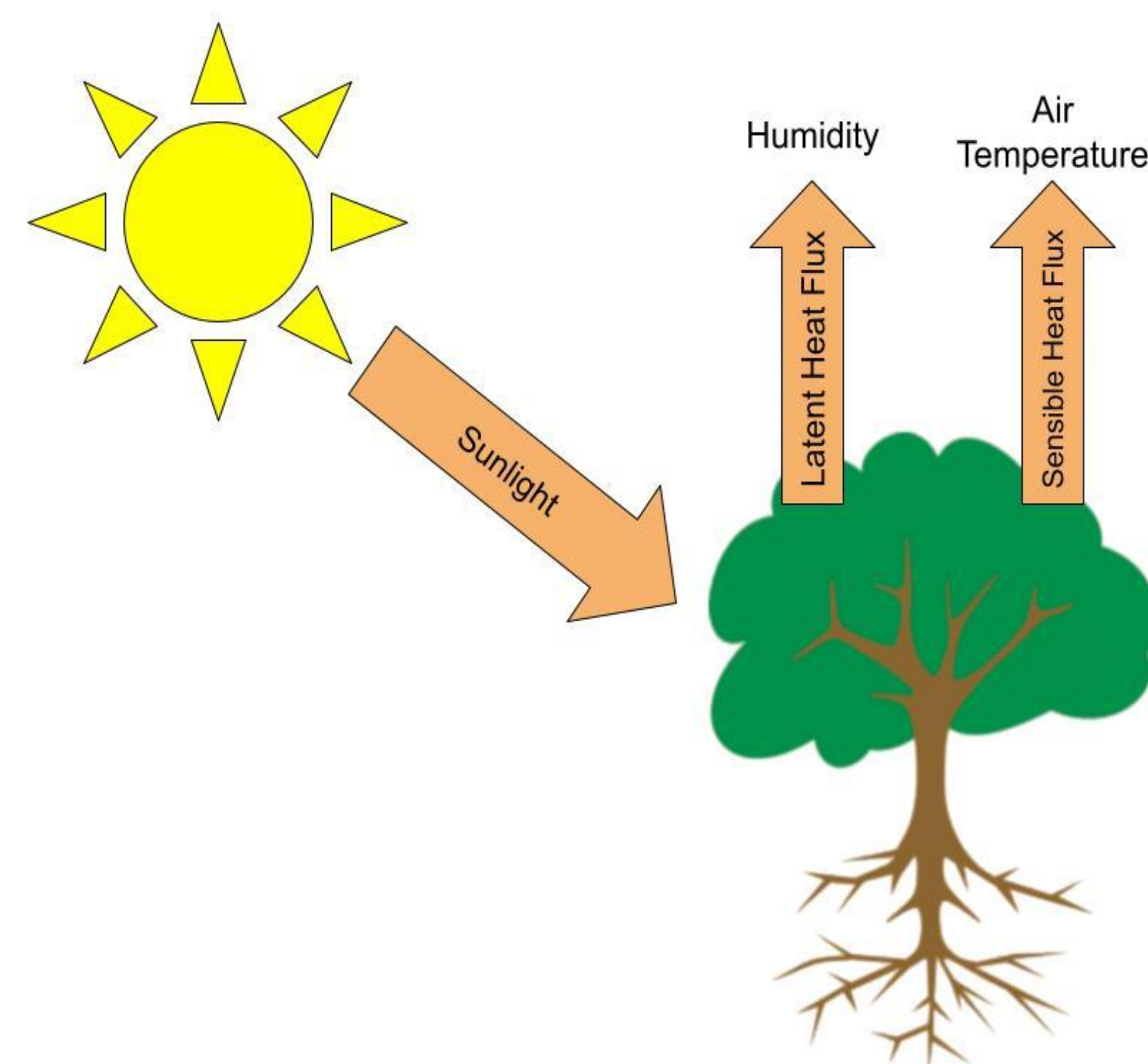


Figure 1

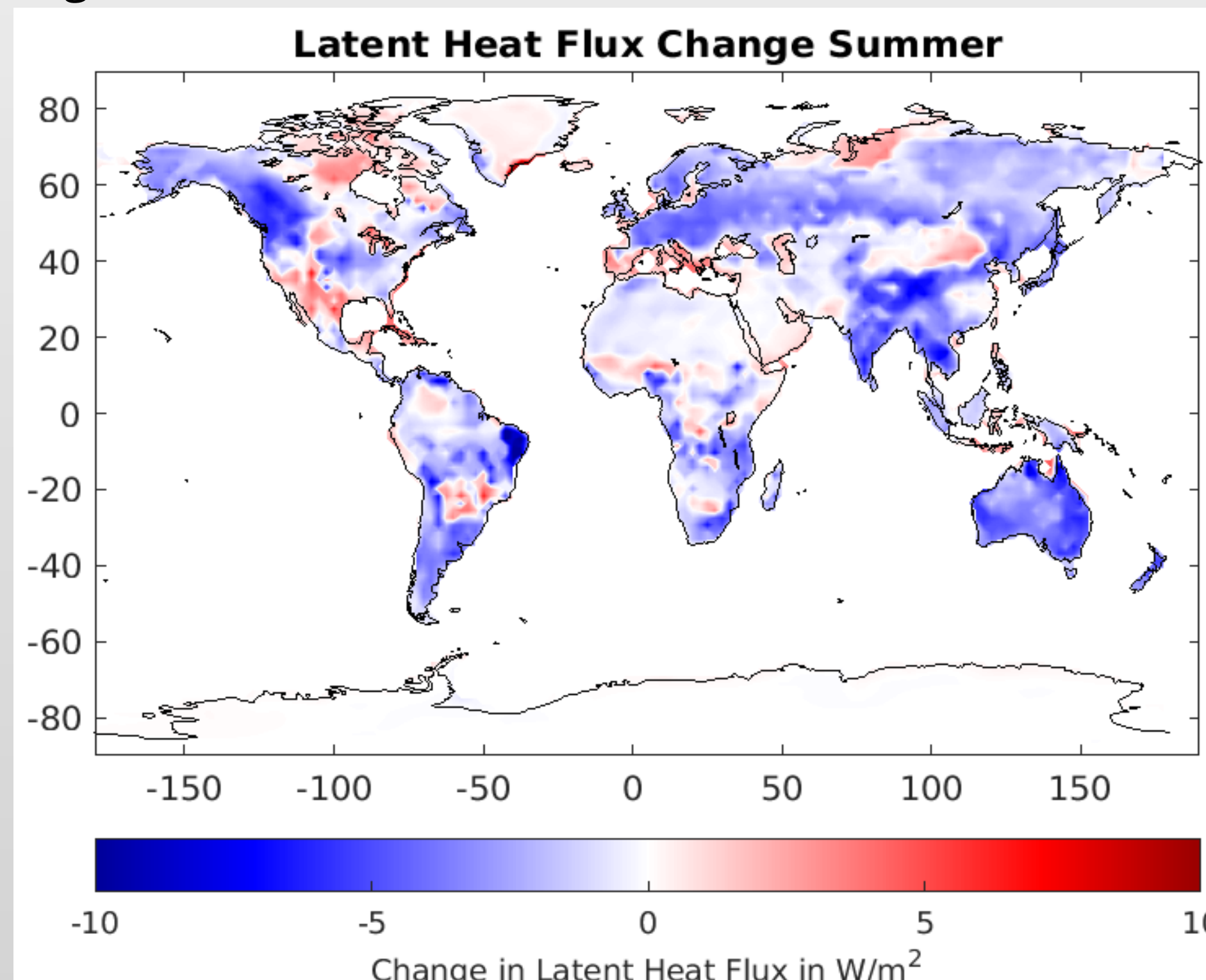


Figure 2

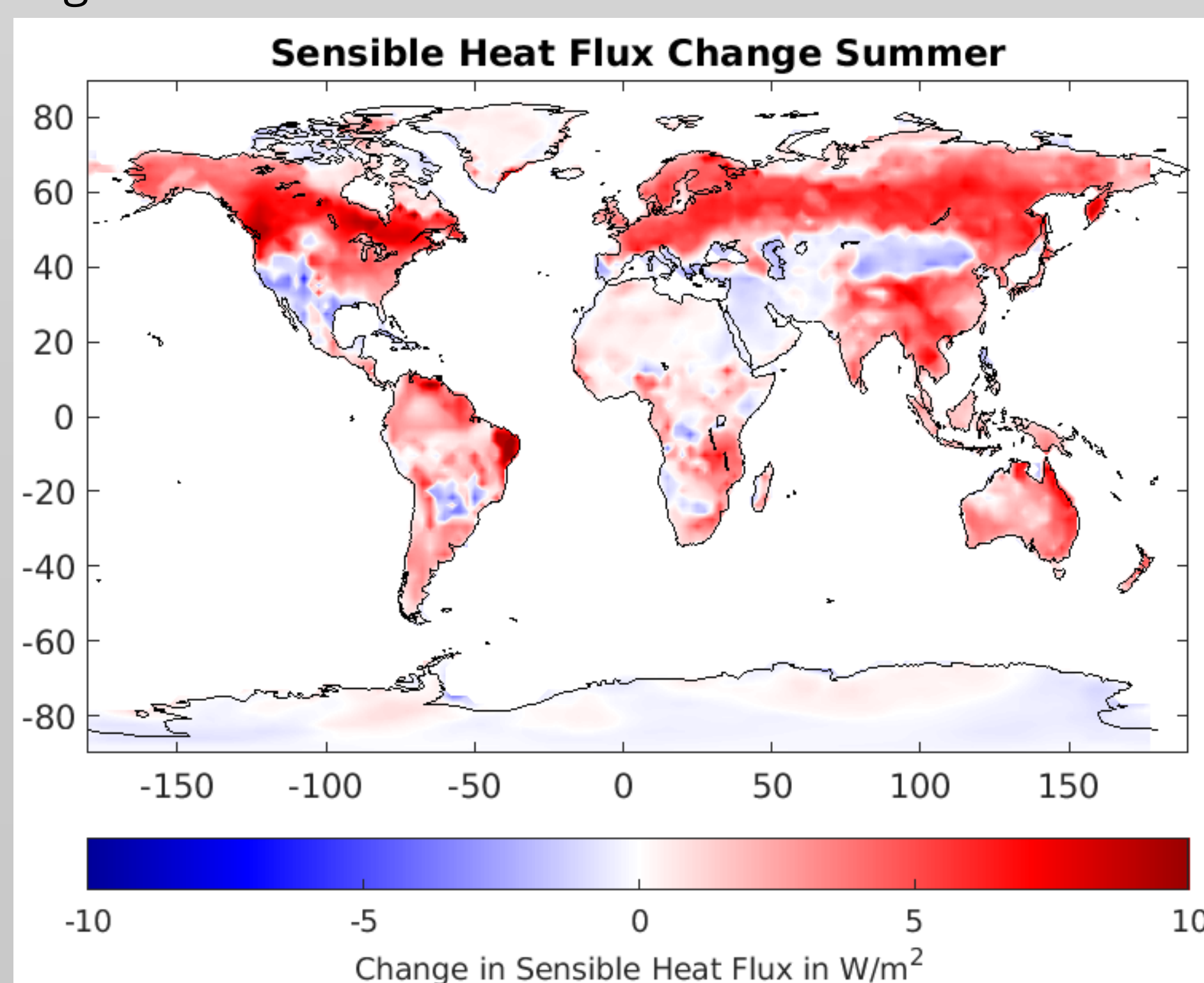


Figure 3

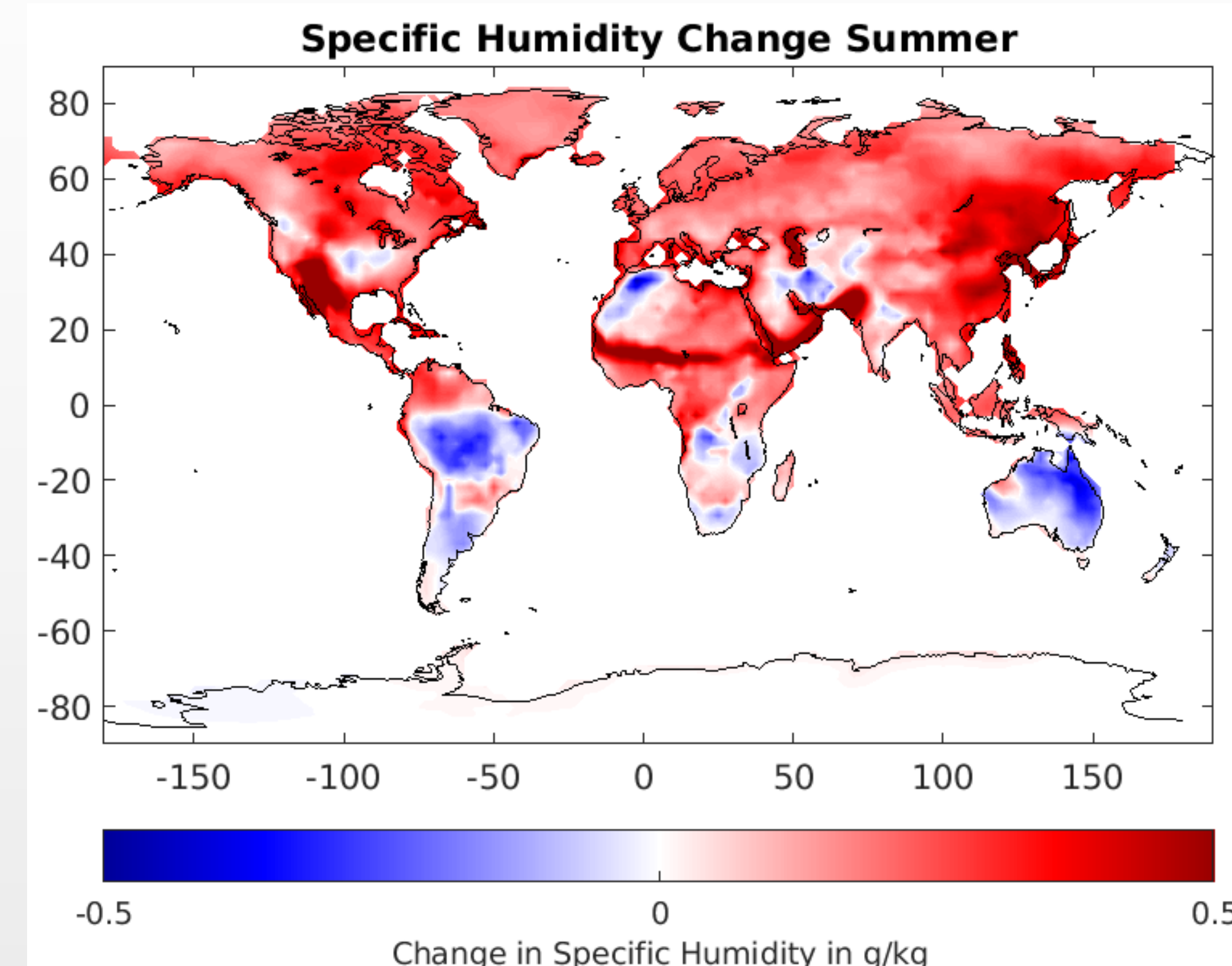


Figure 4

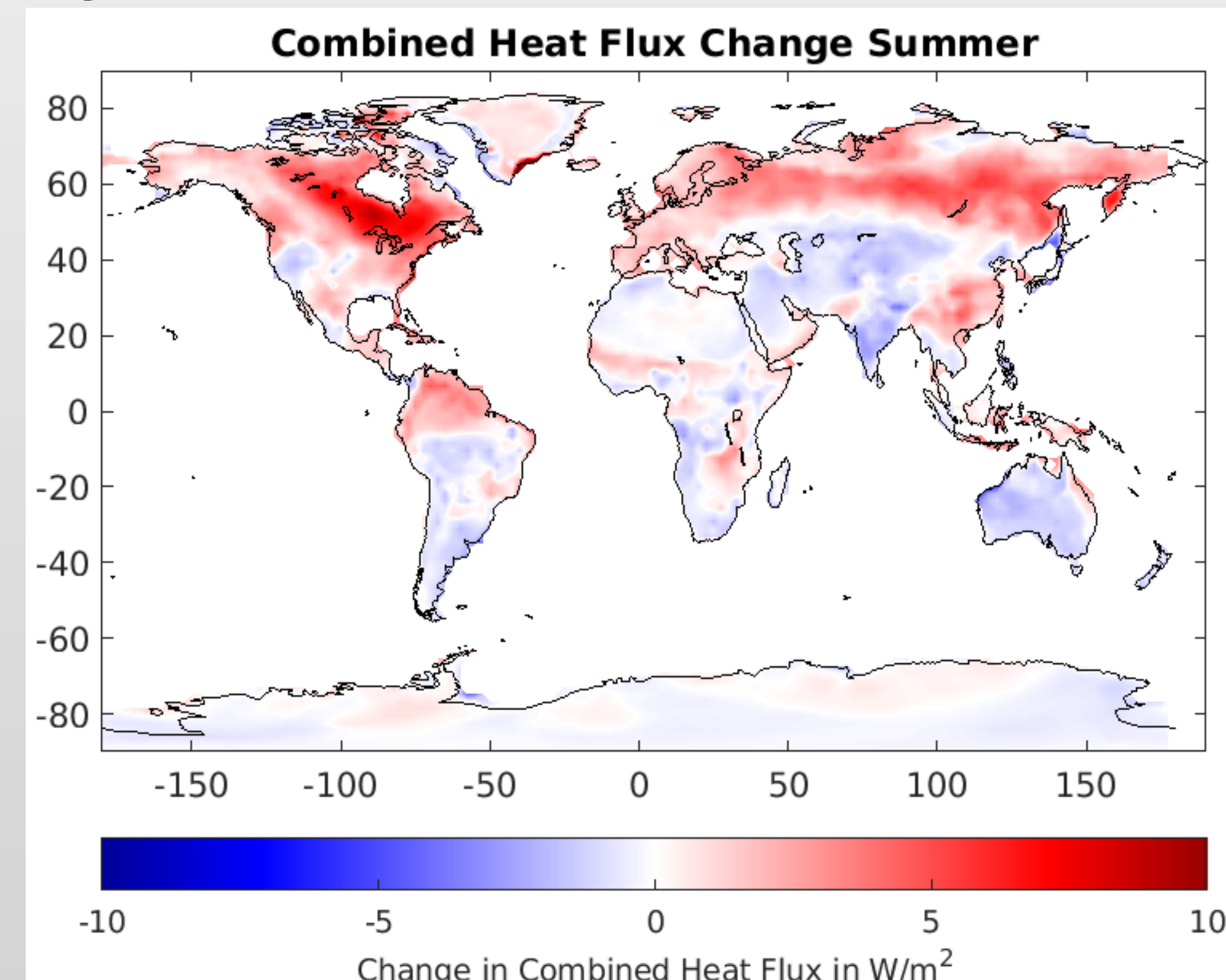


Figure 5

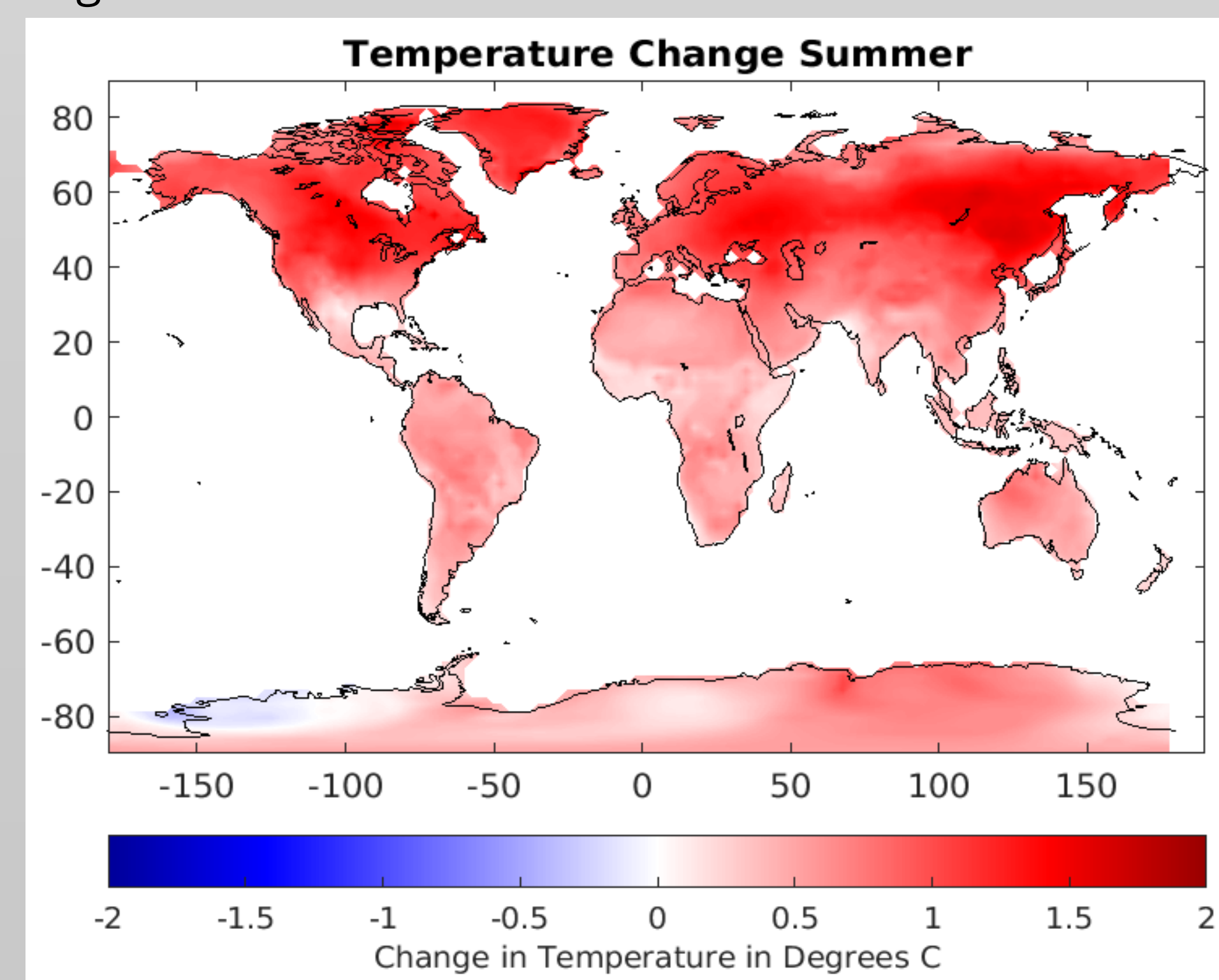


Figure 6

## Results & Conclusion

We started by looking at how the latent heat flux changed, as shown in Figure 2, which shows that there is a widespread decrease. Looking at the sensible heat flux change, we saw that there is a widespread increase (Figure 3). This is what we expected to see, as the closure of stomata leads to lower latent heat and higher sensible heat.

As we look at Figure 4 and the change of specific humidity, however, we see an increase rather than a decrease. This led us to a hypothesis that it is based on the change in the combined latent and sensible heat flux (Figure 5). Indeed, this looks similar to the change in specific humidity that we see in Figure 4.

Figure 6 shows that the combined change also leads to overall higher temperatures globally. From that we can conclude that the combined change in both latent and sensible heat, plays the biggest role in the changes of specific humidity and temperature. These findings are similar to Laguë et al. (2023).

Future work will analyze cloud impacts, relative humidity, and radiation changes, to dive deeper into what is causing the increases we have seen.

## Acknowledgements

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