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Assessing atmospheric sensitivity to SST variations using the maximum entropy production principle

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The poleward shift of the mid-latitude storm tracks is a robust feature predicted under global warming. Several recent studies have demonstrated that increases in sea surface temperature (SST) can impact both the intensity and position of the storm tracks. Some authors suggest that changes in the surface temperature gradients are responsible, as these impact tropospheric baroclinicity. Others believe that warmer temperatures in the tropics increase latent heating, causing changes in the Hadley Cell which in turn displace the storm tracks.

In attempt to better characterize the response to changes in SST, we use a simplified energy balance model based on the principle of Maximum Entropy Production (MEP). The model is similar to one propsed by Partridge (1975; 1978), but captures only the atmospheric response (the surface temperatures are fixed). We find that the model exhibits many features in common with a full atmospheric general circulation model (CAM 3.0), including changes in temperature, convective heat flux and meridional heat transport. However, the model fails to capture the observed shifts in the meridional heat transport. This failure stems from the model lacking feedbacks, through which for example convective heating adjusts to changing atmospheric temperatures.