Uncertainty in the pattern of warming

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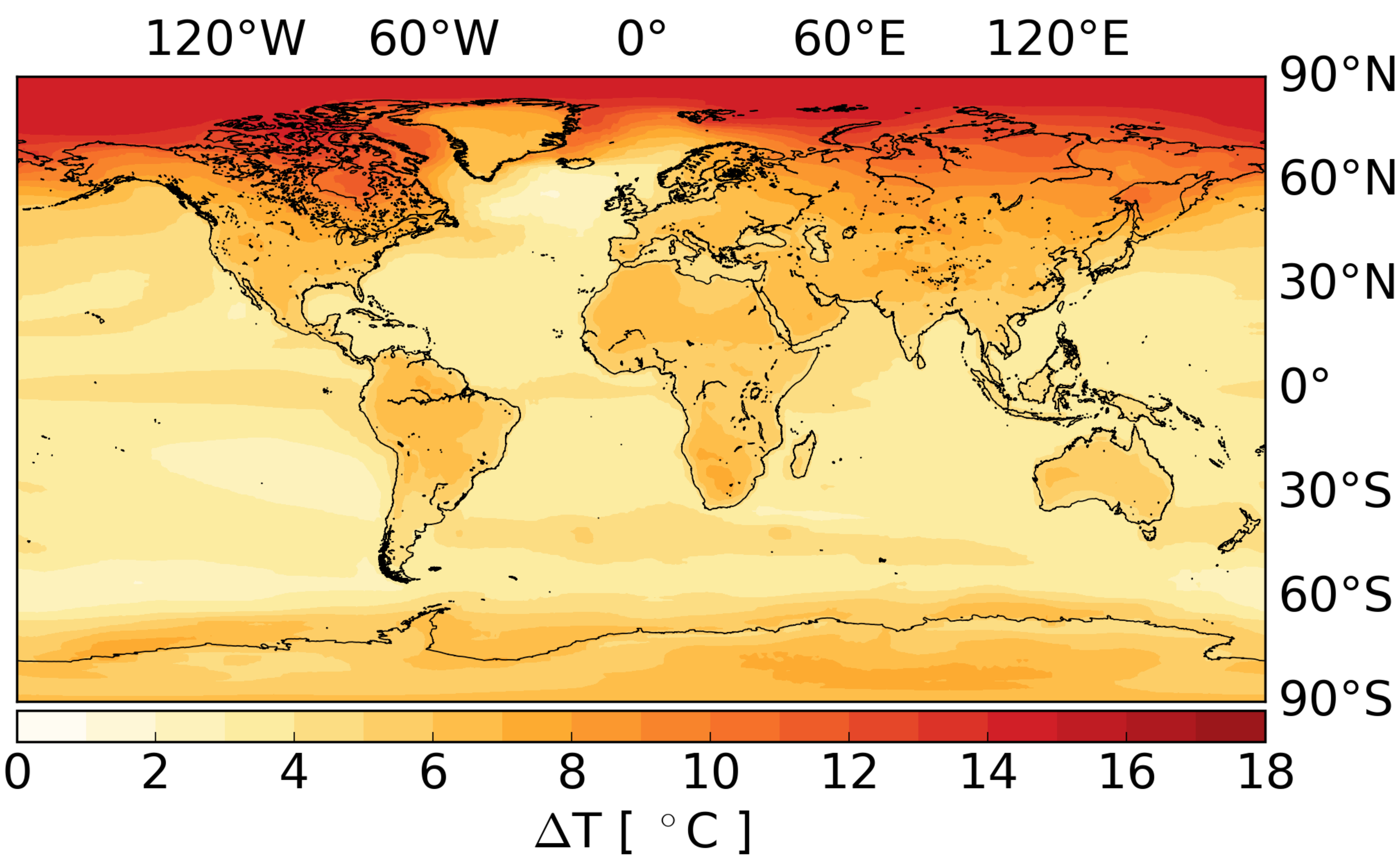

Figure 1. The ensemble-mean 2-meter air temperature change 100-years (85-115) after an abrupt quadrupling of CO_2 from 13 fully-coupled GCMs participating in CMIP5.

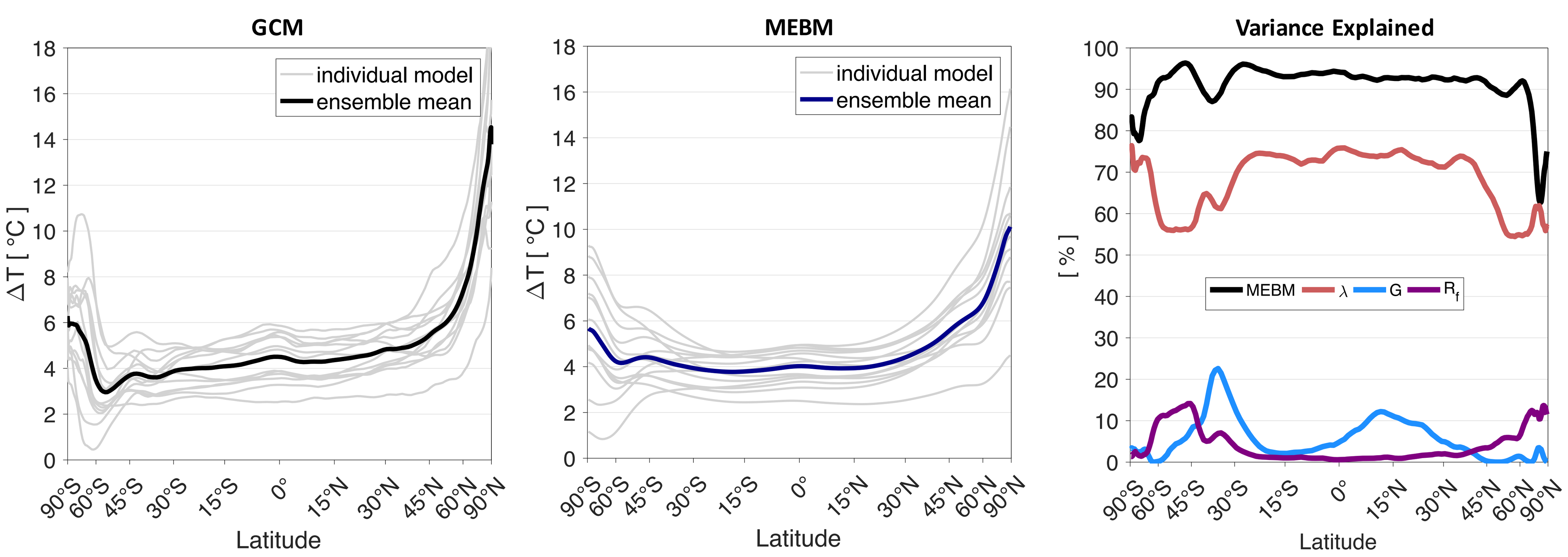

Figure 2. Zonal-mean 2-meter air temperature change from the 13 GCMs and 13 MEBM solutions and the proportion of the variance in the GCM surface temperature response that is predictable from the MEBM temperature solution as a function of latitude.

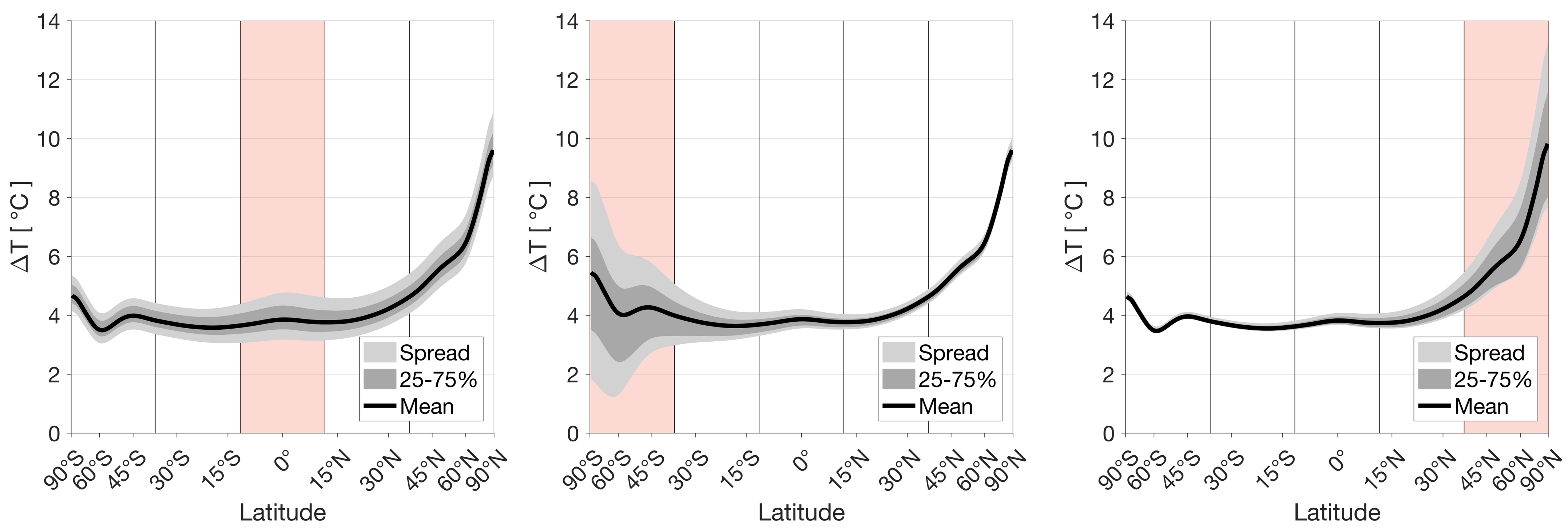

Figure 3. Warming uncertainty that results from climate feedback uncertainty applied in the red shaded region.

Comprehensive GCMs diverge in their projections of future climate change, particularly at regional scales. Most studies have focused on uncertainty in the degree of warming at equilibrium. While this is important for inter-model comparison, the policy relevance of a single number is limited, given that it is a measure of the global-mean, long-term climate response. Arguably, knowledge of the spatial pattern and evolution of climate change is of greater societal consequence.

Here, we use an energy balance model to explain the spread in warming patterns predicted by GCMs (Fig. 1). Figure 3 shows that while uncertainty in *Arctic warming* is due to both local and nonlocal feedback uncertainty, uncertainty in *Arctic amplification* is mainly due to local feedback uncertainty.

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