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Internal Variability in European Summer Temperatures

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The last two decades of European summers were marked by an increasing likelihood of extreme events, such as heatwaves, associated with high temperatures and dryness in the central and eastern parts of Europe [1, 2]. This tendency has largely been attributed to the anthropogenic increase of greenhouse gas emissions, and is expected to be accentuated as emissions continue. However, the European summer climate is highly influenced by internal variability. To characterize how temperatures, and such extreme events, will evolve in the future, it is crucial to consider the effect of internal variability consistently, as well as the underlying processes contributing to this variability. Using the MPI-ESM large ensemble, we evaluate the amplitude of the internal variability signal in European summer temperatures in current and future climate, as well as the evolution of the variability itself, under different emission scenarios. We find that monthly mean summer temperature anomalies observed over Europe during recent decades are well within the internal variability range simulated by MPI-ESM, and that the amplitude of the internal variability signal, of about 4°C, is roughly twice as large as the shift in the mean state caused by the forced response to increasing greenhouse concentrations.

References

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