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The diurnal cycle of outgoing radiation: A global perspective

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The reflected solar radiation and emitted thermal radiation at the top of the atmosphere, referred to collectively as Earth Outgoing Radiation (EOR), exhibit strong diurnal signatures. These diurnal signatures, resulting from a periodic forcing cycle as the Earth rotates, are directly linked to the evolution of weather and climate processes. Correct representation of these diurnal processes is essential for a complete understanding of energy flows through the Earth system, yet directly capturing diurnal variability in EOR at a global scale has proved challenging from current satellite observations.

We seek to gain insight into the processes that control the diurnal variability in EOR using global output at high temporal resolution from the Met Office numerical weather prediction model. We begin by presenting dominant patterns of diurnal variability in EOR, extracted via a principal component analysis. Next, we discuss the physical controls on these dominant patterns, such as surface heating, convective cloud development and marine stratocumulus cloud dissipation, and their relative importance. This will include examining the extent of coupling between the dominant EOR patterns and the diurnal variability in other relevant geophysical variables. Finally, we point out the significance of diurnal lag times that exist between EOR and the other variables, and assess the robustness of these results in geostationary satellite observations.