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Thermodynamic work done in a WTG-coupled two column model diagnosed using energy cycles.

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Supra-domain parametrisations such as the Weak-Temperature Gradient (WTG) provide a representation of the large-scale circulation in studies of convection using coupled-column models.

We extend an approach to analyzing the thermodynamic work throughput of an overturning convective system in terms of thermodynamic cycles (identifying separately mechanical work contributions and the cost of maintaining a humid atmosphere) proposed in Pauluis (2016) and for the first time demonstrate how this can be applied to the case of two convecting columns, coupled by the WTG approximation and identify the energetic contribution of the large scale circulation.

Model results show that even though the large-scale circulation is weak, it plays a significant role in the global energetic balance of the system. We find that it is largely independent of the strength of the coupling, which has potentially profound consequences. On the other hand, the relative importance of the lifting of moisture and total buoyancy work does depend on the coupling.