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ITCZ dynamics as seen by complex network theory

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The intertropical convergence zone (ITCZ) is an important component of the tropical rain belt. Climate models still struggle to represent the ITCZ and differ substantially in its simulated response to climate change. Here, we study to what extent complex network theory, which can effectively extract spatio-temporal variability patterns from climate data, helps to understand the dynamics of the ITCZ and model differences therein. For this purpose, we study simulations with 14 global climate models in an idealized aquaplanet setup performed within the TRAC-MIP model intercomparison project.

We construct network representations based on the spatial correlation pattern of surface temperature and perform a detailed study of the zonal mean patterns of different topological and spatial network characteristics. This allows us to identify clusters of climate models which differ not only in their current climate state dynamics but also in their response to climate change. Specifically, we address possible mechanisms controlling the seasonal change of the location of the ITCZ, and we connect our results to previous work on ITCZ controls by cross-equatorial heat transport and tropical sea-surface temperature gradients.