

CLICCS A2 - Clouds and Tropical Circulation

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The tropics are the engine of the atmospheric general circulation, and their response to warming helps set Earth's climate sensitivity. Recently it has become appreciated that shallow circulations in the lower troposphere are crucial for linking fluxes of energy – at the surface and through the atmosphere – and the deep overturning circulations that dictate the distribution of precipitation (Bony et al., 2015). Changes in the tropical circulation, be it long-term shifts in tropical convection, such as seen in the Sahel, or changes in the strength of the large scale Walker circulation across the Pacific (Plesca et al. 2018), have profound consequences for ecosystems and societies, not just in the tropics. A central question for the coming years will be the extent to which the tropics warm, and how the circulation systems respond to this warming. Recent work has highlighted the role of radiative effects (often, but not always, from clouds) in mediating processes as diverse as convective self-aggregation (Naumann et al., 2019, Naumann et al., 2017), ENSO (Rädel et al., 2016), decadal variability (Bellomo et al., 2015), and the structure of the ITCZ (e.g., Shaw and Voigt, 2015). How these drivers of circulation will change with warming, is poorly known.

The project aims to better understand the tropical heat budget, its link to circulation systems, and how these respond to warming. The understanding of the systems sensitivity will be crucial in reducing the epistemic uncertainty in this globally important region – a prerequisite for more tightly constraining global climate sensitivity and hence the range of possible and plausible climate futures. This directly contributes to answering the question of which climate futures are possible and which are plausible, the overarching research question of CLICCS.

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