Tropical Climate Responses to Variations in Turbulent Drag

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How Does the Hadley Circulation Respond to Turbulent Drag?
- Turbulent drag in the lower atmosphere may be one important source of uncertainty in our understanding of and the ability to predict changes in the Hadley circulation

Regimes Emerge with Varying Drag
- Position and strength of the Hadley circulation divide into regimes with drag – low drag, transitional drag, and high drag regimes
- Greater drag associated with more equatorward Hadley cell edge, more equatorward ITCZ location, and a stronger, merged jet stream (not shown)
- Larger drag is consistent with position predicted from Held and Hou (1980), and variation of strength with drag also qualitatively consistent with HH1980 prediction

Response Extends to Tropical Precipitation
- ITCZ location, latitudinal precipitation distribution, and how the precipitation distribution changes with warming divided into drag regimes similarly to circulation
- In general, “wet-gets-wetter” mechanism holds with warming though this is most straightforward for high drag

Departure from HH1980 Expectation
- Variation of meridional heat transport with drag is in the opposite sense to that based on expectation
- Reasons remain unclear – due to lack of energetic constraints in HH80?

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