

# **Tropical Expansion: Comparison of “Upper” and “Lower” metrics.**

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There is mounting evidence that the width of the tropics has increased over the last few decades, but there are large differences in reported expansion rates. This is partially due to the wide variety of metrics that have been used to define the tropical width. In this presentation we report on a systematic investigation into the relationship among metrics of the zonal mean tropical width using pre-industrial control and abrupt quadrupling of CO<sub>2</sub> simulations from a suite of coupled climate models. It is shown that “lower atmosphere” metrics based on the mean meridional stream function or near surface winds are correlated with each other and have similar responses to quadrupling of CO<sub>2</sub>, but there is little correlation between these metrics and “upper atmospheric” metrics based on subtropical upper tropospheric winds or tropopause pressure. However, the subtropical jet and tropopause metrics are generally correlated with each other, and are measuring similar aspects of the circulation, which are uncorrelated with Hadley cell expansion or contraction. Simple dynamical balances are used to explain the decoupling of the upper and lower metrics, and differing sensitivities to tropospheric and stratospheric changes.

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