



## **Co-variability of the subtropical Jet, the lower stratospheric circulation and tracer distributions**

Hella Garny

DLR, Institute for Atmospheric Physics, Oberpfaffenhofen-Wessling, Germany (hella.garny@dlr.de)

The width of the tropics has been estimated by a variety of metrics in the past. Recently, it was found that the metrics can be divided into two categories: the so-called “lower” and “upper” tropospheric metrics, corresponding to the region of their definition (Waugh et al, 2018). The upper metrics include the position of the subtropical jet (STJ), the lower metrics the position of the eddy-driven jet (EDJ). It is shown here that the strength of the subtropical jet co-varies with the “lower” metrics (i.e. the position of the EDJ), based on correlations of seasonal mean ERA-Interim data. The position and strength of the subtropical jet are thus two (nearly orthogonal) modes of variability of the tropospheric circulation. The co-variability of the lower stratospheric circulation with those two modes is investigated using linear regression. It is found that the strength of the meridional circulation in the lower stratosphere ( 70 hPa) co-varies with the strength of the STJ rather than with its position, thus with the so-called “lower metrics” of the tropical width. The circulation anomalies are reflected in tracer distributions, shown here for both passive tracers (Age of Air) as well as ozone, based on data from the Chemistry-climate model EMAC. The tracer anomalies can be used to define metrics for the two modes of variability based on the height of a tracer isoline in the lowermost stratosphere: The maximal strength of the gradient of the isoline height correlates to the STJ strength, while the position of this maximal gradient correlates to the position of the STJ. Those relations might prove useful to obtain metrics of the circulation modes that can be derived from observable trace gas concentrations.

Waugh, D.W., K.M. Grise, W.J. Seviour, S.M. Davis, N. Davis, O. Adam, S. Son, I.R. Simpson, P.W. Staten, A.C. Maycock, C.C. Ummenhofer, T. Birner, and A. Ming, 2018: Revisiting the Relationship among Metrics of Tropical Expansion. *J. Climate*, 31, 7565–7581