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A novel method for upper tropospheric jet stream detection

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There are several methods to detect upper tropospheric jet streams. These schemes are often based on a threshold-criterion for the wind speed, while others utilise gradients in vorticity or the refractive index for Rossby waves. Most of these schemes diagnose an area or volume, which is identified as the jet stream. For some applications, however, it is of higher value to identify the actual axis of the jet stream. For example, cyclonic and anticyclonic Rossby wave breaking occurs preferentially on the cyclonically and anticyclonically sheared side of the jet stream, respectively, where the jet axis marks the transition between the two types of shear. Furthermore, the definition of an axis allows for the analysis of relative distance between collocated jet streams, allowing for an assessment of potential interaction.

We propose a new method to detect jet axes based on deformation and the relative angle of the axis of dilatation. The detection performs equally well for instantaneous data as well as for monthly or even longer time averages of the wind field. We present climatologies of jet axis positions and pinpoint new insights revealed by our method. Furthermore, we present composites for different phases of common climate indices such as the NAO and PNA. We also present jet axis composites for different phases of the MJO supporting earlier findings and highlighting the interaction of the MJO with the Pacific jet stream.