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Climatology and variability of jets in the upper troposphere

Clemens Spensberger and Thomas Spengler
University of Bergen, Geophysical Institute and Bjerknes Centre, Bergen, Norway (clemens.spensberger@uib.no)

Jets in the upper troposphere constitute a cornerstone of both synoptic meteorology and climate dynamics, thus providing a direct link between weather and mid-latitude climate variability. Conventionally, jet variability is mostly inferred indirectly through the variability of geopotential or sea-level pressure. Here we use a feature-based jet detection and present a global climatology of upper tropospheric jets as well as their variability for ocean sectors in both Hemispheres. The jet streams on both hemispheres are found to spiral poleward, featuring a continuous transition from subtropical to eddy-driven jets. Most intrinsic patterns of jet variability represent a changeover from a meridional shifting type variability to a pulsing-type variability, or vice-versa, across each ocean basin.

For the Southern Hemisphere, we find considerable discrepancies between geopotential and jet-based variability. Specifically, we show that SAM cannot be interpreted in terms of mid-latitude variability, as SAM merely modulates the most poleward part of the cyclone tracks and only marginally influences the distribution of other weather-related features of the storm track (e.g., position of jet axes and Rossby wave breaking). Instead, SAM emerges as the leading pattern of geopotential variability due to strong correlations of sea-level pressure around the Antarctic continent. Considering sector-specific variability pattern, we identify modes of consistent geopotential and jet variability in the South Pacific, and, to a lesser extent, the South Indian Ocean. In the South Pacific the leading mode of variability points towards NAO-like variability.