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Comparing Sudden Stratospheric Warming Definitions in Reanalysis Data

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Sudden Stratospheric Warmings (SSWs) are the main source of variability in the northern hemisphere polar stratosphere during winter. They are characterized by a dramatic warming of the polar stratosphere and weakening of the polar vortex circulation. SSWs can have an impact on surface weather, which makes them a potential tool for seasonal prediction. However, there is no consensus on the definition of SSWs, and multiple methods exist in the literature, yielding discrepancies on the detected events. In this presentation we compare the SSWs signatures of eight representative definitions for the 1958-2009 period and using three different reanalysis data (ERA, NCEP and JRA).

The monthly distribution of SSWs is indistinguishable across definitions, with a common peak in January. However, the multi-decadal variability is method-dependent, with only three definitions displaying minimum frequencies in the 1990s. Comparison of several SSW benchmarks reveals negligible differences among methods due to the large case-to-case variability of events within a given definition. In the troposphere, the most robust signals across definitions before and after events are dominated by major SSWs, which are detected by most methods. Interestingly, minor SSWs represent the largest source of discrepancy in the surface signals of SSWs across definitions. Therefore, our results indicate that only major SSWs should be considered in future studies if robust tropospheric signals of SSWs want to be obtained regardless of the chosen method.