

El Niño Southern Oscillation influence on the Asian summer monsoon anticyclone

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We analyze the influence of the El Niño Southern Oscillation (ENSO) on the atmospheric circulation and the mean ozone distribution in the tropical and sub-tropical UTLS region. In particular, we focus on the impact of ENSO on the onset of the Asian summer monsoon (ASM) anticyclone. Using the Multivariate ENSO Index, we define climatologies (composites) of atmospheric circulation and composition in the months following El Niño and La Niña (boreal) winters and investigate how ENSO-related flow anomalies propagate into spring and summer. To quantify differences in the divergent and non-divergent part of the flow, the velocity potential (VP) and the stream function (SF) respectively, are calculated from the ERA-Interim reanalysis around the tropical tropopause (potential temperature level $\theta=380$ K). While VP quantifies the well-known ENSO anomalies of the Walker circulation, SF can be used to study the impact of ENSO on the formation of the ASM anticyclone which turns out to be slightly weaker after El Niño than after La Niña winters. In addition, stratospheric intrusions around the eastern flank of the anticyclone into the Tropical Tropopause Layer (TTL) are weaker in the months after strong El Niño events due to more zonally symmetric subtropical jets than after La Niña winters. By using satellite (MLS), in-situ (SHADOZ) observations and model simulations (CLaMS) of ozone, we discuss ENSO-induced differences around the tropical tropopause. Ozone composites show more zonally symmetric features with less in-mixed ozone from the stratosphere into the TTL during and after strong El Niño events and even during the formation of the ASM anticyclone. The difference between El Niño and La Niña composites becomes statistically insignificant in late summer.

Key words: ENSO, Asian summer monsoon anticyclone, UTLS, stratosphere-troposphere exchange