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Stratosphere-Troposphere Exchange during PICO3 campain

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Stratosphere-Troposphere Exchange (STE) is still poorly understood and remain an important problem in dynamical atmospheric science. In particular, subtropical latitudes are not as well documented as mid-latitudes. PICO3 (Pic of ozone) campain responds to a better understanding of STE in that region. PICO3 is an airborne campain which occured during October 16 and 21 2000, over Canary Island. It provides in-situ measurements of ozone and dynamic fields, and three flights document two stratospheric filaments linked to a Rossby Wave Breaking (RWB) over mid-latitude. To consider the synoptic situation associated to their formation, global scale analyses from ECMWF are used. Also, to obtain a better description of these evolving structures, we performed two mesoscale simulations with or without chemistry, with the Meso-NH non-hydrostatic model. These simulations activate in particular Lagrangian tracers, to recover air parcels in a back or forward way. Lagrangian technique is also used on ECMWF analyses with the Lagrangian Analyses Tool (LAGRANTO) to apply the Reverse Domain Filling (RDF) technique and reconstruct high resolution PV field.

This study highlights and documents several STE structures which are: a tropopause fold at mid-latitudes, a filamentation over Canary Island of a trough linked to a RWB, the deformation of the cyclonic-shear side of the subtropical jet consecutive to the RWB and finally, the juxtaposition of these two stratospheric filaments. Furthermore, this study seems to show that these structures contribute significatively in STE budget, with in particular an important impact on tropospheric chemistry : discussing the reversibility of the STE events, we find that each stratospheric structure is associated to deep transport from stratosphere to troposphere air masses, with on majority a long residence time into troposphere.