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Stratosphere-troposphere exchange processes driven by the subtropical jet

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The upper troposphere-lower stratosphere (UTLS) plays a role in the global climatic system through transport and mixing of chemical radiatively-sensitive species processes which at present are understudied. Subtropical UTLS presents a more complex temperature vertical structure than mid-latitude regions due to the seasonal drifting with latitude of the Subtropical jet (STJ) inducing fast changes in the vertical distribution of ozone and other chemical species. The main objective of this work is to assess how the dynamical processes associated to the STJ control the exchange of ozone in the UTLS. A set of 865 ECC-type ozonesonde profiles performed in the period November 1992 - December 2006 at the Tenerife station (28º 17' N, 16º 29'W, 36 m.a.s.l.) have been analyzed. ECMWF ERA reanalysis are routinely performed to study the dynamics of the STJ. Three case-studies are analyzed when the subtropical jet is located to the south, above, and to the north of the Canary Islands, respectively, showing detailed STE dynamical processes associated to a "non-disturbed" STJ in a complex UTLS characterized by a double tropopause structure. The core of the STJ is normally observed just at the first tropopause (mid-altitude tropopause) altitude (12 km a.s.l.). As results of the jet's rotation an indirect circulation is observed around the jet which produces downward flow north of the jet and upward flow south of the jet. A climatological analysis of the ozonesonde profiles shows sharp ozone changes into the UTLS associated to the overpass of the subtropical jet over the station in March-April. In wintertime and early spring an ozone-poor poleward flow above the subtropical jet,

and within the inter-tropopause region, is observed suggesting a transport of equatorial air to mid-latitudes modulated by the STJ. In spring, when the subtropical jet is located above or to the north of the Canary Islands, some ozone-rich tongues are frequently observed in individual profiles just below the mid-latitude tropopause as result of stratosphere-to-troposphere transport.