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Evidences for vertical transport connected to cirrus clouds formation in the tropical UTLS, observed with stratospheric aircraft "Geophysica"

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Water vapor and ozone serve in the UTLS as reliable tracers to indicate dynamic processes at those altitudes, especially in the tropical region. In this study we present observations obtained during two flights of the high altitude aircraft M-55 “Geophysica” during the tropical campaign in SCOUT-O3, respectively on 12 and 30 November 2005. The complex and balanced research payload of this aircraft allows to monitor a number of constituencies. The flight on 12 November was the transfer from Brunei to Darwin, while the flight on 30 November took place from Darwin over the area of Hector formation. Both flights took place after the formation of deep convection in regions and during the time of cirrus formation.

During the flights, in-situ water vapor and ozone were measured by the instruments FLASH-B (based on fluorescent method, realized in CAO) and FOZAN (based on chemi-luminescent method, realized in CAO). Backscatter depolarization lidar MAL (Miniature Aerosol Lidar, realized in Observatory of Neuchâtel) is used to measure the spatial and altitude distribution of the backscatter and depolarization ratios of cirrus clouds below the aircraft. Fast measurements of the pressure and the temperature are performed by TDC (Rosemount sensor, customized in CAO).

In this study horizontal lags of the flights are analyzed. The flight altitude on 12 November was around the tropopause. The aircraft flew above a cirrus deck, where MAL observed a number of vertically ongoing cloud features, departing from the

deck and reaching the flight altitude. During the flight on 30 November one horizontal lag of flight was above the tropopause and below the hydropause, at an altitude of 16700 m. Sharp positive altitudinal gradient of ozone concentration and negative gradient of water vapor are observed. MAL shows a cirrus cloud in the process of formation, demonstrating a number of detached structures. Over a distance of 500 km we observed a correlation between the detached cloud parcels and the variations in the ozone and water vapor concentrations, as well as in the potential temperature. This correlation indicates to vertical transport taking place in the volume where the formation of the cirrus clouds takes place: the upward movement coincides with the volumes where the cirrus is formed, respectively the downward movement takes place over the cloud-free volumes. The details of the observed cloud structure, ozone, water vapor and potential temperature variations are considered and discussed.

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