

使用剖風儀分析梅雨季期間台灣北部及東沙島上空的 低層噴流特徵

Characteristics of Low Level Jets over Northern Taiwan and Dongsha island in Mei-Yu Season revealed by Wind Profiler Observation

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摘 要

使用499 MHz的剖風儀資料，來研究2018~2020年梅雨期間(5/16~6/15)低層噴流(low-level jet, LLJ)在北台灣與東沙島的特徵。以垂直結構來看，北台灣LLJ的發生頻率有明顯的峰值，出現在500-1000 m，其平均風速為17 m/s。另外，也發現400 m以上的LLJ主要是吹西南風；而400m以下的LLJ大多是吹東北風，這與梅雨鋒面通過台灣有關。從晝夜結構看，夜間底層北台灣發生LLJ頻率較高，是與白天太陽的加熱、夜間近地表輻射冷卻、西海岸的氣壓差有關。從東沙島LLJ垂直分布，可以看到底層有兩個明顯的峰值，分別位在600 m和900 m的位置，其平均風速為15 m/s，並且大多吹盛行季風所引起的西南風。分析底層兩個峰值的晝夜變化，上層峰值最大發生頻率在中午和午夜，其日夜變化與綜觀氣壓梯度及非地轉風的大小及方向有關；而下層峰值最大發生頻率在傍晚，與綜觀氣壓梯度及日落後形成的穩定邊界層有關。

定義LLJ日為一天中發生LLJ的小時數超過6小時的日子。北台灣LLJ日，底層風速極值出現於台灣西北側。北台灣位於鋒面系統前緣且水氣傳輸主要來自700~900 hPa的中國華南地區水氣。東沙島LLJ日，底層風速極值出現於台灣東南側及南海。鋒面系統位於台灣上空且水氣傳輸主要來自700~1000 hPa的南海暖濕水氣。定義邊界層噴流(boundary layer jet, BLJ)為LLJ發生在1000 m以下者，而與綜觀天氣系統有關的低層噴流(synoptic system-related low-level jet, SLLJ)為LLJ發生在1000 m以上者。北台灣當下發生強BLJ事件，台灣平均時雨量極值發生於新竹至台中的西北沿海和南部山區；而北台灣當下發生強SLLJ事件，台灣平均時雨量極值發生於桃園至新竹的西北沿海。東沙島當下發生強BLJ事件，台灣平均時雨量極值發生於苗栗的西北沿海至山區和西南沿海至山區；東沙島當下發生強SLLJ事件，台灣則沒有明顯的降水。

關鍵字：低層噴流

Abstract

The 499 MHz wind profiler is used to study the characteristics of the low-level jet (LLJ) over northern Taiwan and Dongsha island during the mei-yu season (5/16~6/15) of 2018~2020. On the vertical structure, the LLJ frequency over northern Taiwan has an apparent peak, appearing at 500-1000 m, and the average wind speed is 17 m/s. In addition, the LLJ above 400m is mainly southwesterly wind caused by the prevailing monsoon. The LLJ below 400m is mostly northerly winds, which are caused by the mei-yu front passing through Taiwan. From the diurnal structure, the LLJ frequency over northern Taiwan is higher at night because of the sun heating the surface during the daytime, radiation cooling the surface at night, the air pressure difference on the west coast. On the vertical structure, the LLJ frequency over Dongsha island has two peaks, which appear at 600 m and 900 m respectively, and the average wind speed is 15 m/s. The LLJ is mainly southwesterly wind caused by the prevailing monsoon. During the study period, the LLJ frequency is 21 %. According to the two peaks appearing in the vertical structure, analyze its diurnal structure. The upper peak of LLJ frequency maximum appears at noon and midnight, and the diurnal variation is related to the sub-synoptic scale pressure gradient and the size and direction of the ageostrophic wind. The bottom peak of LLJ

frequency maximum appears in the evening, which is related to the sub-synoptic scale pressure gradient and the stable boundary layer formed just after sunset.

The LLJ day is defined as LLJ that occurs more than 6 hours in a day. On the northern Taiwan LLJ day, the bottom wind speed extreme appears on the northwest side of Taiwan, and Taiwan locates at the front edge of the frontal system. In addition, the water vapor transmission mainly comes from the water vapor in South China of 700~900 hPa. On the LLJ day of Dongsha Island, the extreme bottom wind speed appears on the southeast side of Taiwan and the South China Sea, and the frontal system locates over Taiwan. In addition, water vapor transmission mainly comes from the warm and humid water vapor in the South China Sea at 700-1000 hPa. The boundary layer jet (BLJ) is defined as LLJ occurs below 1000 m, and the synoptic system-related low-level jet (SLLJ) is defined as LLJ occurs above 1000 m. When the strong BLJ events occurred in northern Taiwan, the average hourly extreme rainfall happened in the southern mountains and the northwest coast from Hsinchu to Taichung. When the strong SLLJ events occurred in northern Taiwan, the average hourly extreme rainfall happened on the northwest coast from Taoyuan to Hsinchu. When the strong BLJ events occurred on Dongsha island, the average hourly extreme rainfall happened on the southwest coast to the mountains and the northwest coast of Miaoli to the mountains. When the strong SLLJ events occurred on Dongsha island, there was no significant precipitation in Taiwan.

Key words: low-level jet (LLJ)