

WINDSHEAR AND TURBULENCE 風切變及湍流

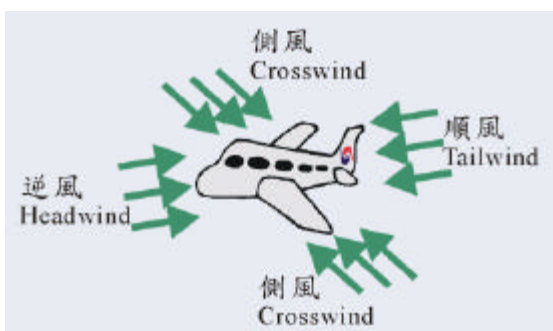
The Hong Kong Observatory (HKO) operates a windshear and turbulence alerting service for aircraft using the Hong Kong International Airport at Chek Lap Kok (CLK).

香港天文台為使用赤鱘角香港國際機場的航機提供風切變和湍流預警服務。

What are 'headwind', 'tailwind' and 'crosswind'? 甚麼是逆風、順風和側風?

Headwind is wind blowing towards the aircraft. Because headwind increases the lift, pilots prefer to land and take off in headwind.

逆風是迎面吹來的風。由於逆風會增加浮力，機師一般喜歡在逆風情況下起飛或降落。



Tailwind is wind blowing from behind the aircraft. It reduces the lift and aircraft generally avoid taking off or landing in tailwind. Other than this, tailwind is preferred by aircraft in flight because it causes the aircraft to go faster, saving time and fuel.

順風是從後面吹來的風。由於順風會減低浮力，故此飛機通常會避免在順風情況下起飛或降落。航行中的飛機則喜歡順風飛行，因為會飛得更快，可節省時間及燃料。

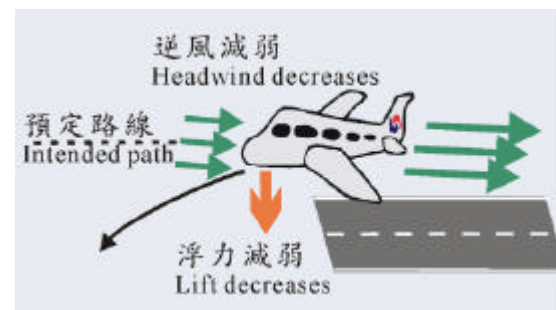
Crosswind is wind blowing from the side of aircraft. Large changes in crosswind during landing might cause an aircraft to deviate from the runway centreline.

側風是從側面吹來的風。飛機降落時如遇到側風劇變，或會偏離跑道中線。

What are 'windshear' and 'turbulence'? 甚麼是風切變和湍流?

Windshear refers to a change in headwind or tailwind sustained for more than a few seconds, resulting in changes in the lift to the aircraft. A decreased lift will cause the aircraft to go below the intended flight path. In the presence of significant windshear, a pilot has to take corrective action to ensure safety.

風切變是指逆風或順風出現持續多於幾秒的轉變而引致浮力產生變化。浮力減少可導致飛機向下偏離，低於預定飛行路線。當有顯著風切變出現時，機師須作出修正行動以確保安全。



Turbulence is caused by rapid irregular motion of air. It brings about bumps or jolts. In severe cases, the aircraft might go momentarily out of control.

湍流是由大氣快速不規則的流動所引起的。它使飛機產生顛簸，嚴重時飛機可能會短暫失控。



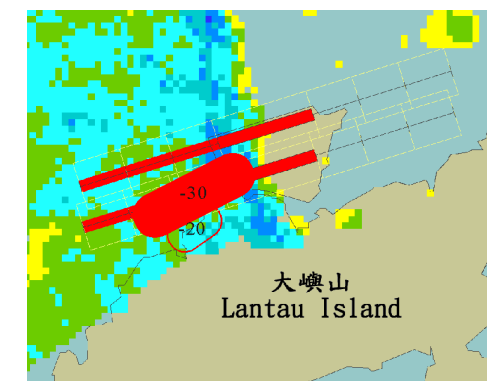
When an aircraft encounters significant windshear or turbulence, loose objects inside the cabin may dislodge and passengers not having their seat belts fastened may sustain injuries. A majority of windshear- and turbulence-related injuries worldwide are related to passengers who have not buckled up.

當飛機遇上顯著風切變或湍流時，機艙內不牢固的物件會移動，沒有扣上安全帶的乘客可能會受傷。世界各地與風切變及湍流有關的受傷事件，大部份都是由於乘客沒有扣上安全帶。

Typical weather conditions under which windshear and turbulence may occur are: tropical cyclones, thunderstorms, cold and warm fronts, and jet streams (narrow bands of strong winds). At low levels near ground, sea breezes, strong monsoon winds and strong winds climbing over hills are also known to cause windshear and turbulence.

在熱帶氣旋、雷暴、冷暖鋒及急流（空中的狹窄強風帶）等天氣情況下，都可

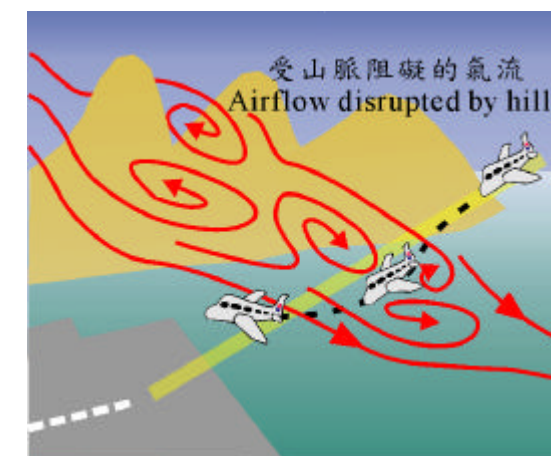
以出現風切變及湍流。此外，低空近地面如出現海風、強烈季候風、強風吹過山脈等情況，也會產生風切變及湍流。



Radar display of thunderstorm-induced windshear affecting the airport
雷達圖像顯示雷暴引起的風切變正在影響機場

Windshear and turbulence due to hills can vary rapidly with time. Some aircraft may experience them while others do not, even though the weather conditions may remain broadly similar.

由山脈引起的風切變及湍流會隨時間急速變化。雖然天氣情況大致不變，有些飛機會遇上它們，有些則不會。

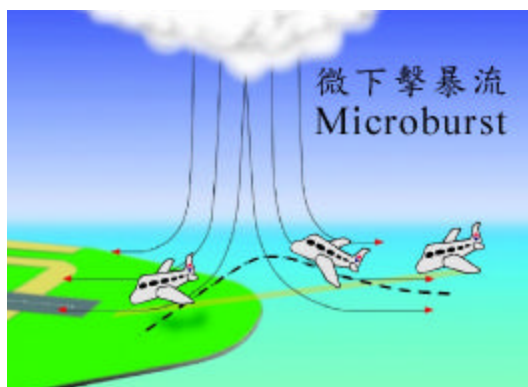


The airflow behind the hills on Lantau can sometimes be transient and disturbed
大嶼山山脈下游的氣流有時會出現瞬間的變化及擾動

What is 'microburst'? 甚麼是微下擊暴流?

Microburst refers to an intense and localized descent of cool air that spreads onto the ground, causing rapid wind changes and thus windshear. It is usually associated with thunderstorms and is hazardous to aircraft landing or taking off.

微下擊暴流是指一團強烈而局部地區性冷空氣下沉，在接近地面時散開，引起風場急速轉變而產生風切變。微下擊暴流通常與雷暴有關，會影響正在升降航班的安全。



How often are windshear and turbulence experienced at CLK? 在赤鱗角出現風切變和湍流的情況有多少?

Over the three and a half years from airport opening (July 1998) to end of 2001, 0.14% of all flights in and out of the airport reported significant windshear. Over the same time period, 0.04% of all flights reported significant turbulence.

自機場啟用（1998年7月）至2001年底的三年半內，進出機場航班總數中有0.14個百分點的飛機報告遇上顯著的風

切變。同期，有0.04個百分點的航班則報告遇上顯著的湍流。

A majority of windshear and turbulence events were reported in the spring months of March and April. Studies showed that the windshear and turbulence levels at CLK and Kai Tak are similar.

風切變及湍流事件大多在春季3、4月份時發生。研究報告顯示，赤鱗角的風切變及湍流情況與啟德大致相若。

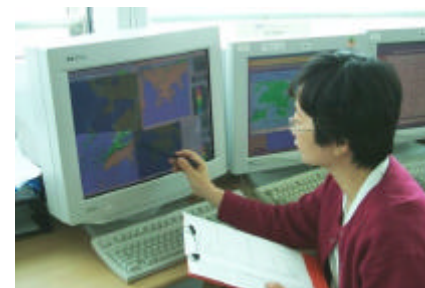
How does the HKO alert aircraft to windshear and turbulence? 香港天文台怎樣去預警航機有關風切變及湍流的出現?

The transient and sporadic nature of windshear and turbulence causes considerable difficulty to the accurate alerting of the phenomena. The HKO closely monitors the weather conditions using state-of-the-art facilities, which include a number of wind sensors in and around the airport and a Terminal Doppler Weather Radar. Based on observations made by these facilities, the HKO issues windshear and turbulence alerts for relay by air traffic control personnel to aircraft landing at and departing from the airport.



Terminal Doppler Weather Radar at Tai Lam Chung
位於大欖涌的機場多普勒天氣雷達

由於風切變及湍流有瞬間變化及偶發的特性，發出準確的預警有一定困難。天文台利用先進的儀器緊密監察天氣狀況。這些儀器包括多個安裝在機場及附近範圍的風向及風速感應器，以及一部機場多普勒天氣雷達。根據觀測所得資料，天文台透過航空交通管制人員將風切變及湍流預警發放給正在降落及起飛的航機。



A forecaster analysing weather information
預報員正分析天氣資料

PRECAUTIONARY MEASURES BY PASSENGERS 乘客應採取的防護措施

- Fasten seat-belt at all times.
任何時候均扣上安全帶。
- Make sure your hand baggage is safely stowed away.
妥善放置手提行李。
- Stay calm. Listen to the aircrew and follow their instructions.
保持冷靜，聽從機組人員的指示。



Hong Kong Observatory web site 天文台網址：
<http://www.weather.gov.hk/aviation>
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2002年1月 (January 2002)

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