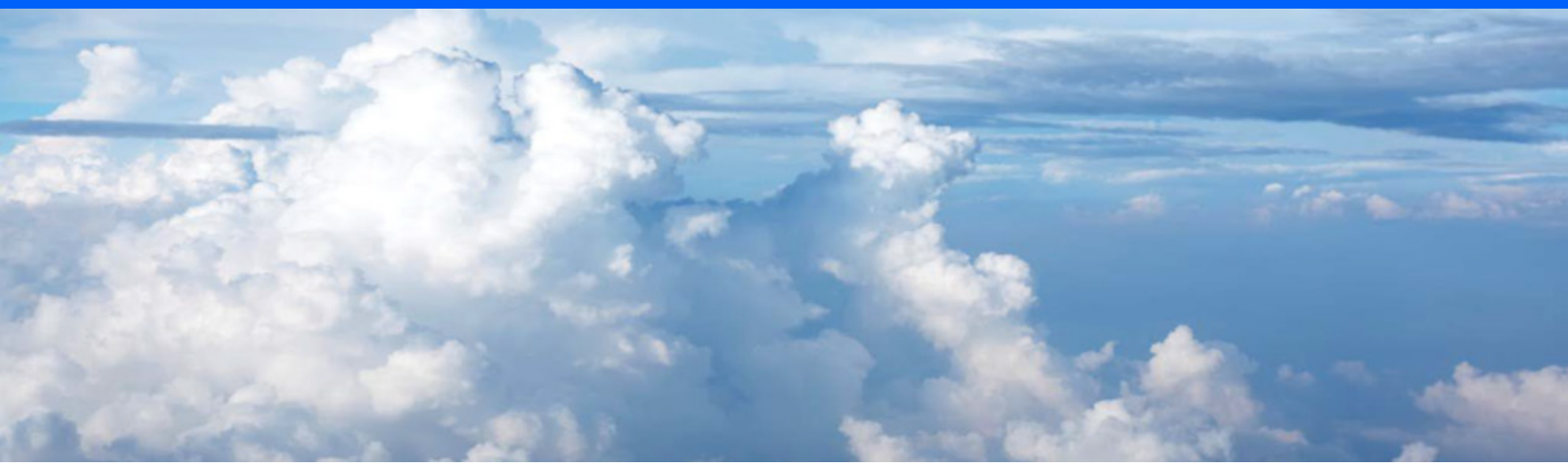
ICAO

ENVIRONMENT

Climate Adaptation Synthesis

Changing wind

Factsheet



2018

Aviation and Changing Wind

In the lower troposphere, changes in wind strength and direction are projected. In the upper troposphere, changes to the jet stream are projected.

Potential Effects

Changes to prevailing wind direction

- Changes to, or deviation from, the prevailing wind direction at airports could affect runway utilisation and schedules. It may also change the criteria for approach and departure procedures.
- Flights might be cancelled, delayed or redirected when crosswinds are too strong for aircraft to safely take off or land which could reduce airport and aircraft operating efficiency and capacity. It may also reduce arrival and departure punctuality of flights.
- Changes to procedures due to deviation from prevailing wind direction could have environmental impacts, such as changes to noise distribution and increased emissions.

Extreme storms and strong winds

- Extreme storms and strong winds can result in flight delays and cancellations, economic losses, and passenger inconvenience. It can also damage or destroy assets and infrastructure.

Changes to the jet stream

- Changes to the jet stream could impact en-route traffic. For example the most efficient routings and flight times for transatlantic flights (expected to be faster eastbound and slower westbound) might change. This may result in modification of en-route flight levels and Air Navigation Service Providers (ANSPs) and airlines will have to react to changing flow patterns and sector loading. This may impact fuel-critical operations on transatlantic and other long haul flights. There may be a knock-on effect for airports due to reduced arrival reliability.

Clear Air Turbulence

- There may be an increase in Clear Air Turbulence (CAT) leading to greater diversions and “bumpier” flights. This may affect the application of Reduced Vertical Separation Minima (RVSM), which could lead to a reduction in airspace capacity.
- It could also lead to increased injuries to passengers and crew and damage to aircraft.
- If forecasts for affected areas are accurate, aircraft might be able to avoid CAT entirely. Pilots may also relay information on un-forecasted CAT back to the ANSPs and other pilots as they experience impacts.
- As the climate changes, maintenance intervals may need to be reviewed and inspection methods revised more frequently to detect any signs of aircraft fatigue, or equivalent, particularly when assessing new, composite materials of modern aircraft.

- Changes in the jet stream can cause blocking of weather system propagation: this may result in extreme weather events, such as heavy snow, to airports, which have not been previously affected.

Adaptation and Resilience Measures

Changes to prevailing wind direction

Measures proposed or already being implemented are more limited for changes in wind conditions than for other climate change impacts. Implications of prevailing winds need to be assessed at the local level and operational measures identified to maintain safety and increase robustness and flexibility. Some sources stated more scientific research is needed as many uncertainties remain as to how winds may change.

Clear Air Turbulence

- Technologies for aircraft that can assess wind and turbulence changes in real time are being studied. Technologies under development may be able to identify Clear Air Turbulence (CAT) up to 10-15 kilometres ahead, which would give pilots enough time to alert passengers and crew, (e.g., to ensure that everyone had fastened their seatbelts, or to attempt a diversion around the area).
- As a result, there is a need to improve the accuracy of operational CAT forecasts so as to be able to avoid areas of CAT as much as possible. Increased use of Pilot Weather Reports (PIREPs - brief reports from pilots of observed in-flight weather conditions) could help provide other pilots with increased information on areas with likely Clear Air Turbulence and enable them to take preventative measures.
- Airframe design may need to be adjusted to adapt to changing turbulence beyond the features manufacturers have already built in to accommodate CAT, especially as “Many of the aircraft that will be flying in the second half of the present century are currently in the design phase”. For example, some newer aircraft are fitted with an accelerometer in their nose cones. If the accelerometer registers a sudden change in altitude, which is large enough to indicate potential turbulence, then the wing flaps are rapidly adjusted in an attempt to decrease the vertical movement and reduce the acceleration.

Sources and Additional Information:

2018 ICAO CAEP WG2 Task O7.0 Climate Adaptation Synthesis Analysis