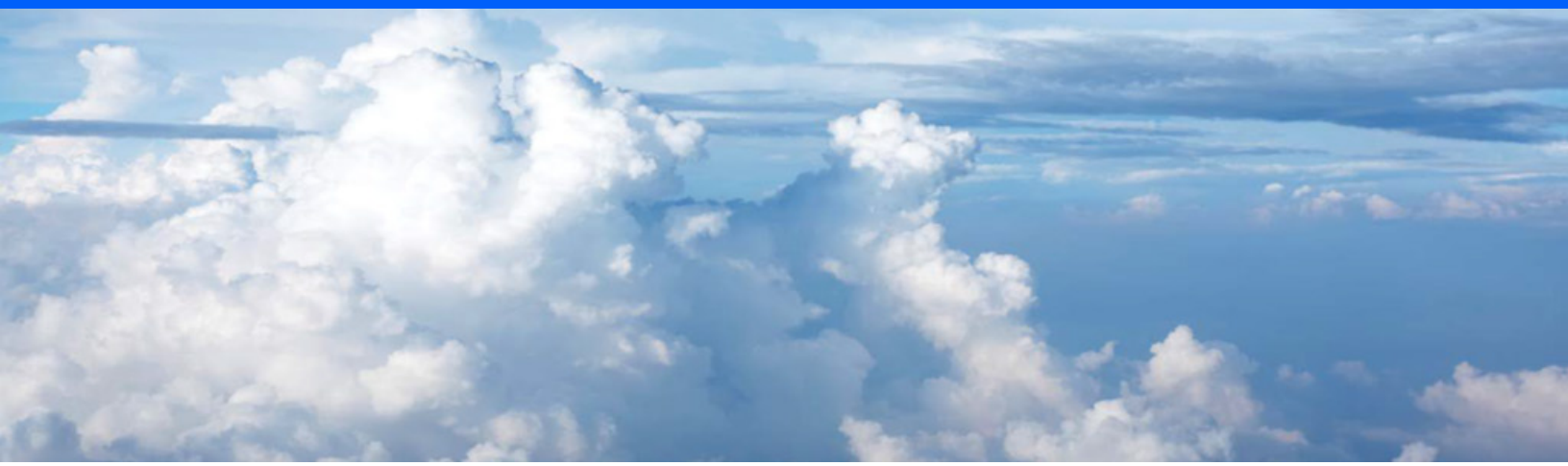
ICAO

ENVIRONMENT

Climate Adaptation Synthesis

Temperature change

Factsheet



2018

Aviation and Temperature Change

Global average annual temperatures are rising, although with regional differences to temperature change rates. More frequent occurrences and more consecutive high-heat days are projected for some regions, particularly in the summer months. However, occasional cold winter extremes will continue to occur. In some regions, increased humidity may lead to more fog in the mornings.

Potential Effects

- Decreases in air density caused by rising temperature reduces aircraft lift and the ratio of lift to weight, and can increase the required runway length to maintain normal operations or limit climb performance. This may also result in maximum take-off weight restrictions.
- High-heat days may stress existing cooling systems creating a demand for additional cooling facilities and affect employees.
- High-heat days can increase risk of fire at airport facilities.
- More extreme cold temperature days in northern climates can directly affect aviation. For example, flights can be cancelled if the temperature falls below an aircraft's certification limits. Extreme cold spells, especially for an extended period, can cause equipment underperformance, chemical reaction rates to change (melting ice and snow), increased aircraft turnaround times leading to congestion, fueling delays due to equipment freezing and issues within the terminal facilities themselves, including burst water pipes and challenges to maintain acceptable indoor temperatures.
- In northern areas, warmer temperatures may cause permafrost to thaw, destabilizing and damaging ground infrastructure, including the airfield, and contributing to erosion.
- Higher temperatures can damage the airfield surface if temperatures exceed design standards.
- Groundwater can influence permafrost thaw: the combination of higher temperatures and advective heat transfer from groundwater flow can accelerate thawing.
- Changing air temperature can alter destination travel preferences affecting demand for certain routes.
- There may be costs associated with repairing or replacing damaged or vulnerable infrastructure.

Adaptation and Resilience Measures

- In areas where higher temperatures may be a challenge for aircraft take-offs, future temperature and aircraft runway length calculations may need to be reconsidered when determining the appropriate runway length.
- Incorporate projected temperature changes in the decision-making, design and renovation of airport infrastructure.
- Harden runways, taxiways and access roads in areas affected by permafrost thaw.

- Monitor permafrost depth and land subsidence, through actual instrumentation or through remote sensing, to better understand changes to permafrost underlying runways and airport infrastructure.
- Airports located in colder climates could learn how airports in warmer climates consider and adapt to warmer temperatures while maintaining operations.
- During extreme cold events proactively deploy warming stations to protect ground support crews and develop procedures to service frozen equipment and fuel hydrants as required. Consider back-up and additional measures for heating terminal areas.
- Schedule changes to allow fog to dissipate can mitigate the effects of more frequent fog events. This could mean moving early morning departures to late morning for some locations.

Sources and Additional Information:

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