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Climate Adaptation Synthesis **Factsheets**

Aviation and **Temperature Change**

Global average and extreme 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, especially late in the night and in the mornings.

Potential Impacts

- Rising temperatures affect aircraft lift and the ratio of lift to weight, due to change in air density, the maximum available engine thrust when ambient temperature exceeds a specific threshold defined by the engine manufacturer. This may affect the required runway length to maintain normal operations or may limit climb performance
- High-heat days may stress existing cooling systems creating a demand for additional cooling facilities and have health impacts for personnel and passengers.
- High-heat days can increase the risk of fire due to the increased prevalence of conditions conducive to wildfires or ignition of aircraft fuel.
- Higher temperatures can damage the airfield surface if temperatures exceed design standards.
- In northern parts of the northern hemisphere, warmer temperatures may cause permafrost to thaw, destabilizing and damaging ground infrastructure, including the airfield, and contributing to erosion.
- 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 heat damaged or vulnerable infrastructure.
- More extreme cold temperature days in cold 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.

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Adaptation and Resilience Measures

- In areas where higher temperatures may be a challenge for aircraft take-off performance, departure times for heavier aircraft can be moved to the comparatively cooler times of day, e.g. morning or later in the evening, however this may have implications for noise disturbance. Future temperature and aircraft runway length calculations may need to be reconsidered when determining the appropriate runway length.
- Increase cooling capabilities in buildings and aircraft. Measures to promote heat health and safety for ground staff will be required.
- 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.
- 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: 2024 ICAO CAEP Climate Adaptation Synthesis Report