Climate Change Risks for European Aviation

Summary of the key findings

EUROCONTROL

Short-term weather outlook

- There are clear links between high impact weather events and disruption to the European aviation network.
- While weather events will continue to cause ATFM delays across the European aviation network, climate change is not expected to drive significant changes in the occurrence of weather patterns associated with high impact weather events in the next five years.
- Weather significant days impacting en-route traffic occur mainly during summer.
- Weather significant days impacting arrival traffic occur mainly during winter.

Storms & flight operations

- On average, storms are responsible for up to 7.5% of total en-route ATFM delays at network level, and the trend is increasing.
- Extreme rainfall days and associated convective activity (i.e. storms) are projected to increase across northern Europe and to decrease across southern Europe by 2050.
- In 2019, over 1 million km were flown as a result of avoiding a major storm. This corresponds to over 6,000t of extra fuel consumed, or over 19,000t of CO_2 produced.
- The impact of storms on Vertical Flight Efficiency varies geographically. Generally, the impact is greater during climb than descent.
- A small number of localised storms cause substantial increases in Horizontal Flight Inefficiency. Historic performance on days where storms accounted for at least 50% of all en-route ATFM delays was 3.5%, but in general it rarely worsens to more than 4%.
- The total storm-induced costs in the ECAC area, calculated on days of major storms (across the countries that incurred weather related en-route ATFM delays) was 2.2 billion EUR in 2019.
- Horizontal Flight Inefficiency could potentially rise from 3.5% today on days when major storms occur, to 4.0%-4.2% in 2050. An increase of 0.5% corresponds to the emission of an additional 5,700t of CO_2 per year.
- The average en-route ATFM delay for a flight delayed by a major storm is currently around 17-18 minutes. This is forecast to increase to 21-22 minutes per flight by 2050. The additional distance flown per flight would also increase, from 8.6km to 10.0-10.6km.

Sea level rise & airport operations

- Storm surges will still represent the main driver of marine inundation along most European coasts in the 21st century.
- Two thirds of coastal and low-lying airports are forecast to be at risk of some level of runway flooding by 2090 under both lower intermediate and worst case emissions scenarios. Countries around the North Sea are forecast to be particularly affected.
- The number of airports at risk from severe/full flooding will increase by 15% by 2090 under the lower intermediate emissions scenario and by 21% by 2090 under the worst case scenario.
- A one-day closure of an airport due to full or partial/severe flooding, could potentially impact 1% (medium airports) and 2-3% (large airports) of all air traffic movements per day in the ECAC area.
- A total of 91% of the airports identified to be at risk of flooding in the future are small airports. These airports play a key role in transportation for local communities or have an important role for the military, tourism or the General Aviation community.
- Unplanned loss of airport capacity due to sea level rise can pose a significant threat to the efficiency and delay performance of the entire European Air Traffic Management system.

Tourism

- The increase in Tourism Climatic Index in the summer months in the North-West ECAC area suggests this destination will become increasingly attractive for general tourism by 2050.
- The decrease in Tourism Climatic Index in the summer months in the South-East and South-West ECAC areas by 2050 is not significant enough to imply a decrease in the attractiveness of these destinations for general tourism.
- The proportion of summer tourists that are flexible to travel in the months shouldering the summer season ('shoulder months') is set to increase by 2050 – there could be 50% more passengers aged 65 and older.
- Longer periods of optimal index values in the 'shoulder months', coupled with the rising level of tourist flexibility regarding travel dates, indicate potential for a widening summer traffic peak by 2050.

Upper winds & flight operations

- Flight durations are likely to decrease in both directions during summer and winter on transatlantic flights, as well as between Europe and Asia, except in winter from Asia to Europe where there is unlikely to be any change.
- The overall impact of changing wind patterns on flight duration is expected to be small when considering the impact on a single flight.
- Flight durations are likely to decrease in both directions during summer and winter between North Europe and the Canaries, except in winter when flight durations from North Europe to the Canaries could increase.
- The reduction in flight times as a result of projected changes in high-altitude winds is likely to bring annual savings of more than 55,000t of aviation fuel and almost 175,000t of CO_2 on the traffic flows analysed.