Supporting European Aviation

EUROCONTROL

Climate Change and the Role of Air Traffic Control

Adapting European ATM to a Changing Climate

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FOUNDING MEMBER SESAR JOINT UNDERTAKING

NETWORK MANAGER

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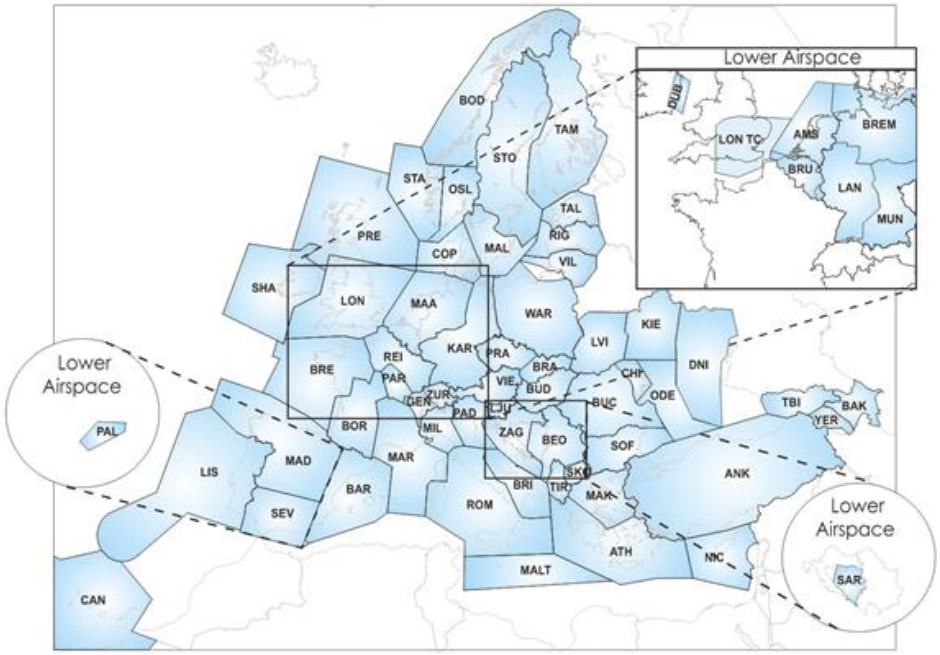
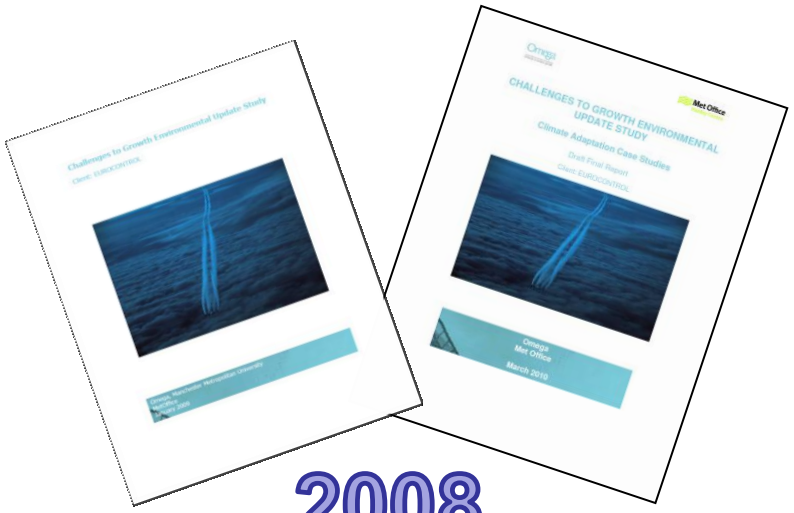
ICAO: The contracting States recognise that every State has complete and exclusive sovereignty over the airspace above its territory.



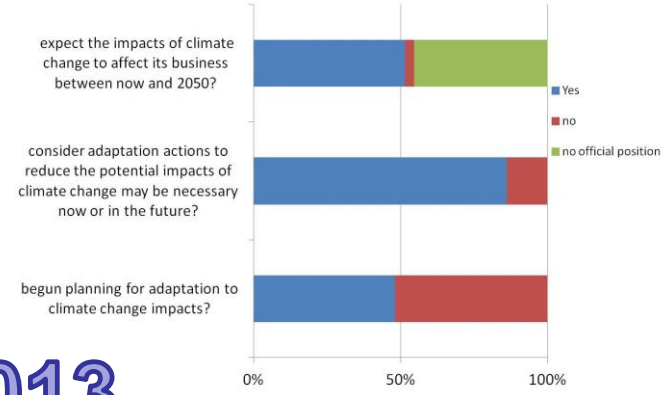
EUROCONTROL

- 41 Member States, typically each with its own ANSP
- Approximately 64 Area Control Centres (ACC)
- Over 700 sectors when at full capacity
- Approx. 17,000 Air Traffic Controllers
- 14.2 million flight hours controlled

EUROCONTROL's work on climate change risk and adaptation



2008



2013

2014

2018

Climate Change Risks for European Aviation 2021

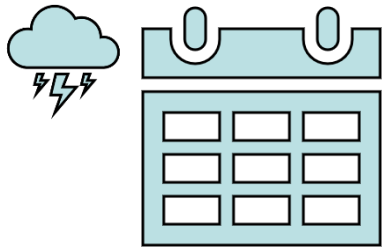
- An overview of short-term weather impacts on European aviation
- Impact of changes in storm patterns and intensity on flight operations
- Impact of sea level rise on European airport capacity
- Impact of climate change on tourism demand
- Impact of changes in wind patterns on flight operations

https://www.eurocontrol.int/publication/eurocontrol-study-climate-change-risks-european-aviation

IMPACT OF CHANGES IN STORM PATTERNS AND INTENSITY ON FLIGHT OPERATIONS

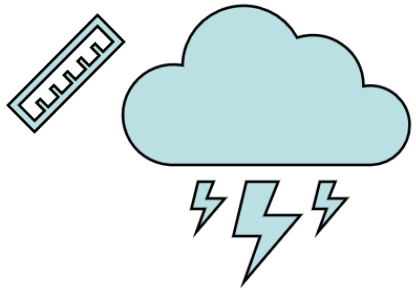
DISCLAIMER

Inputs to the assessment of storm patterns and intensity



Significant Weather Day (SWD)

days on which significant ATFM delay was experienced



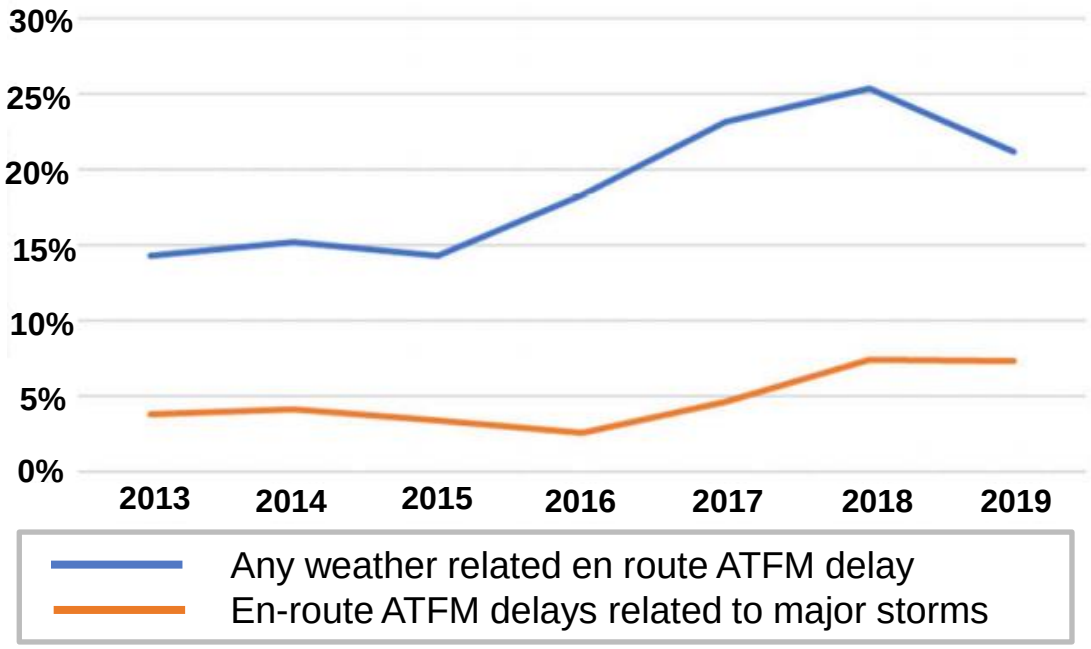
Convective available potential energy (CAPE)

A proxy for storm intensity

Storm frequency is increasing and has a clear effect on en-route ATFM delay

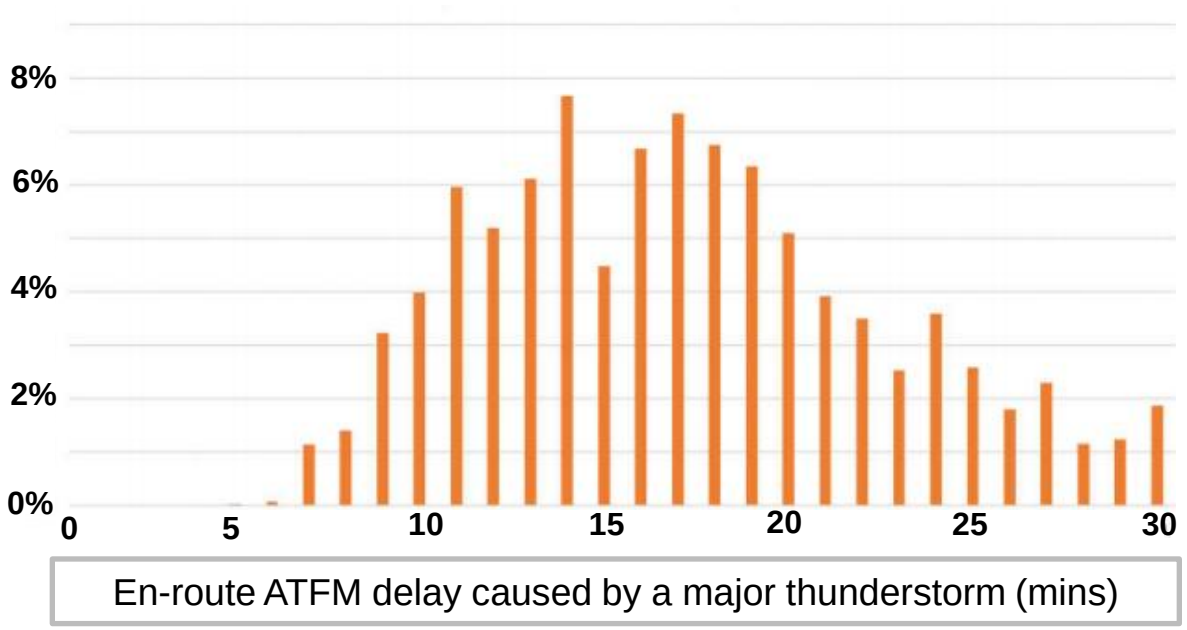
% of total en-route ATFM delay per year

EUROCONTROL area



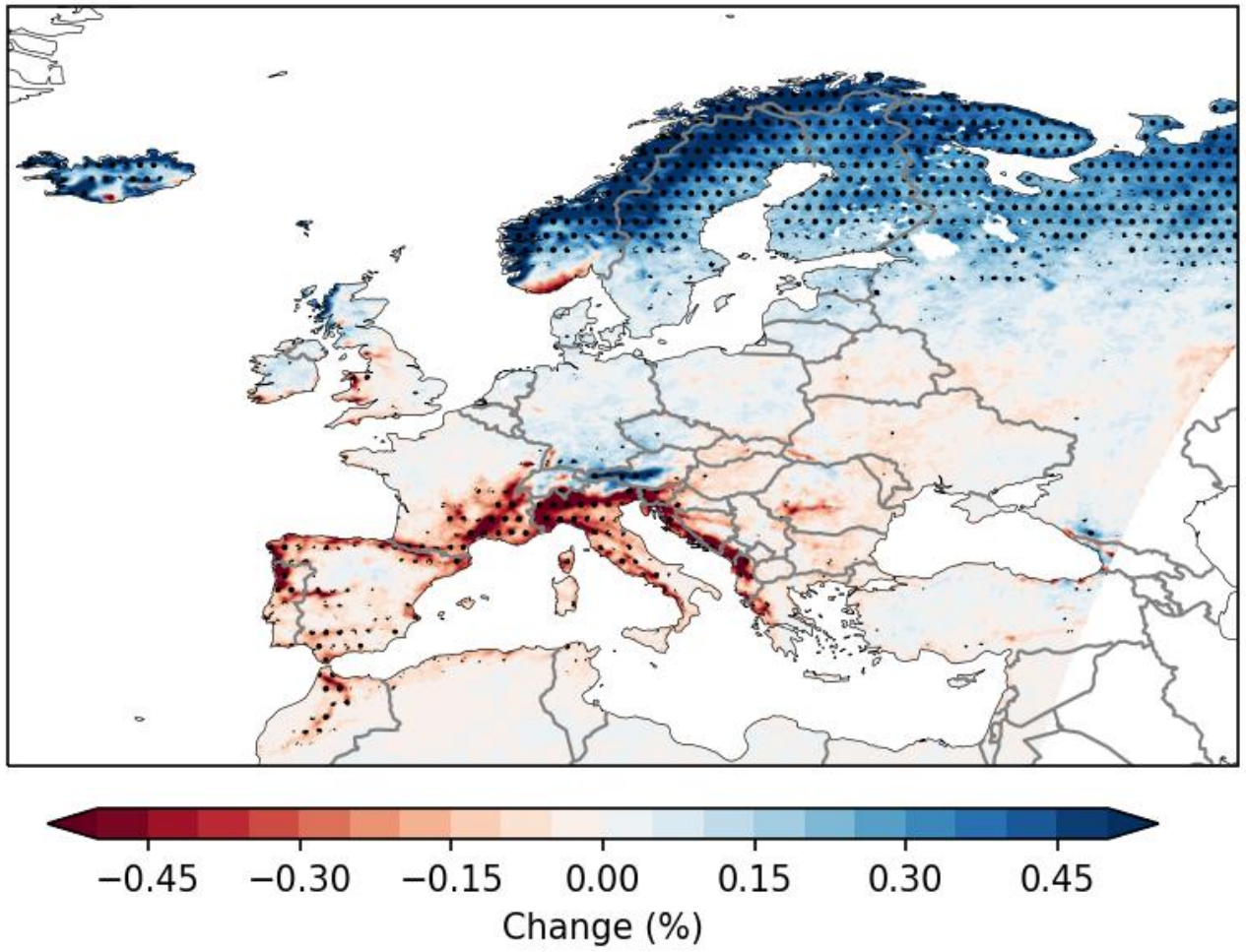
% of flights delayed by a major thunderstorm

EUROCONTROL area (2013-2019)



- On average, **storms are responsible for up to 7.5% of total en-route ATFM delays** at network level, and the **trend is increasing**.
- If a flight is affected by a storm, then the average en-route ATFM delay due to that storm can be expected to be at around **17-18 minutes per delayed flight**.

Changes in future storm patterns



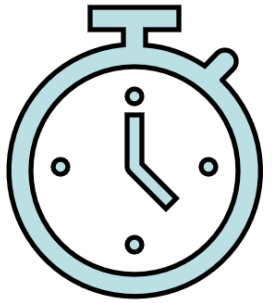
Source: EUROCONTROL Climate Change Risks for European Aviation 2021 Annex 2

The percentage change in the number of days exceeding 26.2 mm of rainfall in summer (taken as April-September) for 2036-2065, relative to 1981-2010, for the RCM-PPE ensemble in the RCP8.5 emissions scenario. Black dots indicate where a robust change is simulated and the ensemble range (taking the second lowest and second highest projected changes from the ensemble to indicate the range) does not span zero change. Regional Climate Model – Perturbed Physics Ensemble (RCM-PPE)

Whilst the frequency of major storms associated with SWD is forecast to drop by 2050, the intensity of storms that do affect flights will lead to more significant delay

-8% to -12%

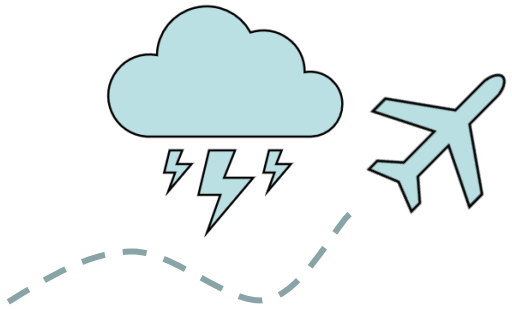
Forecast drop in share of all flights likely to be delayed by a major storm (*if there was no change in the aviation system in 2050)*



20 to 22 minutes

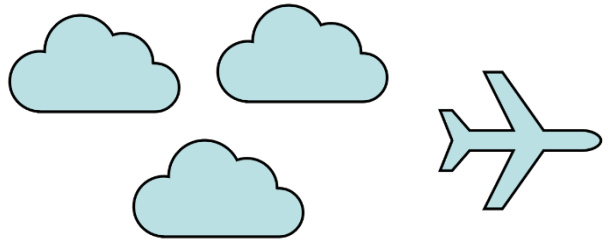
Forecast average en-route ATFM delay due to weather per flight delayed by a major storm in 2050

Projected changes in storm activity suggest a notable increase in Horizontal Flight Inefficiency on days of major storms by 2050



4.0 to 4.2%

Forecast horizontal flight inefficiency by 2050 for days where major storms account for at least 50% delay

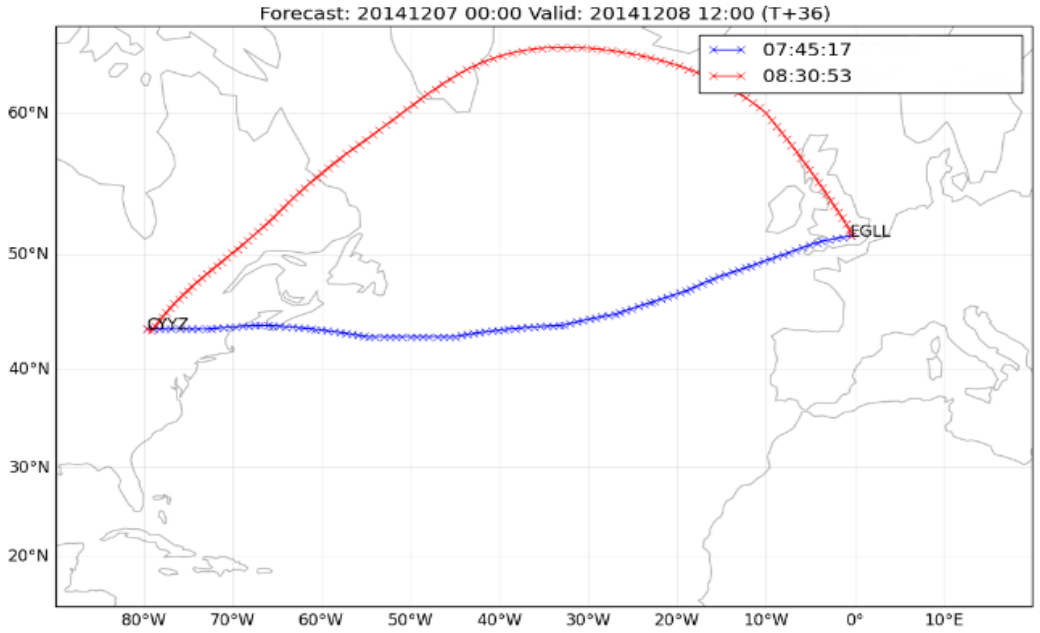


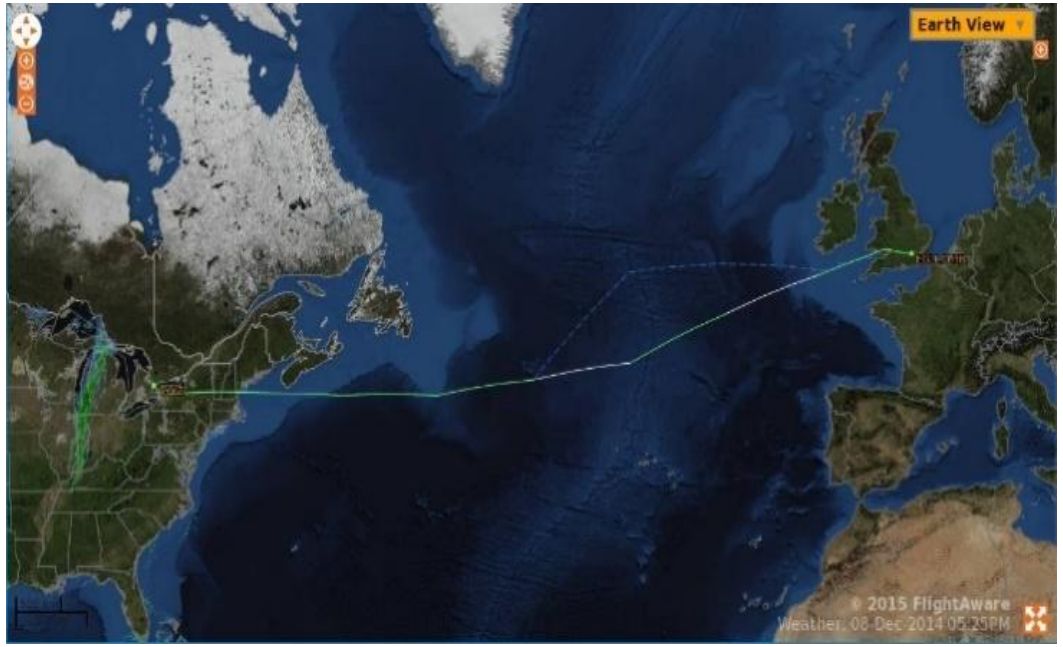
5.7 million kg CO_2

Forecast additional emissions per year due to 0.5% deterioration in horizontal flight inefficiency

IMPACT OF CHANGES IN WIND PATTERNS ON FLIGHT OPERATIONS

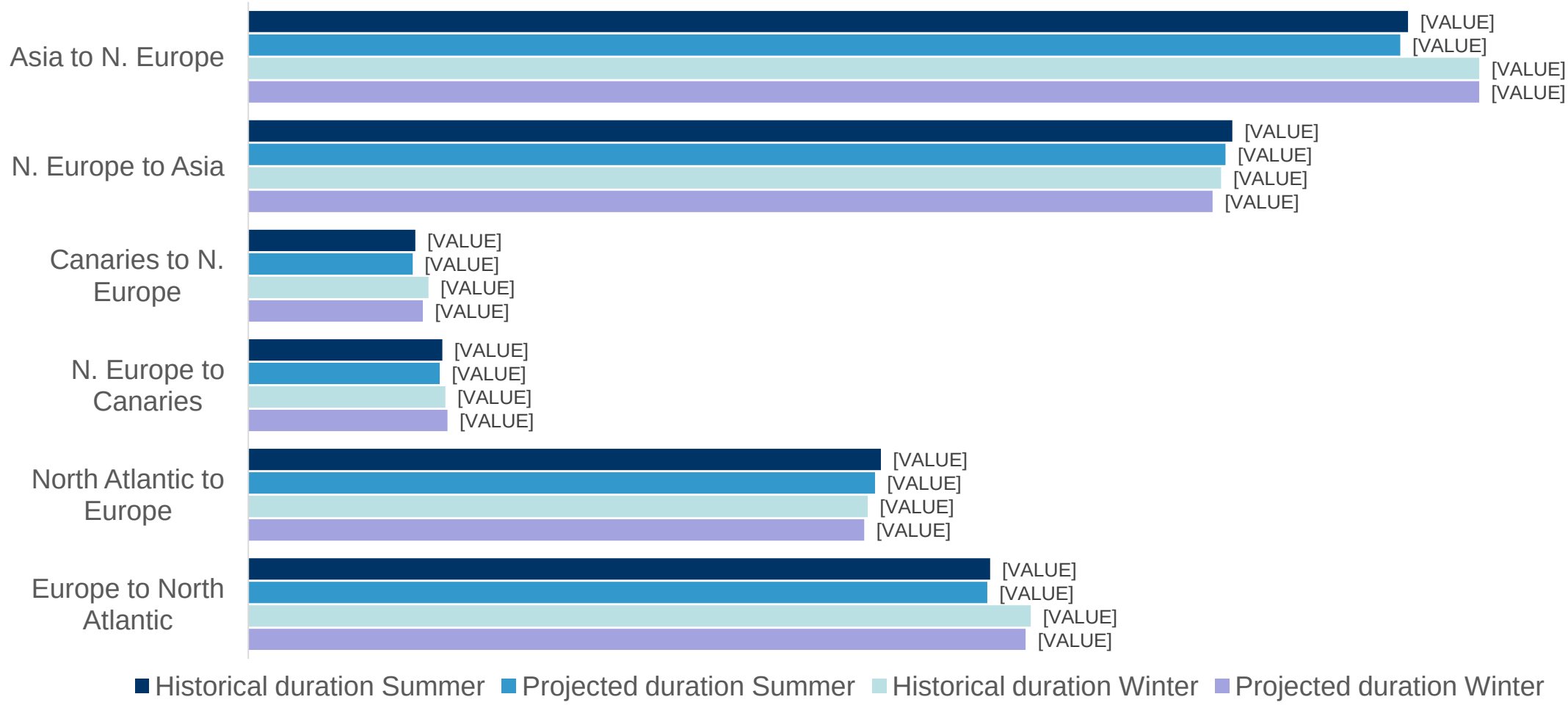
Methodology: Trajectory Prediction Algorithm





Case study highlighting the difference in time-optimal routes predicted by the traditional method (red) and node-based TP technique (blue). Data shown is for a EGLL to CYYZ flight on 8th December 2014. The actual flight path flown (adapted from FlightAware) is shown on the right with a duration of 7 hours 51 minutes.

Overall flight durations will be shorter for both eastbound and westbound transatlantic flights by 2050



*Average flight duration**

** Where apparent contradictions to the existing literature exist - this is due to more recent TP algorithm and climate models being used in present analysis, including multi-model.*

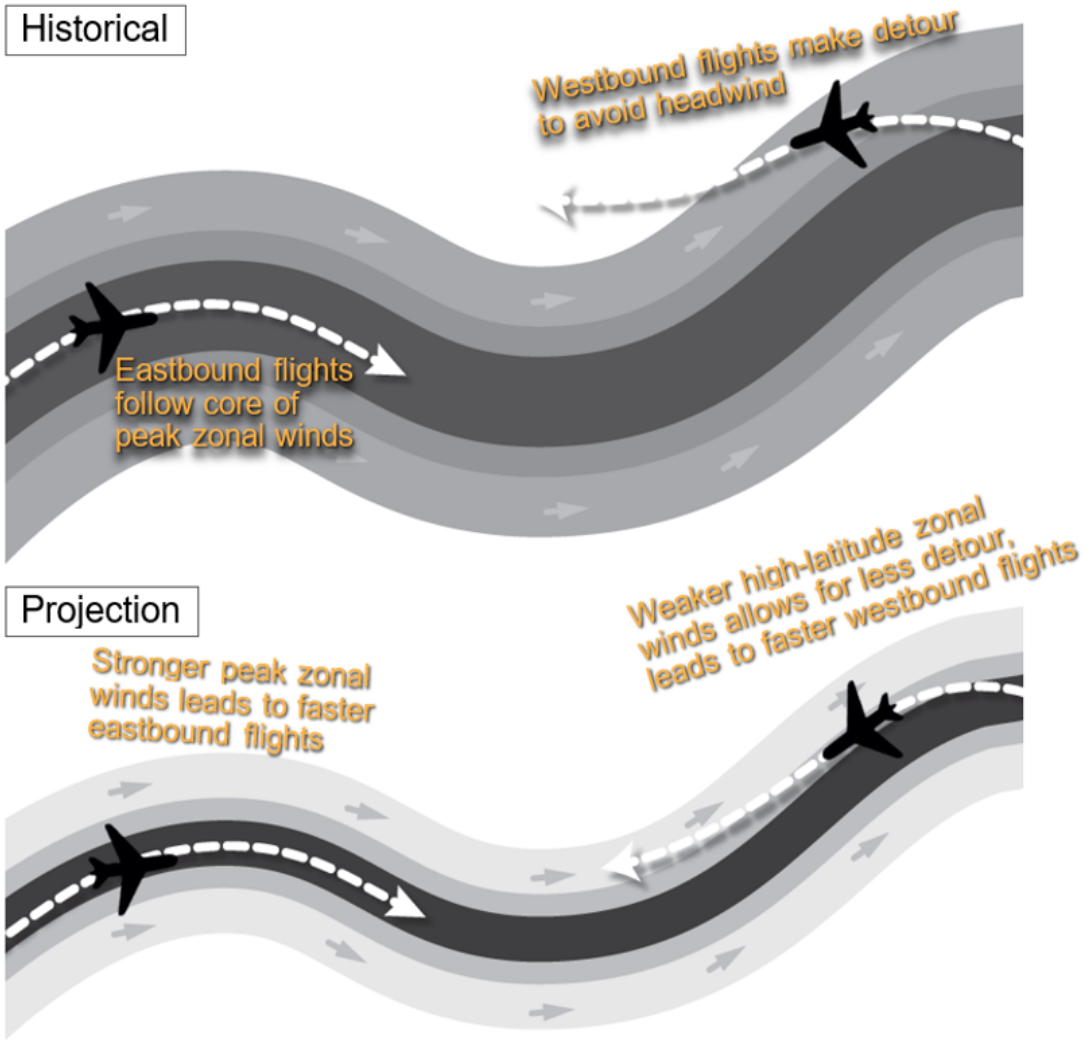


Figure 19: Graphical illustration of how eastbound and westbound flights between EGLL and KJFK change in response to climate in winter (DJF). Shaded regions indicate relative strength of zonal winds with darker colours representing higher wind speeds. This is necessarily a highly simplified view, and the real response will be more nuanced than this.

Winter (DJF)

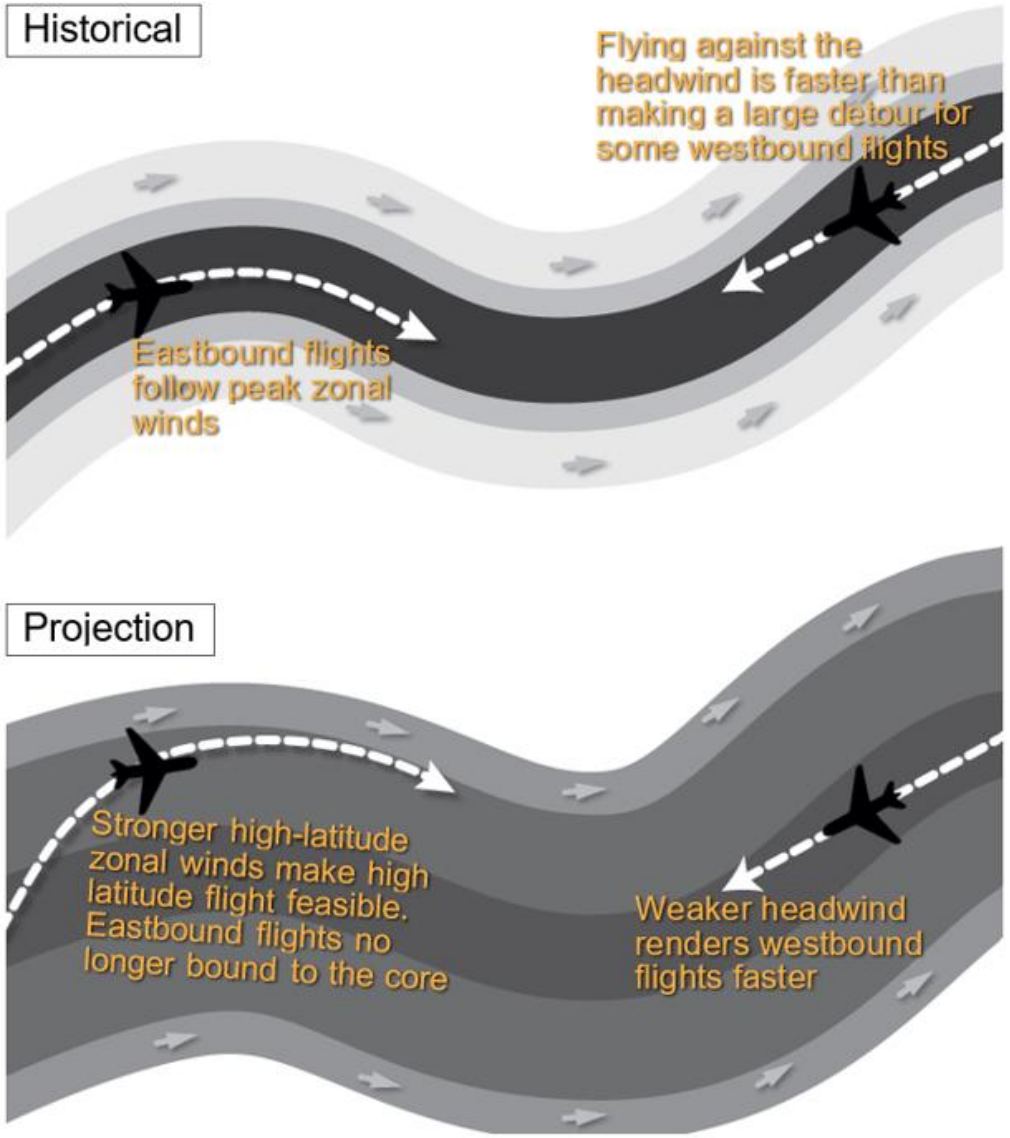


Figure 20: Same as Figure 19 but for summer (JJA). (Note the jet stream is weaker in summer months than winter months, as quantified in Figure 13).

Summer (JJA)

Combined estimated future operational impacts are substantial

Fuel and CO_2 saved (1,000 tonnes)	Current traffic levels		Expected 2050 traffic levels (+47%)		Expected 2050 traffic levels (+65%)	
	Fuel burn	CO_2	Fuel burn	CO_2	Fuel burn	CO_2
Europe → North Atlantic	9	28	13	42	15	47
North Atlantic → Europe	12	38	18	56	20	63
North Europe → Asia	23	72	33	105	37	118
Asia → North Europe	10	32	15	47	17	53
North Europe → Canaries	<1	<1	<1	<1	<1	<1
Canaries → North Europe	1	5	2	7	2	8
TOTAL	**56**	**175**	**82**	**257**	**92**	**288**

Although the **average impact** of changing wind patterns on a single flight may **look negligible**, the **combined impact** which takes into account all flights operating on the traffic flows considered in this study is **considerably more substantial**.

ADAPTING TO A CHANGING CLIMATE

Adapting to a changing climate: coordination and collaboration are key

Individual Action

- States and aviation sector organisations to carry out climate change risk assessment so as to identify and understand the impacts that need to be addressed.
- Identify appropriate adaptation responses: individual organisations taking their own adaptation planning decisions based on their specific circumstances and business plans.

Coordinated Action for an Interconnected Network

- Due to the interconnectedness of the European and global aviation systems, an integrated approach to building resilience is required.
- European aviation sector totake a coordinated and collaborative approach to identify risks and minimise the impacts for all.
- Start taking action now to ensure that our response is both timely and in proportion to the threat.

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Thank you for your attention

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