

ADAPTING AVIATION TO A CHANGING CLIMATE

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We know that the climate is changing and that we should expect impacts such as higher temperatures, sea-level rise and greater weather extremes. This will require all sectors of society to take action to adapt and develop resilience to such impacts, including the aviation sector. But what will be the specific risks for our sector? And how can we assess and take action to address them?

The general climate change impacts which we can expect are reasonably well-established, although they will vary according to climate zone, and there remains less certainty as to how they will evolve at the local scale. This translates into a range of potential risks for aviation, which will also vary according to geographical location and type of operations. Several papers and reports have already set-out in detail the key impacts which aviation may experience from a changing climate (see article page 205).

In general (see **Figure 1**), we can expect impacts such as changes in precipitation temperature and wind patterns, increased frequency of storms, and sea-level rise and storm surges, not to mention less obvious impacts such as increased clear air turbulence and changing wildlife migration patterns. This translates into a range of potential impacts for aviation operations and infrastructure such as temporary or permanent flooding of infrastructure, changes to aircraft performance or reroutings to avoid weather systems (**Figure 1**), some of which, may actually increase aviation's environmental impact.

At the same time, as climate impacts are expected to become more severe, traffic is growing, with some regions expecting to see up significant growth in coming years. This is an issue, not just because the impacts of disruptive events such as convective weather or heavy precipitation can be exacerbated when capacity is constrained, but because disruption in one part of the global network can have a knock-on effect for the network as a whole. Therefore, it is essential to make sure that locations which may experience both high growth in demand and significant impacts from climate change have the information they need to identify and address those effects.

However, this is an emerging issue, which we are still working to understand, and up until now there has been limited information available. Therefore in 2014, EUROCONTROL worked in collaboration with a group of 7 air transport organisations ACI EUROPE, AENA, London Heathrow, Avinor, DGAC/STAC, NATS, and Manchester Metropolitan University, and in consultation with IATA, to develop some awareness material on adapting aviation

Climate risk	Impact	Actors
 Precipitation change	<ul style="list-style-type: none"> ■ disruption to operations e.g. airfield flooding, ground subsidence ■ reduction in airport throughput ■ inadequate drainage system capacity ■ inundation of underground infrastructure (e.g. electrical) ■ inundation of ground transport access (passengers and staff) ■ loss of local utilities provision (e.g. power). 	
 Temperature change	<ul style="list-style-type: none"> ■ changes in aircraft performance ■ changes in noise impact due to changes in aircraft performance ■ heat damage to airport surface (runway, taxiway) ■ increased heating and cooling requirements ■ increased pressure on local utilities e.g. water and power (for cooling). 	
 Sea-level rise	<ul style="list-style-type: none"> ■ loss of airport capacity ■ impacts on en-route capacity due to lack of ground capacity ■ loss of airport infrastructure ■ loss of ground transport access 	
 Wind changes	<ul style="list-style-type: none"> ■ convective weather: disruption to operations ■ convective weather: route extensions ■ jet stream: potential increase in en-route turbulence ■ local wind patterns: potential disruption to operations and changes to distribution of noise impact 	
 Extreme events ²	<ul style="list-style-type: none"> ■ disruption to operations, route extensions ■ disruption to ground transport access ■ disruption to supply of utilities 	

Figure 1. Overview of some key climate risks for aviation

to a changing climate. The outcome was a factsheet, which can be downloaded from www.eurocontrol.int/resilience.

The factsheet starts with an overview of some of the key climate impacts for aviation (Figure 1). Although this is by no means an exhaustive list, it is an introduction to the types of impacts organizations might need to consider. It then provides a checklist of questions for beginning to assess whether your organization is vulnerable to the impacts of climate change. Again, this is not an in-depth guide for carrying out a risk assessment – there is more detailed information out there on that - but it is a starting point for thinking about a climate change risk assessment. The factsheet also provides a set of case studies from organizations who are already taking action to adapt to climate change and gives examples of what they are doing and how they are doing it. Finally, it provides a list of resources where you can get further information on both risks and impacts and more detailed advice on how to carry out a climate change risk assessment.

One of the key objectives of the factsheet is not only to raise awareness of possible risks but also to highlight the potential need to carry out an assessment of potential vulnerability to climate change impacts. This will be considered below.

Climate Change Risk Assessment: What to Ask?

If an organization wants to decide whether and to what extent adaptation actions may be required, undertaking a review of

possible climate vulnerabilities is a good place to start.

The Adapting Aviation to a Changing Climate factsheet identifies an initial set of high-level questions to ask when considering an airport climate change risk assessment (Figure 2). The purpose of these initial questions is to help an organization decide whether it has sufficient reason to warrant a full assessment.

The first key question to ask is how the climate will change in the local area. Understanding this is fundamental as it highlights the key areas where adaptation actions may be required. Following this, it needs to be identified who within the organization would have responsibility for adaptation action – and this could be more than one person or department. Climate impacts could affect operations, safety and infrastructure therefore it is important to make sure all of the necessary people are involved.

When it comes to initiating an actual climate impact assessment, organizations may already have risk assessment methodologies in place or national guidelines could be available. Alternatively, airports could use or adapt an existing methodology developed for climate change impact assessment by another airport. At least four proven examples are currently available from the Airport Cooperative Research Programme, London Heathrow, the French Directorate General of Civil Aviation (DGAC) and Avinor, the Norwegian airport operator and ANSP.

Finally, once an assessment is initiated, it is important to keep in mind that not only the climate vulnerability of the infrastructure but

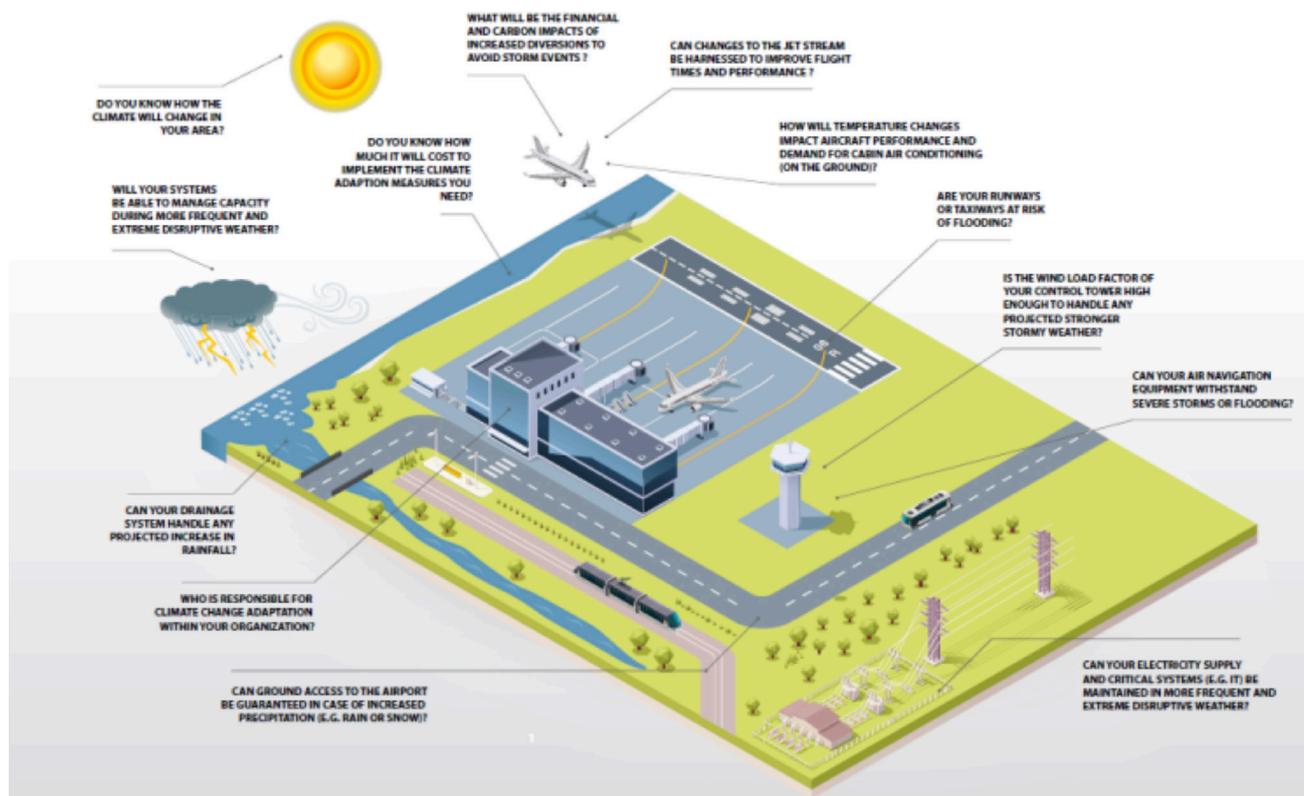


Figure 2. Climate change risk assessment: initial questions to ask

also potential operational and business risks should be assessed, and that not all impacts (e.g. ground transport access or utility supply) may be entirely within the control of the airport itself.

Key priorities for building aviation climate resilience

In September 2015 EUROCONTROL and Manchester Metropolitan University organized a workshop on Adapting Aviation to a Changing Climate. The 30 participants, representing industry, regulators and academia, identified four key priorities for action to develop climate change resilience for the European, and global, aviation sector (Figure 3).



Figure 3. Key priorities for building aviation climate resilience

Priority 1: Understanding the problem

- Review and frame the challenge from a holistic sectoral perspective: identifying the key potential impacts for each stakeholder and the network as a whole.
- Identify what knowledge of those impacts already exists and where are the knowledge gaps: identify research priorities.

Priority 2: Assessing the problem

- Develop a generic impact matrix from a common baseline e.g. a 3°C temperature rise and Xm of sea-level rise: challenging but essential to ensure that adaptation actions are coordinated and effective.
- Use compatible risk assessment methodologies to facilitate the development of harmonized local and network resilience measures.

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Priority 3: Actions to Adapt

- Identifying operational measures and infrastructure measures to build resilience to increased disruption and changing baseline conditions.
- Identify win-win and no-regrets measures (e.g. measures that address other issues but that also promote resilience).
- Be aware of trade-offs, especially where environmental improvements may introduce vulnerabilities.

Priority 4: Communicate and collaborate

- Communicate and collaborate, regionally and globally.
- Collaboration and coordinate knowledge and research from other regions and sectors.
- Raise awareness and disseminate best practices.

So, what is next?

We now have a reasonable qualitative understanding of the implications of climate change for the aviation sector and the high-level actions which we need to take to address them. However, uncertainties remain and so far little work has been done to quantify what climate change implies from an operational perspective.

Moreover, we need to remember that we are a diverse and global sector, yet a vulnerability in one part of the network can impact the network as a whole. Therefore we not only need to identify and address our individual needs, but to work together as a global sector, particularly through ICAO to learn from each other, collaborate and communicate, and build partnerships for action.

The global aviation sector is making significant efforts to reduce its contribution to climate change by increasing its operational efficiency. Let's not jeopardise the benefits of those operational improvements by not being able to deal with future climate conditions.