

Climate Change Risk Assessment, Vulnerabilities, and Adaptation Measures

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Introduction

Despite efforts and advancements in science and technology to reduce greenhouse gas emissions, some impacts of climate change are unavoidable. Higher temperatures are already contributing to more frequent storms, and sea level rise has caused unprecedented storm-surge impacts. The aviation community is not immune to these impacts. As part of the process to begin identifying and investigating the specific effects of climate change on civil aviation, in 2020, ICAO (International Civil Aviation Organization) published the first-ever Climate Adaptation Synthesis Report.² The following years as part of the ICAO Committee on Aviation Environmental Protection (CAEP)/12 cycle (2019-2022), following the Assembly Resolution A40-18 that requested the Council “to develop guidance on climate change risk assessment for international aviation”, the Working Group 2 produced guidance material on climate change risk assessment, identifying vulnerabilities, and adaptation measures, that will be published on the ICAO website in the second half of 2022. The guidance provides support on performing a climate change risk assessment and on developing and implementing a climate change adaptation plan. There is an overview of key climate change vulnerabilities which a State or organisation may be at risk from and a menu of potential adaptation options which can be considered to reduce those impacts. It is intended for use by airports, aircraft operators and air navigation service providers (ANSP) across the global aviation network, and can also be used at the National

level by States that are engaging in climate change risk assessment of their aviation sector either as an aviation-specific assessment or as part of a wider national or transportation sector assessment.

Significance of Climate Change Adaptation for Aviation

Aviation is vital for the mobility of people and cargo. Therefore disruption to the sector due to climate change impacts will cause ripple effects across the global economy. As aviation is often an important part of disaster recovery, airports and air traffic control operations must continue to be reliable even as storms intensify and become more frequent. Aviation climate resilience is the ability for aircraft operations and infrastructure to be able to withstand and recover from external perturbation resulting from the impacts of climate change. Climate change adaptation to strength resilience to actual or projected climate and its effects, specifically tailored to aviation, is critical.

Benefits of Risk Assessment and Adaptation Planning

To adapt to climate change impacts, aviation stakeholders must be able to determine risks and identify priorities for planning. Identifying and prioritizing risks and possible adaptation measures is critical since it is not possible

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² <https://www.icao.int/environmental-protection/Pages/Climate-Adaptation.aspx>

to plan for all possible scenarios. The guidance on Risk Assessment and Adaptation Planning sets out a step-by-step process divided by two stages, “Risk Assessment” and “Adaptation Planning”, to carry out a climate change risk assessment and develop and implement a climate change adaptation plan. This process can be scaled and utilized by States and organisations of any size or structure. There are six key steps in the risk assessment stage (Figure 1).

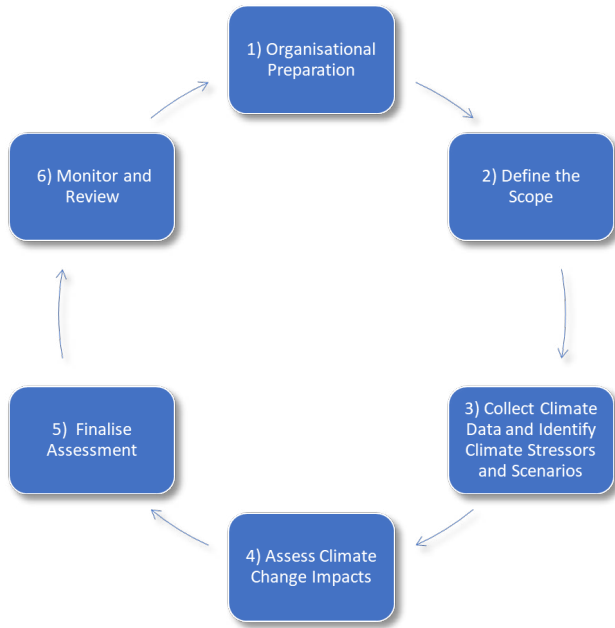


FIGURE 1: Six key steps in climate change risk assessment

The first step is to get the buy-in, or commitment, of senior leadership within the state or organisation so that they understand why the risk assessment is necessary. The next step is to define the scope of the assessment. During this stage, consideration should also be given to all the different stakeholders that should be involved in the risk assessment. For example, if the risk assessment was being scoped for an airport, different parts of an airport may be managed by different entities, and it will be important to make sure that all critical entities are represented. Another key component of defining the scope is to identify the timeline your Risk Assessment will consider.

The third step in the Risk Assessment process is to identify and collect data on climate stressors and any scenarios that will be used. During this step, it may be helpful to work with local MET providers to get climate data on what the key climate change impacts might be, how local

conditions might change. Once the climate stressors and projections have been identified, step four is to assess what the consequences of those impacts might be for the organisation’s infrastructure and operations and what the likelihood of those impacts happening might be. It may also be important to consider cumulative impacts, for example how might a combination of sea level rise and higher wind speeds impact storm surges?

The guidance also includes an overview Key Climate Change Vulnerabilities for Aviation Organisations for the four climate change impacts categories which respondents to the 2018 ICAO Climate Adaptation Synthesis Report stakeholder survey identified as the climate impacts categories they expect to be most affected by. These are: Higher Average and Extreme Temperatures, Changing Precipitation, Increased Intensity of Storms, and Sea Level Rise. For each organisation type (airports, air navigation service providers (ANSPs), aircraft operators), the section presents a breakdown of potential effects by impact category. This overview may be helpful for States and organisations as they are assessing potential climate change impacts. While this overview is detailed and provides specific effects on the different organization types, it is not meant to be comprehensive of all potential effects and should be used as a starting point for consideration during stage four. Figure 2 gives an example of what this overview looks like.

CAEP WG2 CLIMATE RISK ASSESSMENT, ADAPTATION AND RESILIENCE: KEY CLIMATE CHANGE VULNERABILITIES FOR AVIATION ORGANISATIONS		
Potential effects from four main climate impacts to aviation risk categories		
Airports		
Climate Impact	Risk Category	Potential Effect
Higher Average and Extreme Temperatures	Operations	Runway length: <ul style="list-style-type: none"> Limits to operations due to reduced climb performance: higher temperatures reduce thrust and lift of aircraft during take-off, reducing take-off performance and requiring more fuel, or a reduction in overall weight. Reduced ability of certain airports to take certain aircraft due to runway length limitations and reduced climb performance.

FIGURE 2: Six key steps in climate change risk assessment

Step five is the preparation of a final assessment document. Once this has been done then it is time to use the Risk Assessment as the basis for adaptation planning. However, since the impacts from climate change will continue to evolve and the information on climate change projections continue to be refined, it will be important to monitor and review the assessment periodically and update the risk assessment as appropriate, which is the sixth and final step. Any updates to the risk assessment should go through a similar six-stage process as the initial assessment.

There are four consecutive steps to the adaptation planning and implementation stage (Figure 3). The first step is to identify the most critical elements that should be protected. It may not be feasible to adapt to all potential impacts so it is important to identify where the biggest potential vulnerabilities are.

The second step is to identify potential adaptation and resilience measures, and decide which are most suitable, according to the level of risk and the resources available. The guidance includes a menu of potential adaptation options with a range of potential measures for different impacts and diverse types of organisations which States and organisations can consider and select from to adapt to and build resilience against the vulnerabilities identified (Figure 4). Small Island Developing States (SIDS) can face specific climate change vulnerabilities, especially due to storms and sea level rise, which make adaptation measures particularly important. In the Menu adaptation options which may be critical for SIDS are indicated with a “SIDS” marker

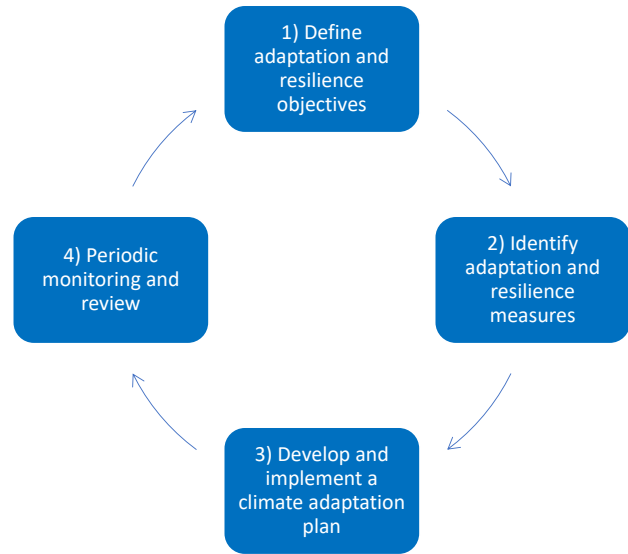


FIGURE 3: Four key steps in adaptation planning

As with the list of potential impacts on organizations from climate change impacts, this menu of adaptation options is detailed but not comprehensive of all possibilities. States and organizations should use this list as the starting point for adaptation planning. The third step is to define a plan to implement those measures, giving priority to the most critical elements.

And finally, as with the risk assessment stage, the fourth and final step is to monitor and review the measures the plan to make sure that the measures are achieving what is required and make any changes if necessary.

CAEP WG2 CLIMATE RISK ASSESSMENT, ADAPTATION AND RESILIENCE: MENU OF ADAPTATION OPTIONS	
Adapting Airports	
Higher Average and Extreme Temperatures	
Operations	
<input type="checkbox"/> Increase cooling capability in buildings <input type="checkbox"/> Increase external air conditioning to match demand (e.g., air conditioning pumping cold air outdoors, or supply of pre-conditioned air to aircraft) <input type="checkbox"/> Implement program to promote safety in the heat for ground staff – potentially extending to aircraft operator and ground handling staff <input type="checkbox"/> Implement or update wildlife management plans to account for changes in wildlife impacts	<i>Adelaide Airport in Australia is in a trial of irrigating the airport buffer, which may result in lowering airport surface temperatures and improving human thermal comfort.</i>
Infrastructure	
<input type="checkbox"/> Extend runway length <input type="checkbox"/> Move obstacles at the end of the runway (to adjust for reduced take-off performance due to reduced thrust and lift)	

FIGURE 4: Example from the Menu of Adaptation Options

Scalability and Tailored Strategies

In addition to identifying risks and priorities, it will be critical to scale adaptation appropriately to the level of risk and tailor adaptation strategies depending on operational goals and infrastructure lifecycles. Not all adaptation options will apply to every scenario, and in some cases, the most important adaptation measures may have low or no cost to resources (e.g., moving electrical equipment to higher locations within buildings). The “Menu of Adaptation Options” is a list of possibilities that each aviation organization may take into consideration, but must tailor as appropriate for their resources and goals. Simply going through the list and selecting a few options may not result in desired adaptation outcomes.

The Next Three Years – and Beyond

The 2018 Climate Adaptation Synthesis³ is a key resource for ICAO States and aviation organisations to prepare for the impacts of climate change. Therefore, it is important to ensure the information in the Synthesis stays current and incorporates the latest scientific information, such as information from the recently released Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report⁴. During the CAEP/13 cycle (2022-2025), Working Group 2 will review and update each section of the Synthesis to ensure that the information is as current as possible.

The 2018 Climate Adaptation Synthesis also included the results of a survey of global aviation sector stakeholders. The survey results captured an overview of the status of climate adaptation action in the global aviation sector at that time, the impacts that stakeholders were most concerned by, the actions they were already taking, and the measures that they thought needed to be taken. As five years have now passed since the survey was sent out to ICAO members and observers, Working Group 2 will also re-run a version of the survey as part of update to the Adaptation Synthesis during the CAEP/13 cycle to see to what extent further adaptation action has been taken and whether stakeholder concerns have evolved.

Conclusion

Climate change already has impacts on aviation, and despite significant advances in greenhouse gas mitigation measures, climate change will continue to have disproportional impacts around the world, particularly to SIDS. Freely-accessible ICAO guidance on climate adaptation that can be scaled to and applied by any state or aviation organisation will be critical to ensuring continued global connectivity and efficiencies.

3 <https://www.icao.int/environmental-protection/Pages/Climate-Adaptation.aspx>

4 <https://www.ipcc.ch/assessment-report/ar6/>