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Vulnerability of airports on climate change: an assessment methodology

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Abstract

The French technical center for civil aviation (STAC) conducted a three step study in order to provide airport operators with a consistent assessment methodology for the evaluation of airports' vulnerability to climate change. This paper aims at presenting the development of the vulnerability assessment method and highlighting the main steps to be conducted to perform a vulnerability assessment study to climate change.

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1. Introduction

Members of the Intergovernmental Panel on Climate Change (IPCC) are unanimous: "Warming of the climate system is unequivocal" (IPCC, 2008). Climate change is already underway and its effects are beginning to be felt: "many natural systems are being affected by regional climate changes". The message from scientists concerning the significance of these changes is unambiguous. Because of the inertia inherent in climate systems, profound changes are now inevitable, whatever means are employed to reduce greenhouse gas emissions.

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Fighting and adapting to climate change are national priorities enforced by the Climate Change National Adaptation Plan (MEDTL. 2011) adopted in France in 2011 and regularly updated since then. This plan is organized in 19 themes, among which “Infrastructures of transport”. The civil aviation technical center (STAC) was commissioned to address a part of one of the 5 sections attached to the previous theme aiming at studying the impacts of climate change on French mainland and overseas airports. Then was launched the VULCLIM project whose main objective was to evaluate the vulnerability of French airports to climate change.

This project provides airport operators with a consistent assessment methodology for the evaluation of airports’ vulnerability to climate change. In order to meet this goal it was necessary to:

- Identify relevant climate changes (expected by the year 2100) and their potential impacts on airports infrastructures;
- Elaborate a methodology for the evaluation of aerodromes vulnerability to the previously identified climate changes and apply this methodology to a sample of representative platforms;
- Design an automatic assessment tool for airports’ operators to evaluate the vulnerability of their platform.

2. Climate changes and their impacts on airport infrastructure

2.1. Build a climate change scenario

Before designing the method of evaluation of the vulnerability of airports to climate change, some preliminary work was necessary.

First, a precise climate change scenario was to be defined to evaluate aerodromes vulnerability.

The IPCC experts identified four possible climate change scenarios for the greenhouse gases emissions based on different economic and demographic hypothesis. The PNACC chose to work with two of the four scenarios of the IPCC: scenarios A2 and B2. These two IPCC scenarios considered different climate variables with possible impacts on airports:

- temperatures
- precipitations
- winds
- sea level

The STAC added “Biodiversity” to the variables list of the climate change scenario since it can have a remarkable impact on airports’ operations, threatening operations and causing flight delays or cancellations.

At this stage, the STAC has a list of relevant climate variables whose evolutions could affect airports. Then, the IPCC scenario portrayed a list of expected climate changes associated with all five variables. These climate changes represent the way the variables are likely to evolve according to IPCC predictions. For example, it is well known that the “Temperatures” variable must be affected by climate change. Then, the IPCC scenarios conclude that:

- mean temperatures must increase
- daily maximums and minimums must increase
- the annual number of days of heat waves must increase.

All climate changes above specifically describe the evolution of the “Temperatures” variable and other changes can be associated with all previous climate variables. Some climate changes are trends while the others consist in extreme events. For example, the “Wind” variable is likely to engender:

- changes in the direction of mean winds which can be considered trend changes
- a change in the frequency and intensity of extreme winds that are associated with extreme events.

Climate changes associated with the five relevant variables could have different impacts on airport operations. For instance, each of the identified variables might affect the functionality of the airport system and consequently threaten the proper running of the platform.

The STAC then analyzed the possible impacts associated with the climate variables in order to work out whether they were relevant enough to be included in the climate change scenario. Only climate changes with possible remarkable consequences on airport usability were eventually embedded in the climate change scenario. Table 1 below summarizes all climate changes and their impacts on airports and identifies the climate changes retained in the climate change scenario (in grey cells).

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