

Airport Vulnerability to Climate Change

Information note

A part of the National Adaptation Plan to Climate Change (PNACC)

This study is part of the National Adaptation Plan to Climate Change (PNACC in French), which aims to prepare the country for climate change hazards and impacts. PNACC has a transport section for which the French Civil Aviation Administration is responsible for the air transport STAC was asked to develop a climate change vulnerability assessment method for civil airports.



Temperature change



Precipitation change



Wind pattern changes



Extreme weather events



Changes in Sea level



Changes in biodiversity

A threefold study:

Part 1: identify relevant climate potential impacts on airport infrastructure and relevant technical standards.

Part 2: develop a climate change vulnerability assessment method for civil airports.

Part 3: test the method on representative French airports.

Climate hazard impacts on airports

Airport-specific climate hazards were identified from several sources (e.g. Intergovernmental Panel for Climate Change [IPCC], PNACC January 2011 report on climatic scenarios by J. JOUZEL, Météo France data). For each hazard, potential impacts were identified based on feedback from airport operators and literature review.

Three key identified where airports could-potentially be impacted by climate change: infrastructure (e.g. movement, road access, car parks), buildings (e.g. terminal, control tower) and operations (e.g. takeoff/landing, catering).

Impacts on infrastructure

- * Changes to takeoff distances, requiring runway extension or MTOW reduction;
- * Accelerated deterioration of runway/taxiway pavement, reduced pavement load movement area damage, clay swelling or shrinking causing pavement damage;
- * Reduced need for de-icing agents, reducing soil/water pollution;
- * Movement area submersion, requiring construction of protection (dykes, reinforced embankments);
- * Submersion des aires de mouvement, nécessité de construire des protections;
- * Coastal infrastructure collapse;
- * Prevailing wind direction change, causing optimal runway orientation to change.

Impacts on buildings

- * Building temperature increase: reduced heating costs, air conditioning needs increase;
- * For airports bordering forest areas, increased risk of closure due to forest fire;
- * Flood/submersion of littoral areas;
- * Clay swelling or shrinking causing building damage;
- * High winds destroying mobile or frangible equipment (air bridges);
- * Partial or total building destruction (tornado, flood).

Impacts on operations

- * Increased risk of reduced visibility due to forest fire smoke during drought or heatwave;
- * Increased frequency of crosswinds/tailwinds reducing runway capacity;
- * Storms/high winds increasing FOD frequency, increase in temporary runway closure;
- * Airport closure due to storm/tornado alert or aftermath, isolating remote territories (overseas);
- * Less traffic disruption/delays due to snow events;
- * Harsher apron working conditions, leading to absenteeism;
- * Temporary apron or runway closure due to heavy rain/flood;
- * Changes in bird population and natural habitat, increased bird hazards.

VULCLIM: a method to assess airport exposure to climate change

Methodology

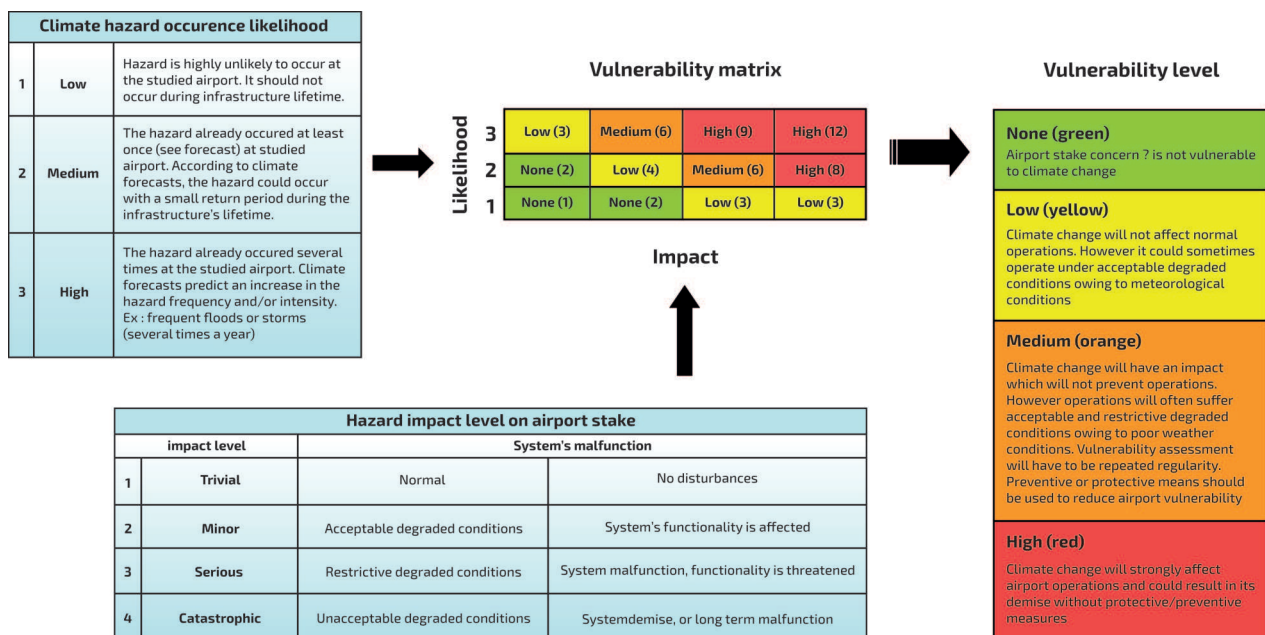
VULCLIM uses risk mapping to assess airport vulnerability. It enables a thorough vulnerability analysis while producing an easy-to-understand result. The process begins with a thorough analysis of the airport a comprehensive knowledge of its transportation features (e.g. composition, known vulnerabilities to malfunctions, critical components), followed by the definition of climate change scenarios, with identified climate hazards and clearly defined scenarios.

The need to understand a hypothetical future situation of the studied airport, using both average and extreme climatic condition forecasts, makes the vulnerability analysis more complex. Analysis of past climate events and feedbacks are critical to inform the forecast, and constitute an integral part of vulnerability analysis.

The combination of these two analyses (airport concerns and climate hazards) allows the creation double entry table, crossing analyzing of the climate hazard occurring with the level of impact on the airport concerned of that hazard so as to assess the actual risk.





The vulnerability assessment grid is a double entry table cross climate hazards likely to impact airport concerns, and their components (infrastructures, buildings, operations)...



Putting the method into practice : Nice Côte d'Azur airport

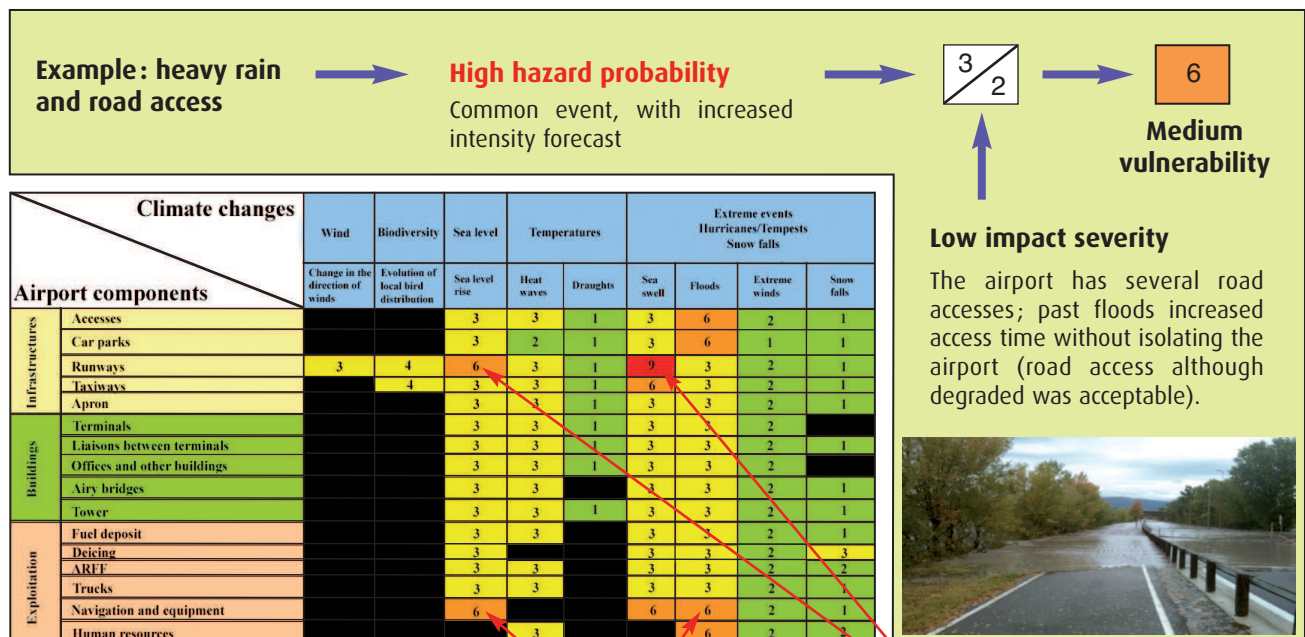
Features :

Nom	Nice Côte-d'Azur
Code OACI/IATA	LFMN/NCE
Plan de situation	Vue aérienne

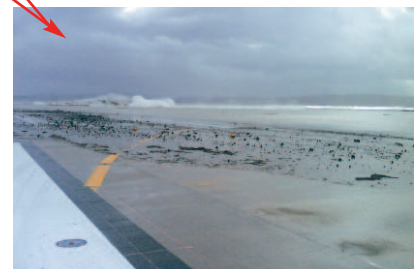



- * Third busiest French airport with 11 million passengers in 2012 and 176 400 movements;
- * 370 ha footprint, with more than 200 ha built on sea;
- * Two parallel runways;
- * Two terminals;
- * 21 % of flight cancellations due conditions in 2010.

The Nice airport vulnerability grid, compiled in collaboration with the airport operator, permits the identification of the strengths (green and yellow areas) and weaknesses (orange and red) of the airport to climate change impacts.

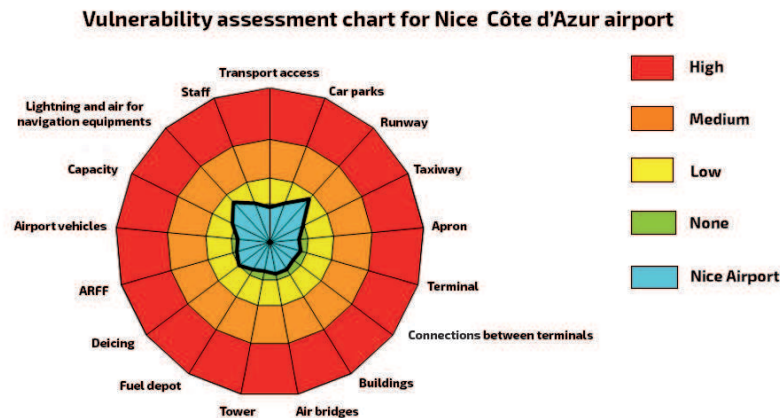


Some storms disrupt airport operations stones on the runways, flooding parts of the maneuvering area or inhibiting surface drainage. Forecast rises in sea level could increase airport vulnerability to these hazards.



Vulnerability assessment chart for Nice Côte d'Azur

The graphic depiction below of the Nice Côte d'Azur vulnerability assessment grid emphasizes the airport's overall level of vulnerability, illustrated by the blue area; the size of the area is proportional to the airport's level of vulnerability. For Nice Côte d'Azur, most of the airport components are located in the no or low vulnerability areas. A higher vulnerability can be identified for two concerns, namely the runway and for the air traffic control navigation equipment. For the navigation equipment, the vulnerability assessment grid (cf. last page) indicates several cases of medium vulnerability (orange). The runway is subject to a high vulnerability (red) to rough water.



A proactive assessment

At Nice airport, the parallel runway system, partly built on sea and with low elevation, will be vulnerable to maritime hazards rising sea levels and rough sea during storms. Due to climate change, these hazards will increase in frequency and intensity.

« Aéroports de la Côte d'Azur », the airport operator, is conducting a maintenance campaign of existing embankments. This work, with a cost of 10,40 M€ from 2011 to 2013, aims to reinforce riprap areas which protect the runways from storms on the airport's maritime side.



References

- * <http://www.circeproject.eu/> projet de recherche européen sur le sujet du changement climatique.
- * <http://www.eea.europa.eu/publications/climate-impacts-and-vulnerability-2012>, site de l'agence européenne de l'environnement, page dédiée au changement climatique.
- * <http://onerc.org/> Observatoire National sur les Effets du Réchauffement Climatique.
- * <http://www.developpement-durable.gouv.fr/Scenarios-regionales-janvier> scénarios climatiques PNACC.
- * <http://www.developpement-durable.gouv.fr/IMG/pdf/ONERC-PNACC-complet.pdf> site relatif au PNACC.
- * www.drias-climat.fr a pour vocation de mettre à disposition des projections climatiques régionalisées (France).
- * <http://www.prim.net/> site internet du Ministère sur les risques majeurs.
- * <http://www.cnrm-game.fr/spip.php?article531> Centre National de Recherches Météorologiques, Groupe d'études de l'Atmosphère Météorologique.
- * <http://infoterre.brgm.fr/> et <http://www.argiles.fr/> permettent d'identifier les zones géographiques soumises à un aléa faible moyen ou fort au phénomène de retrait/gonflement des argiles.
- * <http://imfex.mediasfrance.org/> phénomènes extrêmes, vent et précipitations.
- * <http://imfex.mediasfrance.org/web/> site d'information sur l'Impact des changements anthropiques sur la FRéquence des phénomènes Extrêmes de vent, de température et de précipitations.
- * <http://pluiesextremes.meteo.fr/> site dédié aux "pluies extrêmes" dont l'objectif est d'informer sur la fréquence des événements pluviométriques extrêmes et de présenter les épisodes les plus marquants qui se sont produits en métropole, depuis 1958 et jusqu'en 2009.
- * <http://flood.firetree.net/> simulateur de montée des eaux développé par Google.

The detailed methodology is available on request on the following address:

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