Measuring airports’ vulnerability to assess their climate change resilience capacity

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Context

• Climate change resilience national programme (PNACC) aims to prepare the country to climate change impacts

• Apply to several fields (health, tourism, urban planning, transport, energy and industry…)

• DGAC is responsible for the aviation component of the transport field

→ studying the impact of climate change to assess airports vulnerability on climate change effects.
The VULCLIM project

Goal: assessing the risk of climate change on airports in order to raise operators awareness on their resilience capacity

• A three-step process
  ▪ Identifying a list of climate change hazards and their consequences on airports
  ▪ Developing a methodology to assess the risk associated with the previous climate change effects
  ▪ Designing an automated tool for airports to identify their strengths and weaknesses facing climate change
Identifying climate change effects and impacts

• Climate change

  ▪ (4+1) climate variables are expected to be affected by climate change

  ▪ And may have different effects
Identifying climate change effects and impacts

- List of possible climate change effects (associated with the 5 variables)
  - Change in the mean direction of winds
  - Higher strong winds
  - Decreasing number of rainy days
  - Increasing number of days with heavy rains
  - Sea-level rise
  - More frequent and intense sea-swells
  - Etc.

- Nine climate change effects are included in the climate change scenario

<table>
<thead>
<tr>
<th>Evolution</th>
<th>Wind</th>
<th>Biodiversity</th>
<th>Sea-level rise</th>
<th>Temperatures</th>
<th>Extreme events</th>
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</thead>
<tbody>
<tr>
<td>Effects</td>
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<td></td>
<td>Direction change</td>
<td>Location, migration</td>
<td>1 metre rise</td>
<td>Heat wave</td>
<td>Drought</td>
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<td>Impacts</td>
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<td>Binding Xwind</td>
<td>Wildlife hazard rise</td>
<td>Submersion</td>
<td>Fires, long take-offs</td>
<td>Clay expansion</td>
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</table>
Assessing airports’ vulnerability on climate change effects

- Measuring the risk that every hazard has to airport based on risk cartography:
  - Complete knowledge of climate change characteristics
  - Exhaustive portrait of the airport from the « transport » perspective
Assessing airports’ vulnerability on climate change effects

The Risk assessment methodology

Climatic Hazard occurrence PROBABILITY level

Hazard IMPACT level on airport system

VULNERABILITY Level
Assessing airports’ vulnerability on climate change effects

- Probability of climate change occurrence based on:
  - For all effects, compare:
    - Climate forecast…
    - … or airport experience
      - Ex: number of wildlife accidents is constant, slightly increasing, strongly increasing
  - … to standard criteria
  - Pick the mark of the standard criteria matched by airport forecast or experience

A mark from 1 to 3 is associated with all nine climate effects.
Assessing airports’ vulnerability on climate change effects

- Example of assessment of probability of climate change occurrence:
  - Heat-waves:
    - Climate forecast

Airport is located in:
- Light red area, probability of occurrence =1
- Medium red area, probability of occurrence =2
- Dark red area, probability of occurrence =3
Assessing airports’ vulnerability on climate change effects

- Impact of climate change hazards on airport components:
  - Consider the operational consequences that climate change hazards pose to airport components
    - E.g.: extreme precipitations on airport access
  - Compare with some identified standard situations
    - Normal: impact = 1
    - Acceptable degraded conditions: impact = 2
    - Restrictive degraded conditions: impact = 3
    - Unacceptable degraded conditions: impact = 4
  - Pick the mark of the standard situation which matches the considered operational consequences

A mark from 1 to 4 is associated with all pairs of airport component / climate change effects.
Assessing airports’ vulnerability on climate change effects

- Exemple of impact assessment: extreme precipitations on runways

- All runways are operational: impact = 1
- At least one runway is operational: impact = 2
- All runways are briefly out of order: impact = 3
- All runways are out of order on the long term: impact = 4
Results and perspective

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<th>Airport system components</th>
<th>Probability of climate change effects occurrence</th>
<th>Impact of climate change effect on airport component</th>
<th>Vulnerability level of component on climate change effect</th>
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**Effects**

- Results and perspective
- Airport system components
- Probability of climate change effects occurrence
- Impact of climate change effect on airport component
- Vulnerability level of component on climate change effect
Results and perspective

Today: a **method** giving a matrix which highlights the strengths and weaknesses of the airport regarding the expected climate change effects

- Identify major effects
- Identify airports’ components to be strengthened in order to increase climate change resilience

Tomorrow: providing airports operators with an **automated tool** to make the vulnerability evaluation easy

- For airports operators
- Based on 2 limesurvey open source questionnaires
- Built the airport risks matrix
- The tool is made with the participation of airports
Feedback after hurricane Irma in St-Barthelemy and St-Martin islands

Saint Martin

Saint Barthélemy
Feedback after hurricane Irma in St-Barthelemy and St-Martin islands

-> Before IRMA   be prepared to limit damage

-> After IRMA   trying to re-open airports ASAP.

• An expert team arrived just after IRMA and just before Jose
• List of damage
• Are runways available for military rescue airplane ?
• Cost of recovery of the airports (emergency and short term costs)
Feedback after hurricane Irma in St-Barthelemy and St-Martin islands

Many Damage
Safety issues
airport protections
animals, FODs
Feedback after hurricane Irma in St-Barthelemy and St-Martin islands

Infrastructures and equipments
Thank you for your attention.