Airports and Adaptation
Changing climate and business conditions

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Outline of Presentation

• Mitigation versus Adaptation
• Climate Changes and Airports
• Changing Business Conditions
• Challenges for Airports
Mitigation versus Adaptation

From IPCC WG2/WG3 meeting 2004
**Expected Changes in Climate**

<table>
<thead>
<tr>
<th></th>
<th>Level of Uncertainty</th>
<th>Probability of Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sea level rise</strong></td>
<td>Virtually certain</td>
<td>≥99 %</td>
</tr>
<tr>
<td><strong>Temperature changes</strong></td>
<td></td>
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<tr>
<td>Decreases in very cold days</td>
<td>Virtually certain</td>
<td>≥99 %</td>
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<tr>
<td>Increases in Arctic temperatures</td>
<td>Virtually certain</td>
<td>≥99 %</td>
</tr>
<tr>
<td>Later onset of seasonal freeze, earlier onset of seasonal thaw</td>
<td>Virtually certain</td>
<td>≥99 %</td>
</tr>
<tr>
<td>Increases in very hot days and heat waves</td>
<td>Very likely</td>
<td>≥90 %</td>
</tr>
<tr>
<td><strong>Precipitation changes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases in intense precipitation events</td>
<td>Very likely</td>
<td>≥90 %</td>
</tr>
<tr>
<td>Increases in drought conditions for some regions</td>
<td>Likely</td>
<td>≥66 %</td>
</tr>
<tr>
<td>Changes in seasonal precipitation and flooding patterns</td>
<td>Likely</td>
<td>≥66 %</td>
</tr>
<tr>
<td><strong>Storms</strong></td>
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<tr>
<td>Increases in hurricane intensity</td>
<td>Likely</td>
<td>≥66 %</td>
</tr>
<tr>
<td>Increased intensity of cold-season storms, with increases in winds, waves and storm surges</td>
<td>Likely</td>
<td>≥66 %</td>
</tr>
</tbody>
</table>


- Local effects more important for airports than global averages
Sea Level Rise

- IPCC (2007) models predict sea level rise in the range of 0.2 to 0.5 metres by 2100 (medium emissions growth scenario)

- Resulting effect can include
  - Regular flooding
  - Storm surge flooding
  - Costal erosion
  - Land subsidence

- Issue for runways, taxiways, terminal buildings, road and rail access routes

- Many coastal airport could be affected
Sea Level Rise

Major coastal airports globally
Sea Level Rise

- National issue for low lying countries – Netherlands, Maldives, Bangladesh
- Airport infrastructure considerations at planning stage and consideration of future viability of existing facilities
- High risk issue
- Solutions not easy
  - Dykes, levees, seawalls
  - Improved drainage with major pumps
  - Elevation of structures
  - Airport closure or relocation
Temperature Rise

- Decreased # cold days & increased # hot and very hot days
- Rises will not be uniform, varying with region
  - Decrease in aircraft lift
  - Reduced snow removal, but more freezing rain conditions
  - Changing seasonal demand
  - Local air quality degradation
  - Melting permafrost base
Temperature Rise

Airport planning and response may mean

– Payload limitation in hot weather
– Need for longer runways
– Slower climb rates – airspace redesign
– Diversion of incoming aircraft if temperature too high
– Increased cooling demand for terminals and aircraft
– Less snow removal
– More stringent local air quality emissions mitigation
Temperature Rise

Svalbard (Norway) Permafrost depth: 1973-2.5m, 2009-4.5m

Ground is softer and runway is starting to sink
Precipitation Changes

- Predictions from 2007 IPCC report show:
  - Typically less rain in tropics (orange) and more precipitation in high latitudes (green)
  - White areas show poor agreement (<65%) between different IPCC model calculations

Source: 2007 IPCC WG1 AR-4
Precipitation Changes

- Flooding – runway closures
- Water damage – erosion, subsidence
- Storm water runoff management
- Ground and surface water course contamination
- Separation of sewerage and storm water
- Water shortages
- Dust storms

Flooding and subsidence beneath runway shoulder in Norway

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Storms

• Expectations include:
  – Increase in frequency of low pressure system events, including hurricanes and cyclones
  – Increase in storm intensity including wind speed
  – Increase in wave size and storm surges
Storms

• Costal protection in Norway

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Storms

• Locally designed and produced wave protection barrier at Rarotonga Airport, Cook Islands
Other Climate & Weather Considerations

- Delays and loss of capacity
- Changes in prevailing wind conditions affecting optimal runway orientation
- Interruption of ground access
Mitigation versus Adaptation

From IPCC WG2/WG3 meeting 2004
Changing Business Conditions

- Effects of climate on seasonal passenger demand
- Investment in airport infrastructure to cope with changed weather patterns (e.g., sea defences, building stability, heating/cooling demand)
- Effects on airport asset values
- Shortages of power, fuel, water
- New storage and delivery infrastructure for non-drop-in alternative fuels
- Regulated limitation on growth
- Aviation operations within an aviation emissions cap
The Challenges for Airports

• Immediate focus remains on mitigation
• Need to start process of evaluation Risk Assessment
• Start addressing uncertainty of climate outcomes especially regarding local effects
• Recognise that although changes may be long-term (50-100 yrs) airport infrastructure expected to last more than 50 yrs
• Instigate analysis of effects of changing business conditions
• Consider the effects of climate change on developing countries
Thanks

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