



ACT>>>
GLOBAL

ICAO: UNITING AVIATION ON CLIMATE CHANGE

ICAO Colloquium on Aviation and Climate Change

Airports and Adaptation

Changing climate and business conditions

Xavier Oh

Airports Council International



ICAO Headquarters, Montréal, Canada, 11- 14 May 2010





ACT>>>
GLOBAL

ICAO Colloquium on Aviation and Climate Change

Outline of Presentation

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

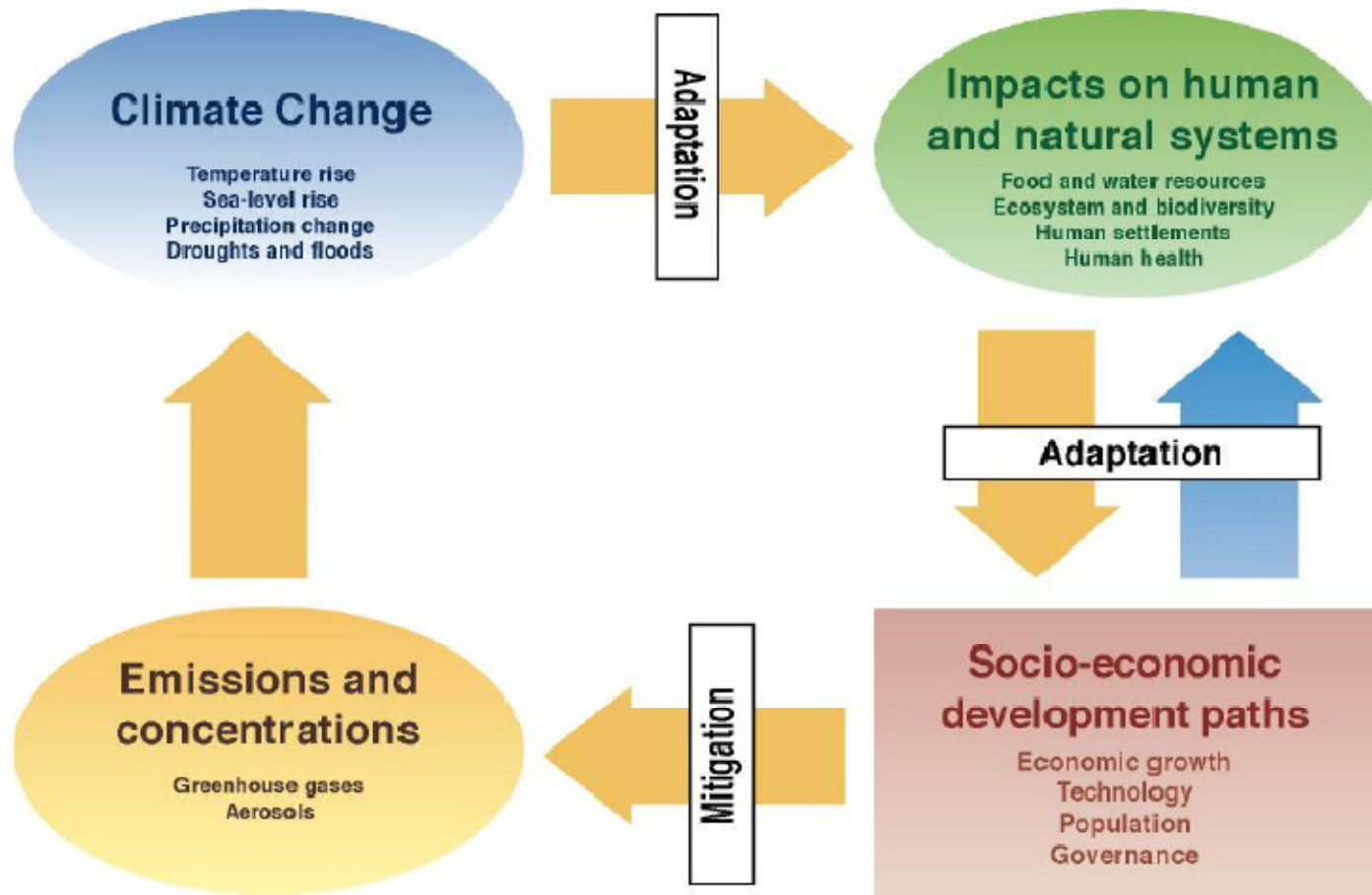


ICAO Headquarters, Montréal, Canada, 11- 14 May 2010



Mitigation versus Adaptation

From IPCC WG2/WG3 meeting 2004



Expected Changes in Climate

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

IPCC. 2007. Summary for Policymakers. In Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

- **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**



ACT >>>
GLOBAL

Sea Level Rise

Major coastal airports globally



ICAO Secretariat



ICAO Headquarters, Montréal, Canada, 11- 14 May 2010





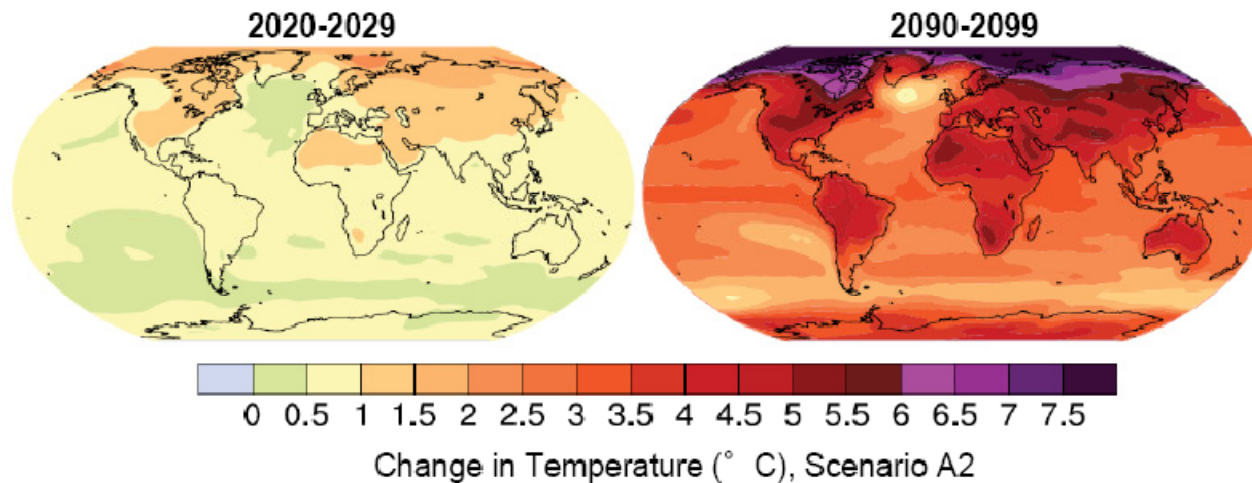
Sea Level Rise

- 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



(IPCC, 2007, Fig. WGI-SPM-6)



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

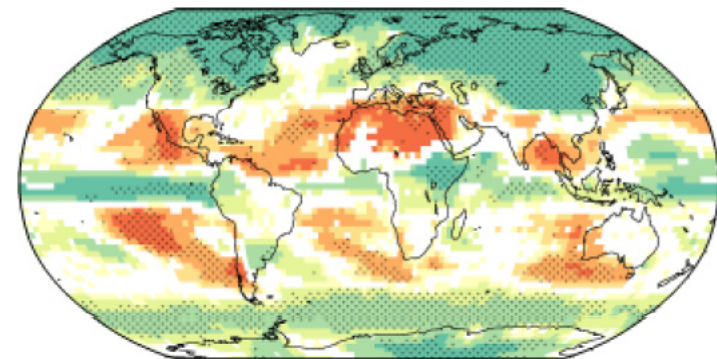
Svalbard (Norway) Permafrost depth: 1973-2.5m, 2009-4.5m

Ground is softer and runway is starting to sink

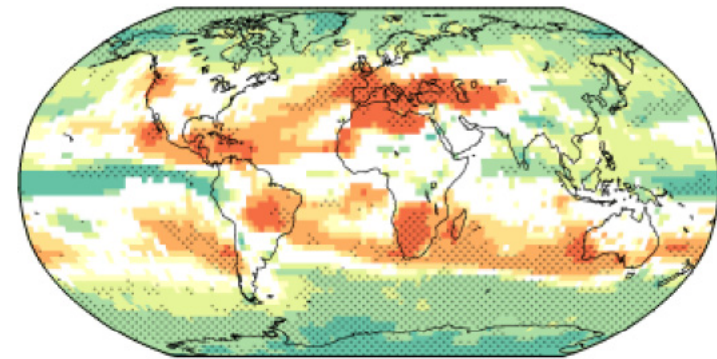


Precipitation Changes

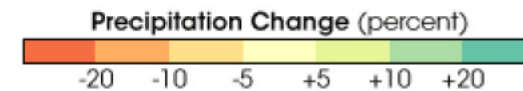
- Predictions from 2007 IPCC report show:
 - Typically less rain in tropics (orange) and more precipitation in high latitudes (green)
 - White areas show poor agreement (<65%) between different IPCC model calculations



December, January, February



June, July, August



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

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**



Storms

- **Locally designed and produced wave protection barrier at Rarotonga Airport, Cook Islands**





ACT>>>
GLOBAL

ICAO Colloquium on Aviation and Climate Change

Other Climate & Weather Considerations

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

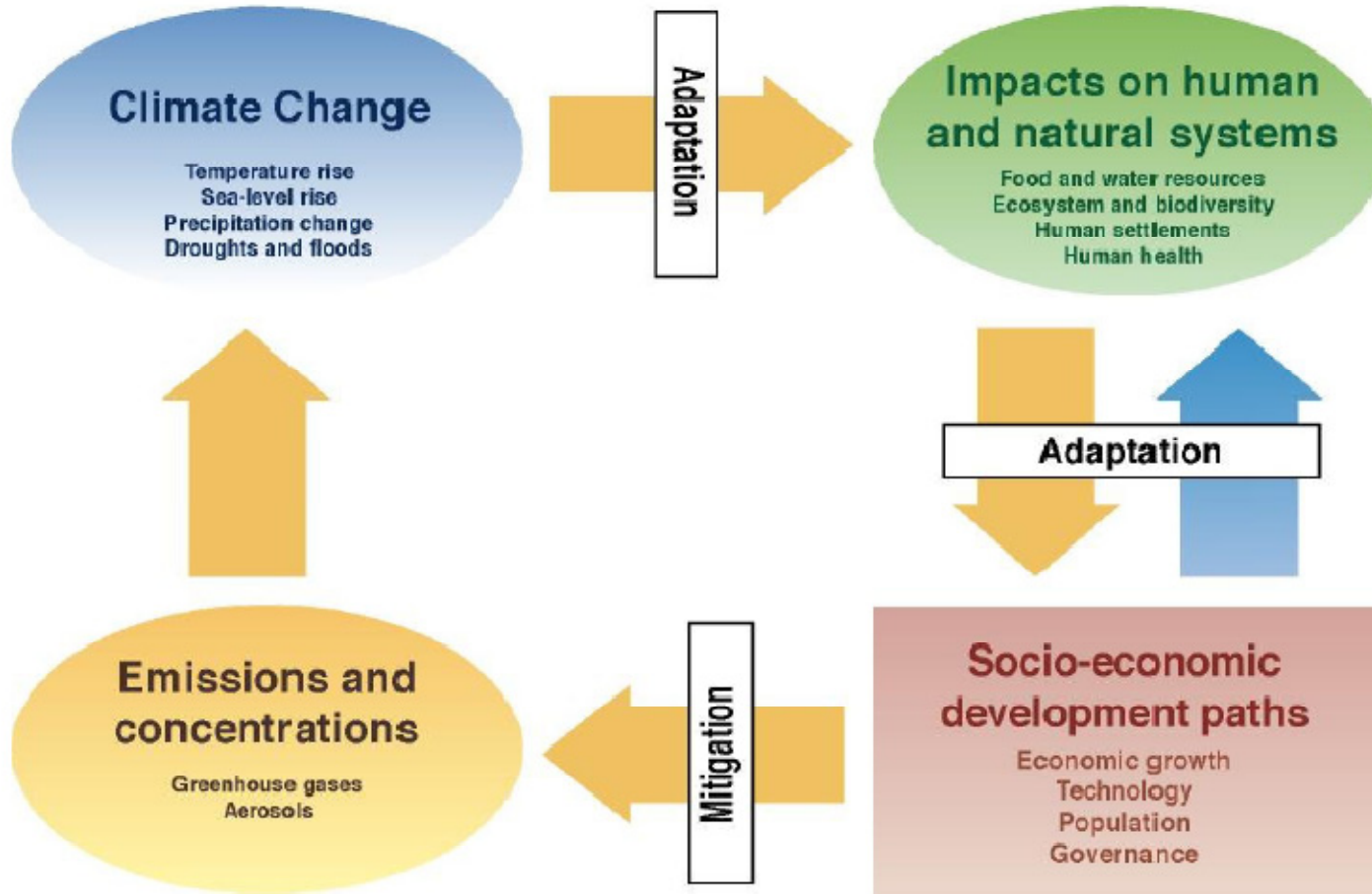


ICAO Headquarters, Montréal, Canada, 11- 14 May 2010



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 (eg 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



ACT>>>
GLOBAL

ICAO Colloquium on Aviation and Climate Change

Thanks

Xavier Oh
xoh@aci.aero



ICAO Headquarters, Montréal, Canada, 11- 14 May 2010

