

Adapting Airports to a Changing Climate

ICAO SEMINAR ON

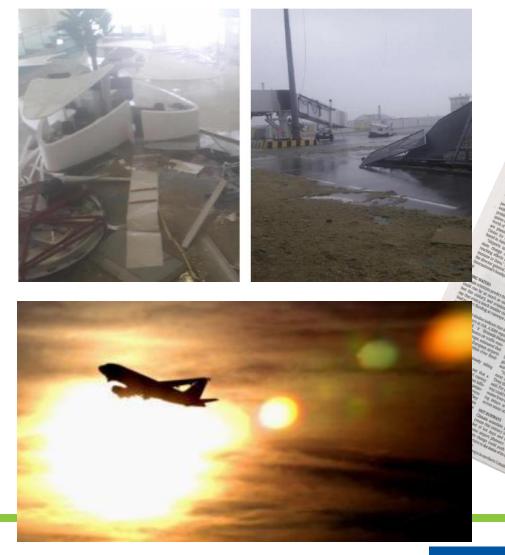
GREEN AIRPORTS

111111111

Rachel BURBIDGE EUROCONTROL



2017 Business Climate change lands at the airport



MONTREAL, CANADA, NOVEMBER 29-30, 2017

Aviation is used to disruptive weather – but if it's going to get worse?



MONTREAL, CANADA, NOVEMBER 29-30, 2017

Climate impacts at airports



Flooding and sea-level rise: Inundation of runways and taxiways Loss of ground transport access Inundation of electrical infrastructure

Increased convective weather: Increased delay / loss of capacity Lack of capacity at diversionary airports



Increased precipitation: Impacts on capacity/delay Inundation of runways and taxiways Inundation of electrical infrastructure Higher summer temperatures: Changes in summer demand patterns Heat damage to infrastructure Increased cooling requirements

Changes in wind direction: Increased crosswinds Capacity implications Potential procedure changes Potential changes to noise distribution

2016 World Airport Traffic Forecasts



Summary of Passenger Traffic Forecasts by Region of Airline Registration

(Scheduled Services)

Passenger traffic results in terms of RPKs

Region	Flight Stage	AAGR		worldwide distribution	
		1995-2010	2011-2030	2010	2030
Europe	Total	5.4%	3.4%	27%	22%
	International	6.3%	3.4%	38%	31%
	Domestic	2.0%	2.8%	8%	6%
Africa	Total	5.7%	4.1%	2%	2%
	International	6.1%	4.0%	3%	3%
	Domestic	3.3%	4.7%	1%	1%
Middle East	Total	11.6%	7.6%	7%	13%
	International	12.4%	7.6%	11%	19%
	Domestic	4.2%	7.7%	1%	2%
Asia/Pacific	Total	6.2%	6.2%	29%	38%
	International	5.1%	5.8%	28%	31%
	Domestic	8.2%	6.6%	32%	49%
North America	Total	2.8%	2.3%	29%	19%
	International	3.6%	2.8%	16%	11%
	Domestic	2.8%	2.1%	52%	33%
Latin America and the Caribbean	Total	4.8%	6.1%	5%	6%
	International	2.9%	5.6%	4%	4%
	Domestic	6.3%	6.5%	6%	9%
WORLD	Total scheduled	5.0%	4.6%	100%	100%
	International	5.7%	4.8%	100%	100%
Global Air Transport Outlook to 2030	Domestic	3.9%	4.4%	100%	100%

Growth and adaptation: a GLOBAL challenge



So, are we prepared?

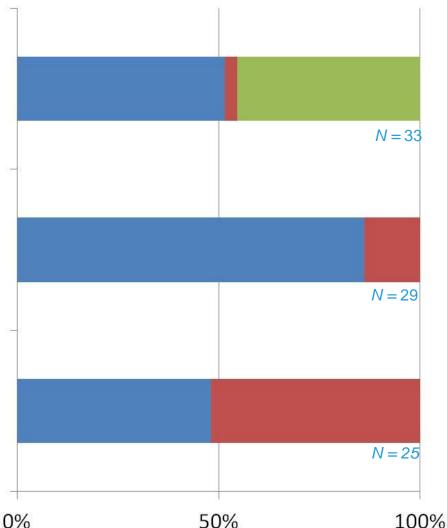
Does your organisation.....

expect the impacts of climate change to affect its business between now and 2050?

consider adaptation actions to reduce the potential impacts of climate change may be necessary now or in the future?

begun planning for adaptation to climate change impacts?

EUROCONTROL Challenges of Growth 2013



6







leasure

OR FLOODING



ring for n

wind und topograpi robust fi was de well a

MUNIRE

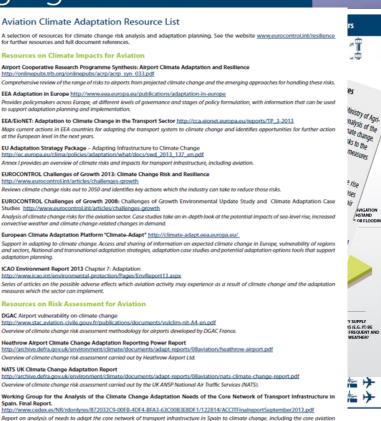
Adapting Aviation to a Changing Climate

What does it tell us?

- What are the key risks for aviation?
- How can you assess whether climate change is a risk for your organisation?
- What are other organisations doing (case-studies)
- Where can you get further information (resource list)
- Website with additional information www.eurocontrol.int/resilience

Climate risk	Aviation Climate
	A selection of resources for for further resources and ful
W Topt	Resources on Climate
or - wetter and wilder w ore water at Norwegian :	Airport Cooperative Resear http://onlinepubs.trb.org/on
	Comprehensive review of the
or water at not ore water at not ports are scattered along the m having runways less than 4m having runways less than 4m having runways into dimate ad rematically into dimate ad	EEA Adaptation in Europe
ports and runways less dimate au	Provides policymakers across
ports are softeness than anim- having runways less than ani- g systematically into climate ad systematically into climate and systematically into climate ad g systematically into prac- tices and ends of runwai the sides and ends of runwai the sides are deep in some	to support adaptation planni
ig 9515 new legislas of runwa t when new legislas of runwa t the sides and ends of the prac t the sides was very deep in some sony had to be turned into in too was very deep in some	EEA/EloNET: Adaptation to
t when t the sides and enned into Pro- tops had to be turned into Pro- eory had to be turned into in some question was very deep in some question was very deep in some question was very deep in some question and on some this required looking into i	Maps current actions in EEA
eory was very looking into	at the European level in the n
It the work to be twinded in Semi- sort had to be twinded in Semi- question was very deep in Semi- question was very deep in Semi- toris wave directions and - in S toons, wave directions and - in S toons, wave directions and - in S toons, wave directions and a solution with a calculate the size, shape and in the calculate the size, shape and with the solution would be able to with a solution would be able to with	EU Adaptation Strategy Pac
peris use directions, shape and tions, wave directions, shape and to calculate the size, shape and by to calculate the size, shape and the would be able to with shape the size of the size of the size of the shape of the size of the size of the size of the size of the shape of the size of the size of the size of the size of the size of the size of the s	http://ec.europa.eu/clima/pc Annex I provides an overview
to calculate would be add criteria	
lings of for dimercian for low-is	EUROCONTROL Challenges http://www.eurocontrol.int/
	Reviews climate change risks
emerre	EUROCONTROL Challenge
ast 7m at a result of di	Studies http://www.eurocor
well as changin	Analysis of climate change ris
istems and the impact of c	convective weather and clima
	European Climate Adaptati
In gented. I recilience to H	Support in adapting to clima and sectors, National and tra
	and sectors, National and trai adaptation planning.
	ICAO Environment Report
phase apron, for separations need of wind is a kee	http://www.icao.int/environ
	Series of articles on the possi
aler0VE)	measures which the sector ca
the airport	Resources on Risk As
Avinon low in the	DGAC Airport vulnerability of
larity cant tem	http://www.stac.aviation-civ
date and	Overview of climate change r
the UK (Heathrow Airport Climate C http://archive.defra.gov.uk/e
	Overview of climate change r
	NATS UK Climate Change A
	http://archive.defra.gov.uk/e
Extreme events ²	Overview of climate change r
	Working Group for the An Spain, Final Report.

network of 46 airports and two heliports.



ATS/

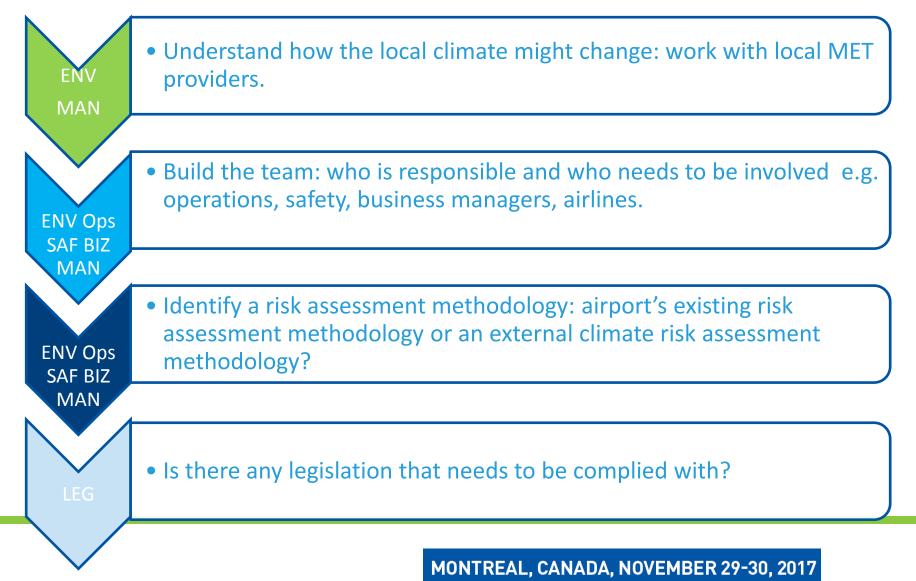
Risk assessment: where to start?

Do you know how much it Can your drainage will cost to implement the system handle any climate adaptation measures Do you know how the projected increase in you need? climate will change in rainfall? your area? Will local climatic changes increase or decrease tourism demand in your region? Can your electricity supply and critical systems (e.g. IT) Can your cooling system be maintained in more handle any projected frequent and extreme increase in disruptive weather? temperature? Who is responsible for Can ground access to the climate change airport be guaranteed in case

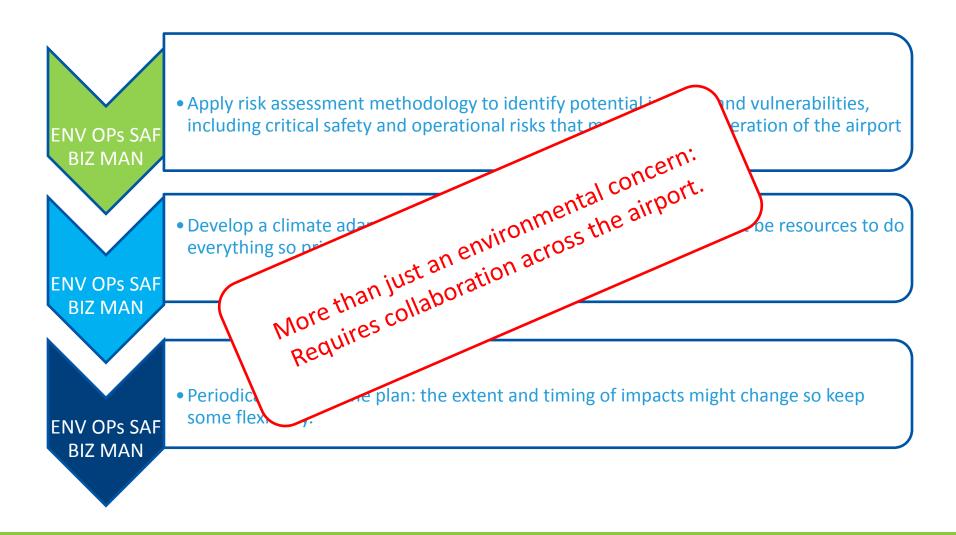
irport be guaranteed in case of increased precipitation (rain or snow) climate change adaptation within your organisation?

2017



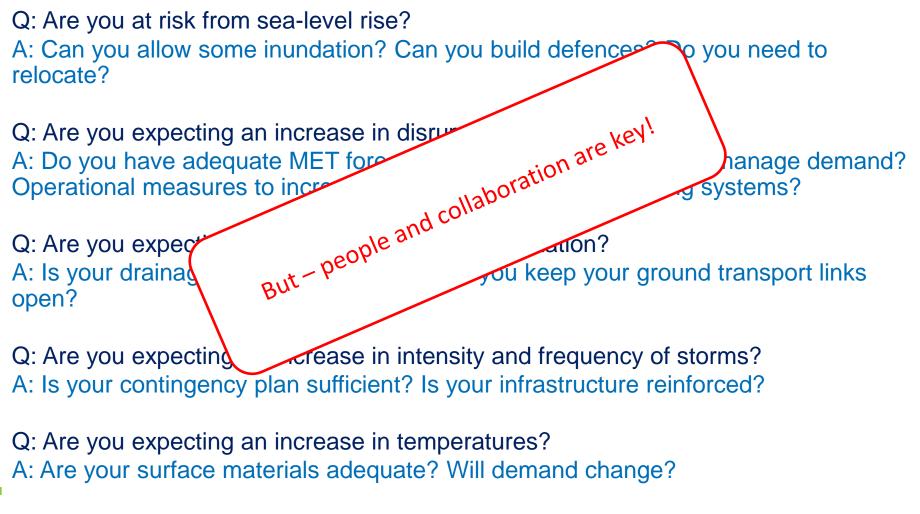






MONTREAL, CANADA, NOVEMBER 29-30, 2017

If you've seen one airport...



ICAO

Different airports: different solutions...



ISG

WG2

And?

Global challenge: global action

- Knowledge on impacts from a science perspective
- Knowledge on risk and resilience

- Update to airport planning manual
- New task for CAEP/11: Climate Adaptation Synthesis Report
- Limit global network vulnerability
- Awareness raising/best practice: learn from each other

MONTREAL, CANADA, NOVEMBER 29-30, 2017

ICAO SEMINAR ON

GREENARPORTS



Adapting airports to a changing climate: what do we need to do?

What we need to do:

- •Identify risks and vulnerabilities: global, regional, local
- •Risk assessment is a good place to start
- Implementation of local and network resilience measures
- •Build resilience into *current* infrastructure and operations planning: routine part of operational and business planning
- •Balance resilience, costs and criticality
- •"No-regrets" and "soft" measures (e.g. training) are cost-effective

Premptive action can be cost-effective – but don't act in haste!

And what next?

- •Global industry = global perspective
- •Uncertainties remain: what else do we need to know?
- Quantification of risks into operational impacts
- Communication and collaboration

Keep on mitigating!

Information and awareness-raising is key













ICAO ENVIRONMENT

ICAO SEMINAR ON **GREEN AIRPORTS**

THE IMPACTS OF CLIMATE CHANGE ON AVIATION: SCIENTIFIC CHALLENGES AND ADAPTATION PATHWAYS

Civil Aviation Organization (ICAO) reached out to the climate science community almost 20 years ago in an neek suitabin mitigatilen measuren fo redoco the emissions of carbon disolde (CD) and other atmospheric pollutari den activities wedpelde. The Organization adapted a comprehensive strategy to address international autation CDD, witch carimated in the adopted on al 2005 Statustica in 2016. Emission reduction entries such as market-based

Adaptation to Climate Changes The Scientific Issues and Challenges be worth to any fight climate framp has here we established method of scheduling here well and the second of the second to any fight and the stability of the second to any fight and the second s cesses involved that drive up the temperatures in the lower cosphere. The consequences of global climate change for wation will be summarized in the following paragraphs. A very of some of the possible impacts is shown

And a second sec San and a second The Ada 8 *

Rinking Sea Levels The the its globally servaged near level, through increased metting of the alteria and gatzers and also Thermal expansion of the norame, itsel understood and documents. Caugust with rinking and levels, sterm sarges literal to more letteres ethol-topical cyclosem suppression the shall by one low-global gatzers at canable localities are thereas the same taken. These effects are levels to be nearchead brough very interes-precipitation spinodes listed to bene shorms, which can had its means finding have near and colliding hand- with item listed. Figure 1. A Schematic Summary of Some of the Possible Impacts of Climate Change on Aviation. in.o. the extreme floods in Myanmar during Tropical Storm Narpin in 2008). Planning of new airports in each regions will require hydrological, climatological, and technical expertise.

Large-Scale Phenomena

Early of scale Protocordina Higher Integrature Maxima Higher Integrature maxima at ground level result in significant decreates in air dentity, reducing the HIT force on the wings of departing aircraft, this reducities in the could have average and the scale of the scale of the statement when high active research in the scientific community, in enacode alflude jet stream in each hemisphere is created and be temperature difference between the cold point optics. Climate models, satellite observations. consequences for aircraft take-off performance, where high altitudes or short narways limit the payload or even the fue carrying capacity. These effects will require more deta analyses for different geographic regions, with major

ACRP

all suggest that this temperature difference led manner; it is decreasing at groun

affected further by the reduced cooling overnight where high cloud is often present. In these cases, the non-CO2 effect of

contrail-related cirrus clouds may have to be considered as an additional factor, potentially reducing the urgroblematic hours of

cess flooding where run-off collides head-on with storm tides

operation even further in some regions.

Rising Sea Levels



Airport Climate Adaptation No. Personal and Resilience and the second second



A Synthesis of Airport Practice NAVAPORATION REVEARCH SCALE



hank You

Christe

CHALLENGES TO GROWTH ENVIRONMENTAL

Airport **Planning Manual**

Dec 5184

AVINOR

Adapting Aviation to a Changing Climate

Key Climate Change Risks for Aviation

In recent years considerable effort has been put into reducing availability impact on the climate. However even if manians stopped al clarbon emissions tomorow some climate change impacts are investable. Although available climate share the time watther on a regular basis such events are likely to become more existemic and monexet tax we experience the impacts of climate change. So how can the available indicatory exosue the selfence of our infrastructure and the provisio of alse, testible operations and possinger area tomics in the future?

his factsheet explains some of the climate change risks for aviation¹ and provides a starting point for carrying out a risk ass ent for your organization. Please see the resource list and website <u>www.eurocontrol.int.huslience</u> for more information Note that these are selected examples only and the significance of these risks will vary according to climate zone, geographical location and type



Anone the risks itsertified above impact the provision of a function anrocks. However, if it sits controls that clients charge will impact the demand for those services due to geographical reasonal within in source passing and anone will be an example interpretives and an example interpretive and an example interpretives and anone will be an example interpretives and an example interpretives and an example interpretives and interpretive interpretives and an example interpretives and an example interpretives and interpretives and an example interpretives and an example interpretives and an example interpretives and interpretives and an example interpretives and an example interpretives and an example interpretives and interpretives and an example interpretives and an example interpretives and an example interpretives and interpretives and an example interpretive and an example interpretives and an example interpretive an

