Operational Effects of Dynamic Weather Conditions

Dragos Munteanu (IATA)
Walter Emmerling (Condor)
Moritz Hanusch (Condor)

Safety Forum, Brussels, June 2024

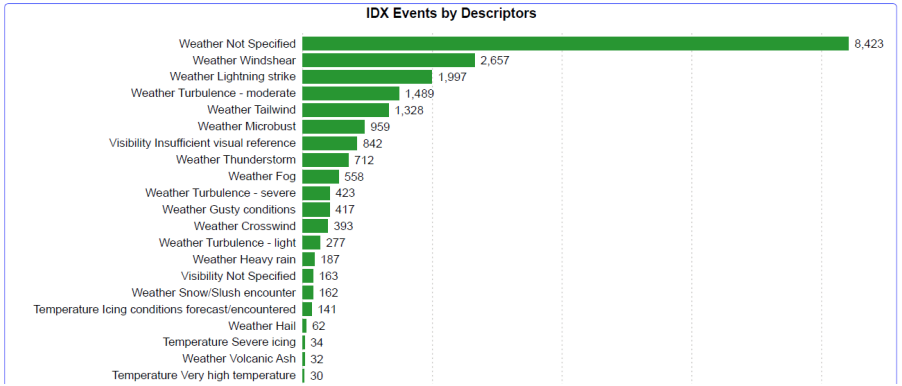
What are airlines reporting?

IDX Weather Related Incidents

ISIT Taxonomy Descriptors

Flight Period: 2022 Jan - 2024 Mar **Region:** Global

The visual below shows the event count of weather related incidents reported in IDX program per ISIT descriptor. A total of **16,112** **Weather related Incident** events were reported in IDX.

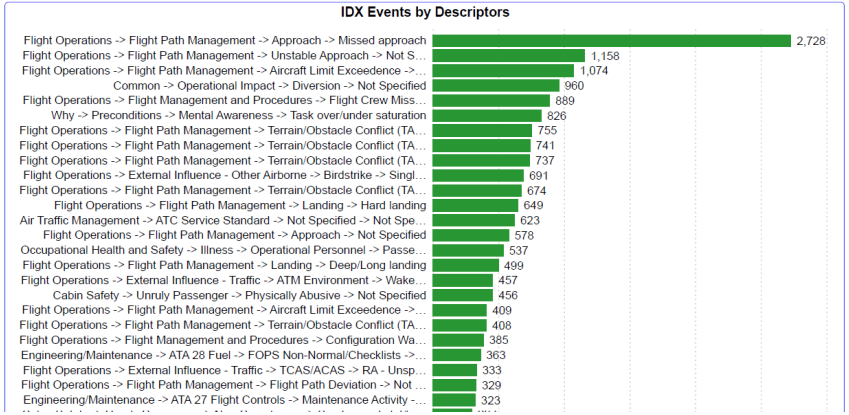


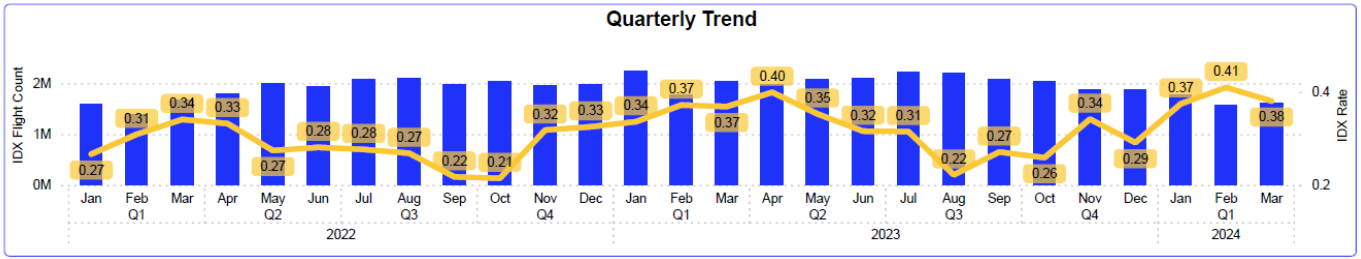
IDX Weather Related Incidents

ISIT Taxonomy Descriptors
Related Descriptors

Flight Period: 2022 Jan - 2024 Mar **Region:** Global

The visuals below shows some of the relevant related descriptors submitted with weather related IDX events.





Severe Weather Conditions are increasing and directly affect aircraft performance:

- Takeoff Performance ➔ Payload, Derate, Engine limits
- Landing Performance ➔ Increased Diversion risk, Increased Fuel cons.
- Inflight Performance ➔ More Turbulence cases, Blocktime issues
- Airport Surface conditions ➔ Faster Pavement deterioration

For example the maximum temperature at Frankfurt Airport already reached 40°C as peak during the last five years.

Number of cases with higher deviation on average blocktime are increasing which begin to show effect on scheduled times.

Mission

Example for impact on PTOM:
A330-941 | 40 ton Payload
FRA/EDDF | RWY 18 Departure

OAT [°C]	PTOM [ton]	ESAD [nm]
15	251.0	5897
25	249.4	5785
30	248.4	5715
35	247.5	5651
40	241.3	5207

Conditions:
ESAD = Range in still air
PTOM = Performance Takeoff Mass
Takeoff in zero wind, 1013hPa, Packs Off, 28% ALTN FWD CG
Cruise Speed M0.82, 3% Contigency, 30min Holding
Alternate 150nm

Derate/Flex Thrust

Example for impact on reduced Thrust:
B787-9/GENX-1B7475 | 4000 ESAD
40 ton Payload | TOM = 218 ton
JFK/KJFK | RWY 13R Departure

OAT [°C]	T/O-Derate [%]	Adapt-D [%]
15	TO2/ 21.01	21.01
25	TO2/21.01	21.01
30	TO2/20.47	20.47
35	TO1/18.36	17.13
40	TO1/15.53	15.08

Conditions:
ESAD = Range in still air
TOM = Required Takeoff Mass
Takeoff in zero wind, 1013hPa, Packs Off, 20% ALTN FWD CG
Cruise Speed M0.82, 3% Contigency, 30min Holding
Alternate 150nm, TO1 = 10% Derate, TO2 = 20% Derate

Limitation

Example for EGT exceedance :

B757-300W takeoff from ACE
Full thrust takeoff required due to takeoff performance limitiation.

After lift-off during climb sudden increase in EGT with exceedance of EGT-Limit

Investigation showed flight into inversion condition which lead to exceedance of EGT-Limit:

47ft PA/29°C: 847°C EGT
1000ft PA/40°C: 881°C EGT
Limit 5min: 877°C EGT

Possible increase in diversion due to more dynamic weather, e.g. higher winds:

Trend shows significant increase in diversions when operating to FNC (Funchal/Madeira) compared to previous years due to increase in critical wind conditions:

Planned Dest.	Diversion APT	2022	2023	2024
FNC	LPA	0	5	1
	TFS	0	1	1
	PXO	3	8	0
	SVQ	0	1	1
	MUC	0	0	1
	DUS	0	2	0
	FRA	0	1	0
	Total	**3**	**18**	**4** (JAN-APR)

We also encounter landing performance driven diversions due to degraded runway conditons (e.g. wet vs dry at JSI airport).

Possible increase in severe weather conditions may require an alternate airport further away and therefore increase fuel burn.

<u>Example:</u>

Flight from Frankfurt to Miami with an A330-941 and 40 ton of payload.

Fuel Comparison Alternate FLL versus ATL:

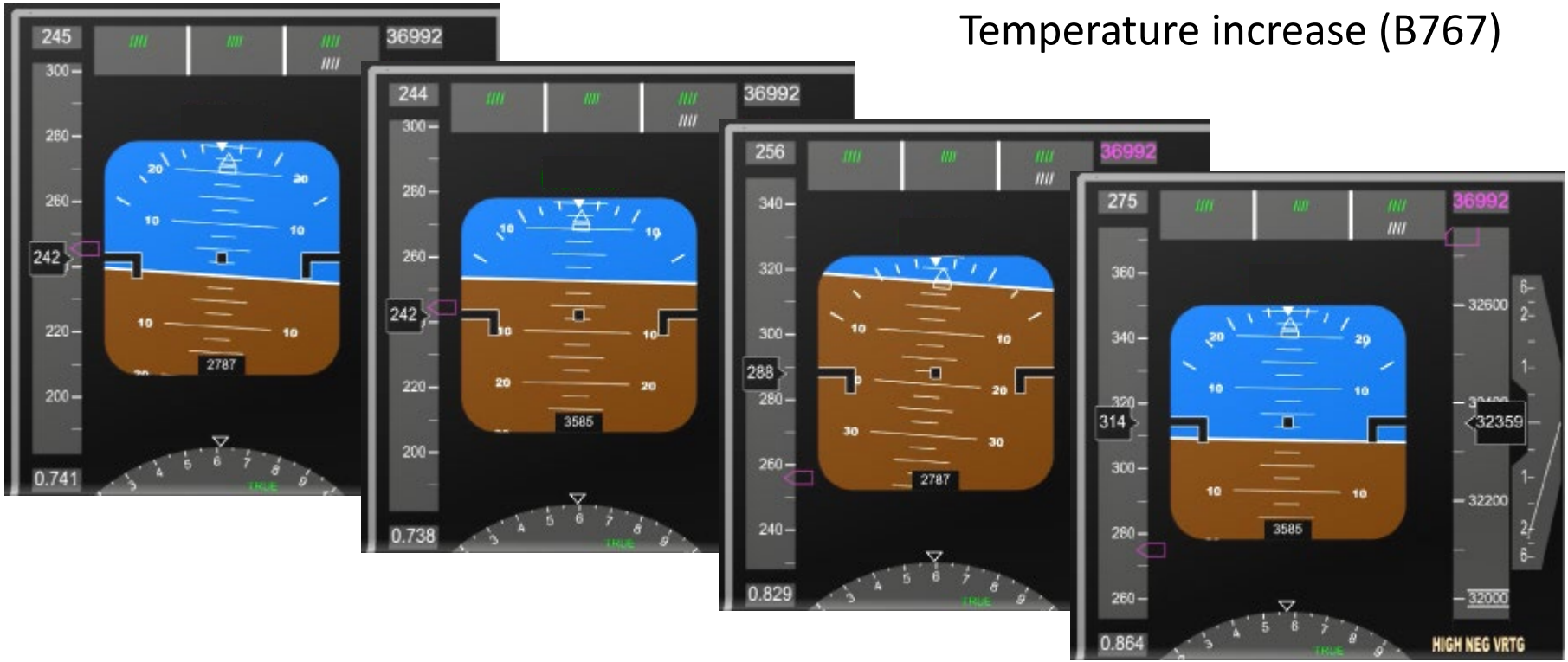
Alternate	**FLL**	**ATL**
Tripfuel	54700kg	56800kg
Blockfuel	59700kg	68700kg
ALTN Fuel	1035kg	8000kg

Additional fuel used with ATL: +2100kg

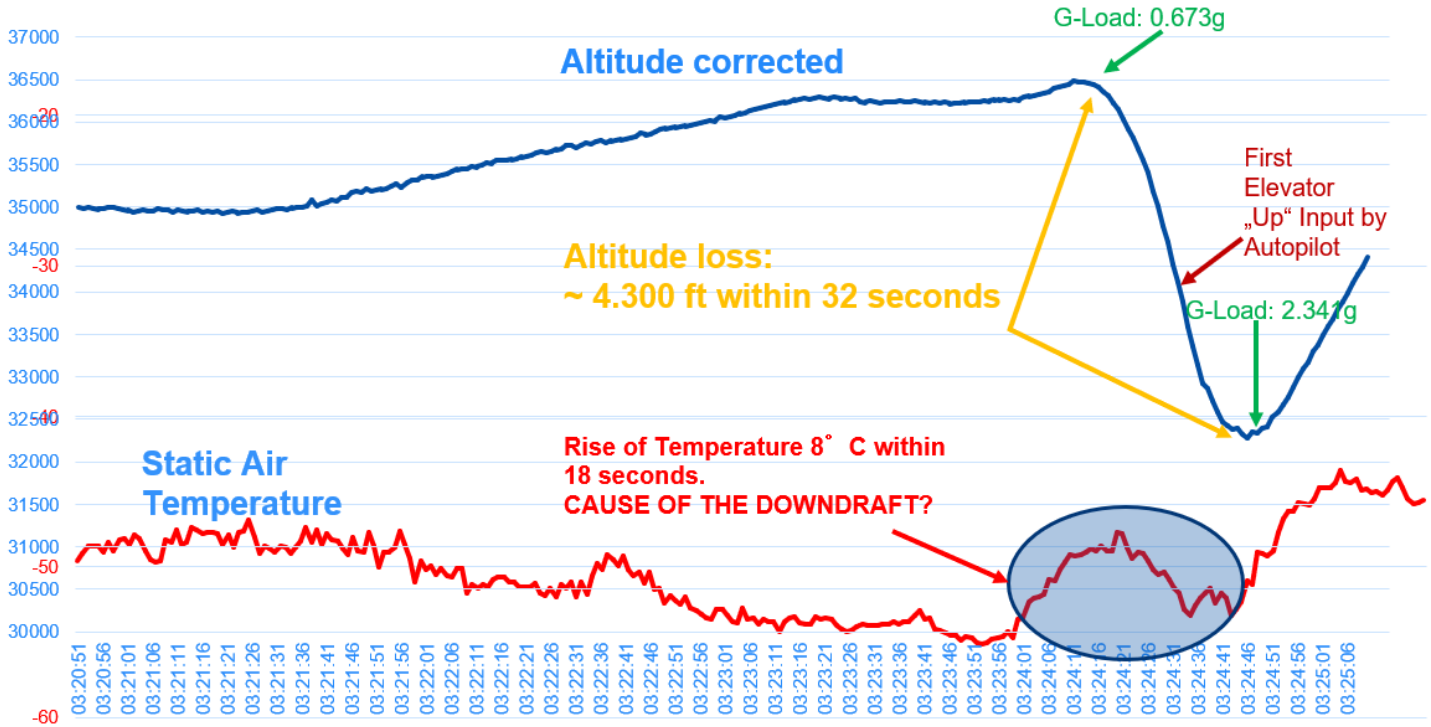
➔ additional CO2 emitted: +6600kg

Case Study: Upset caused by sudden Temperature increase (B767)

Case Study: Upset caused by sudden Temperature increase (B767)



Case Study: Upset caused by sudden Temperature increase (B767)

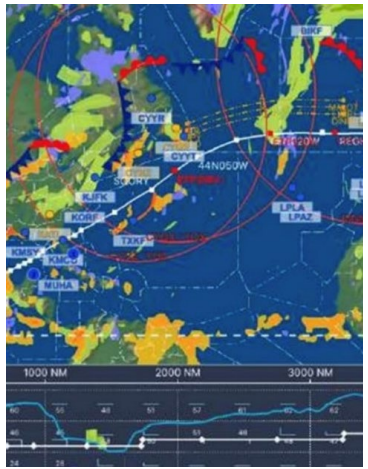


Conclusions / Mitigations

- Equipping flight crew EFBs with SITA eWAS Software – connected aircraft allow continuous updates of situational weather awareness
- Improved flight crew awareness on adverse effects on performance due to climate change / increased appearance of severe weather (e.g. increased awareness regarding inversion temperature conditions that might affect takeoff or enroute performance)
- Routine conduction of flight crew Upset Prevention and Recovery Training (UPRT)
- Use of own developed AODB for optimized aircraft specific takeoff performance

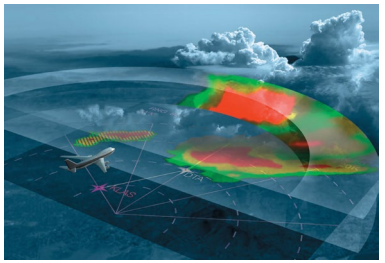
Conclusions / Mitigations

Real-time weather information (turbulence, convective weather, icing)



Flight crew training

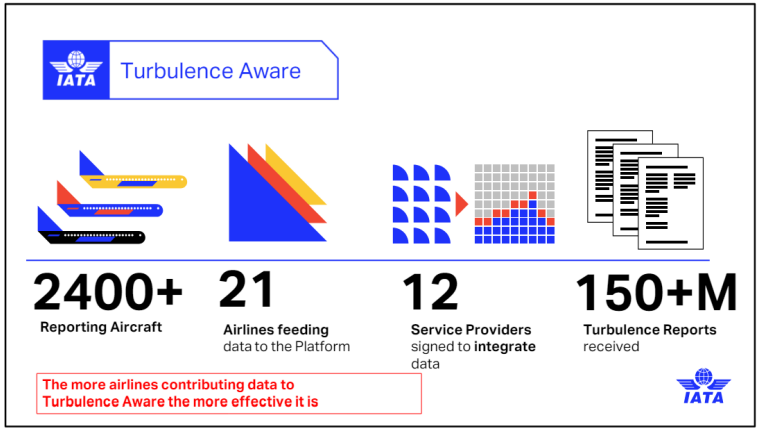
Safety publications, Flight crew awareness

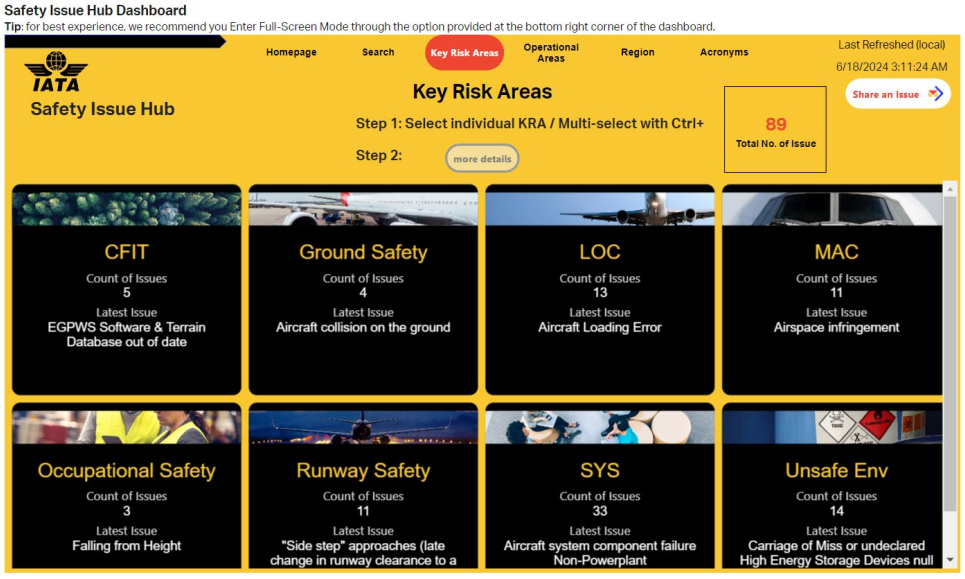


Share the experience (Pireps, Reporting)

Conclusions / Mitigations

- Sharing of information – Turbulence Aware
- Increase reporting
- Refine Strategies
- Optimize resilience





Thank you very much for your attention!

Any questions?

condor

IATA