
WMO Science
for Action

Focus on Airport Meteorology as key enabler for enhanced performance of the European Air Transport System

Real bottleneck is Airport Capacity !!!

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Presentation prepared by Dr. Pümpel and presented on his behalf by Jan Sondij

The fundamental tasks

Aeronautical Meteorology is tasked to improve 4 aspects of aviation:

- Safety, by providing timely and accurate warnings
- Efficiency, by providing the basis for flight planning minimizing total costs
- Regularity, by enabling early mitigating action
- Environment, by helping to reduce fuel burn, GHG emissions and reduce LTO emissions

SAFETY

- Traditionally associated with tactical in-flight decisions (avoidance of convection, turbulence and icing
- With increasing traffic density and high-impact weather, risks of crew stress by unexpected weather hazards (Human error)
- The Black Swan : Unexpected issues (high-level icing, fuel freezing etc)
- Severe hazards often linked to meso-and micro-scale phenomena (hail, wake turbulence, microbursts)

Overlap Safety-Efficiency

Lufthansa Flight Training

Meteorological Effects on Flights

Weather related impacts	Efficiency strong --- weak	Safety strong --- weak
Visibility	●	●
Icing (in-flight)	○	●
Wind	●	○
Thunderstorm	●	●
Turbulence	○	◐
Snow and ice	◐	○
Volcanic ash	○	●
Sand storms	○	●

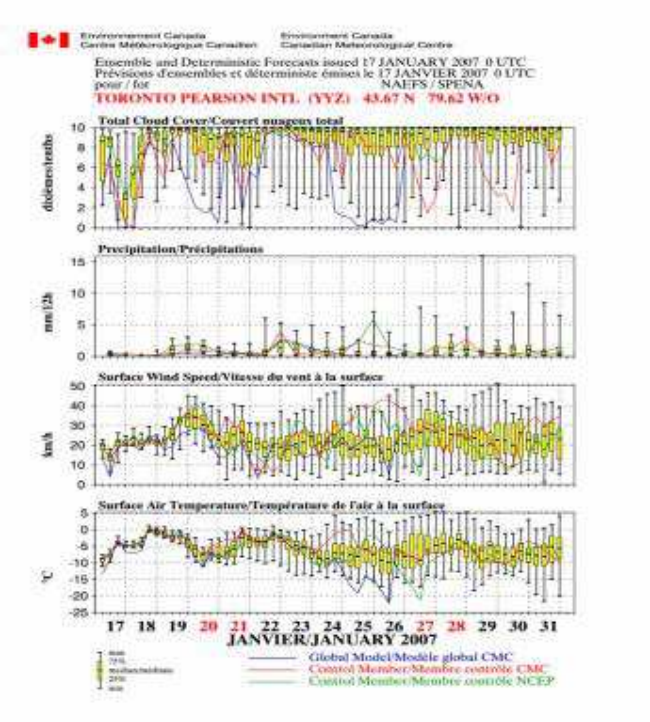
From status paper of german Aviation and Weather Working Group

Regularity

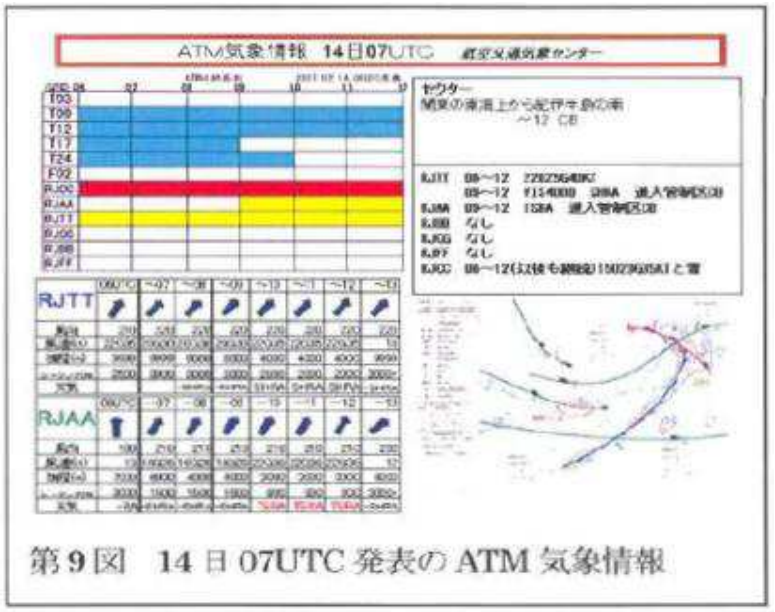
- US studies show that about 70% of flight delays are weather related
- Studies by the European Flysafe Project estimate that up to 80% of serious delays (exceeding 30min) fall in this category
- Only partly avoidable, but pax comfort, crew stress and unnecessary holdings could be reduced by accurate wx fcst

International trend

Ensemble and
Deterministic Forecasts
for Canadian airports
issued by the CMC



Colour coded ATMetC capacity forecast



第9図 14日07UTC発表のATM気象情報

Japan ATMetC time series forecast
from NWP model

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What do we need to observe better?

- In the larger scales, 4D-Variational Analysis schemes have vastly improved the use of remote sensing data (extract useful information from satellite radiances)
- Aircraft data (ADS-B, AMDAR, Mode-S EHS) provide much better detail of vertical profiles and conditions in boundary layer
- Data fusion in the nowcasting time range a challenge

Wake turbulence: A case for improving regularity while maintaining safety

- For Time-based separation, exact knowledge of atmospheric elements in the approach sector crucial
- Forecasts of winds and stability needed in a range of 30-60 min to ensure smooth throughput

  (improved planning!)

Situation at Hub Airports

- Typically capacity limited, in particular during rush hours
- Mix of aircraft categories (anything from medium to xtra heavy)
- This mix puts significant stress on APCH controller (speeds, wake turbulence)

How to square the circle

- Increased number of in-situ and ground-based remote sensing wind observations
- Very high resolution NWP forecasts and nowcasting/forecasting amalgamation
- Very precise measurements in real time to ensure safety where and when forecasts are overtaken by reality

Impact quantification

Need for very close coordination between ATM and MET, as well as operators/crew

Continuous surveillance of match between forecast and reality

Uplink/downlink capability of data and information services

Full integration in emerging SWIM

Adaptation to Climate Change

- Infrastructure investments have a 25-40 year horizon
- Perform studies of local effects of climate variability and change
- Understand and quantify risks to determine mitigating options (investment in improved sensing technology?)

Any Questions?

Thank you for your attention!