



Exploring Extreme Weather Impacts on Transportation System Operations in Europe: Opportunities for Climate Change Adaptation and Mitigation

Aviation and Extreme Weather: Findings from Extreme Weather Impacts on European Networks of Transport Project and Other European Projects

T. Muehlhausen, M. Kreuz



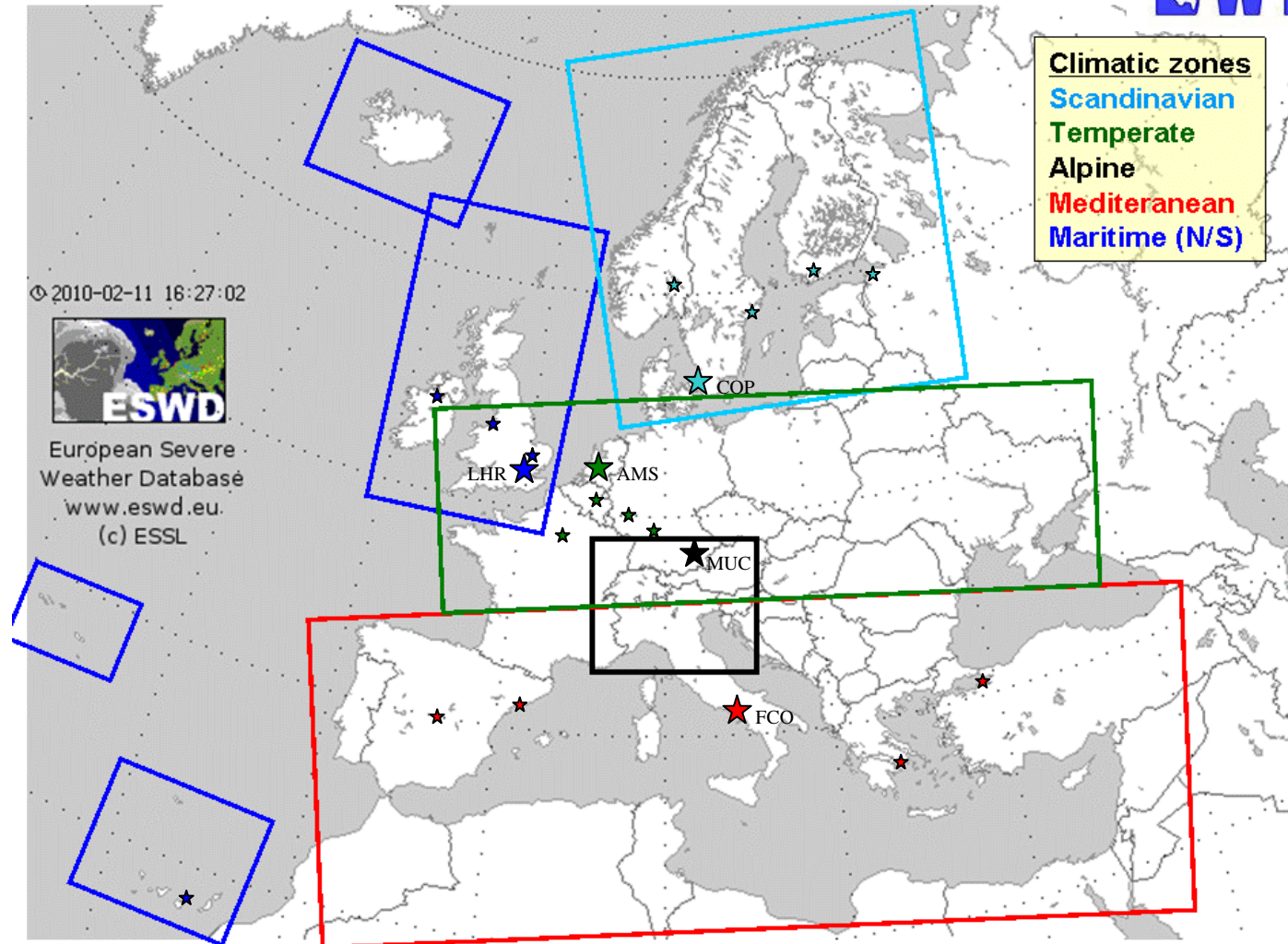
Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft



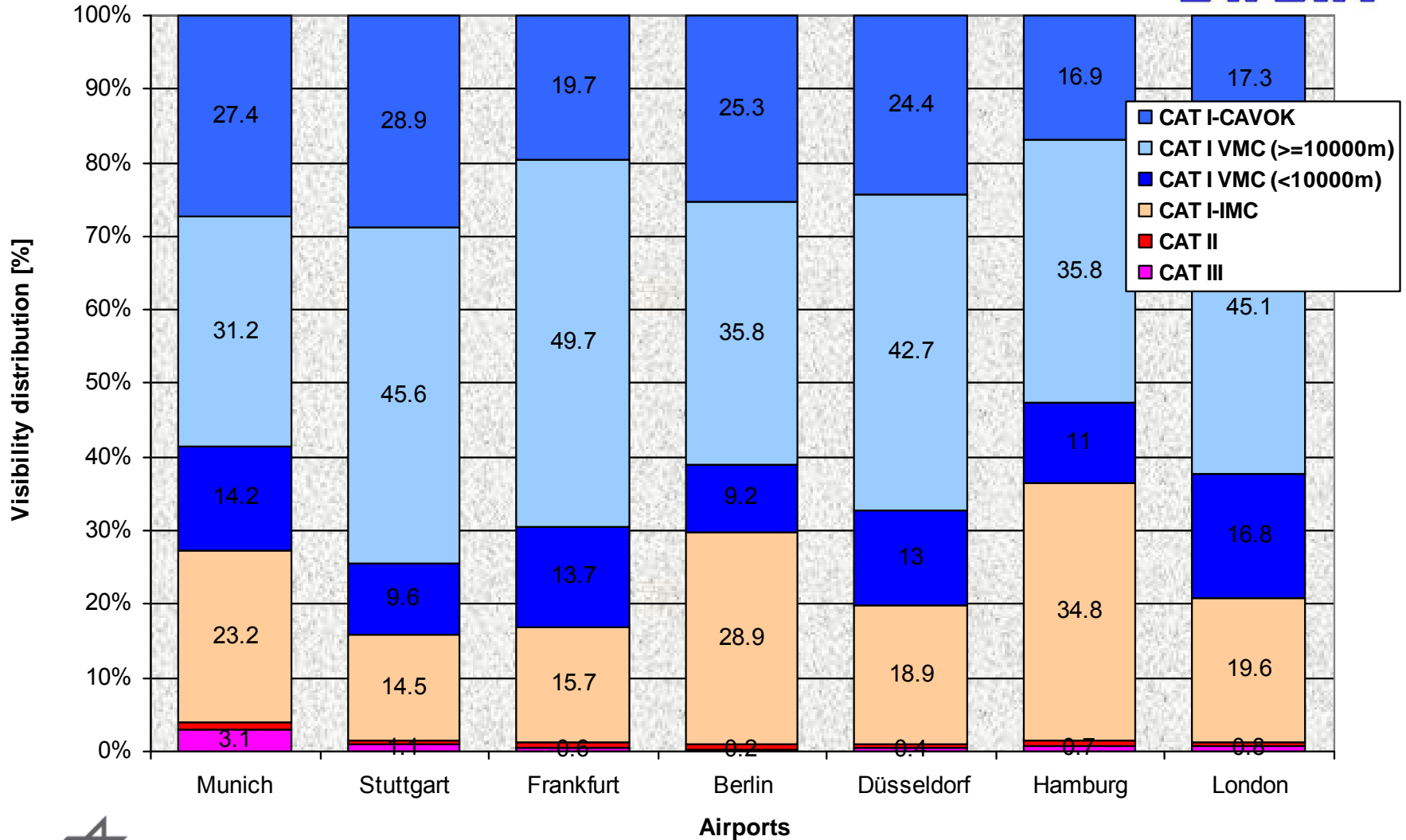
EWENT

Member of  **AT-One**

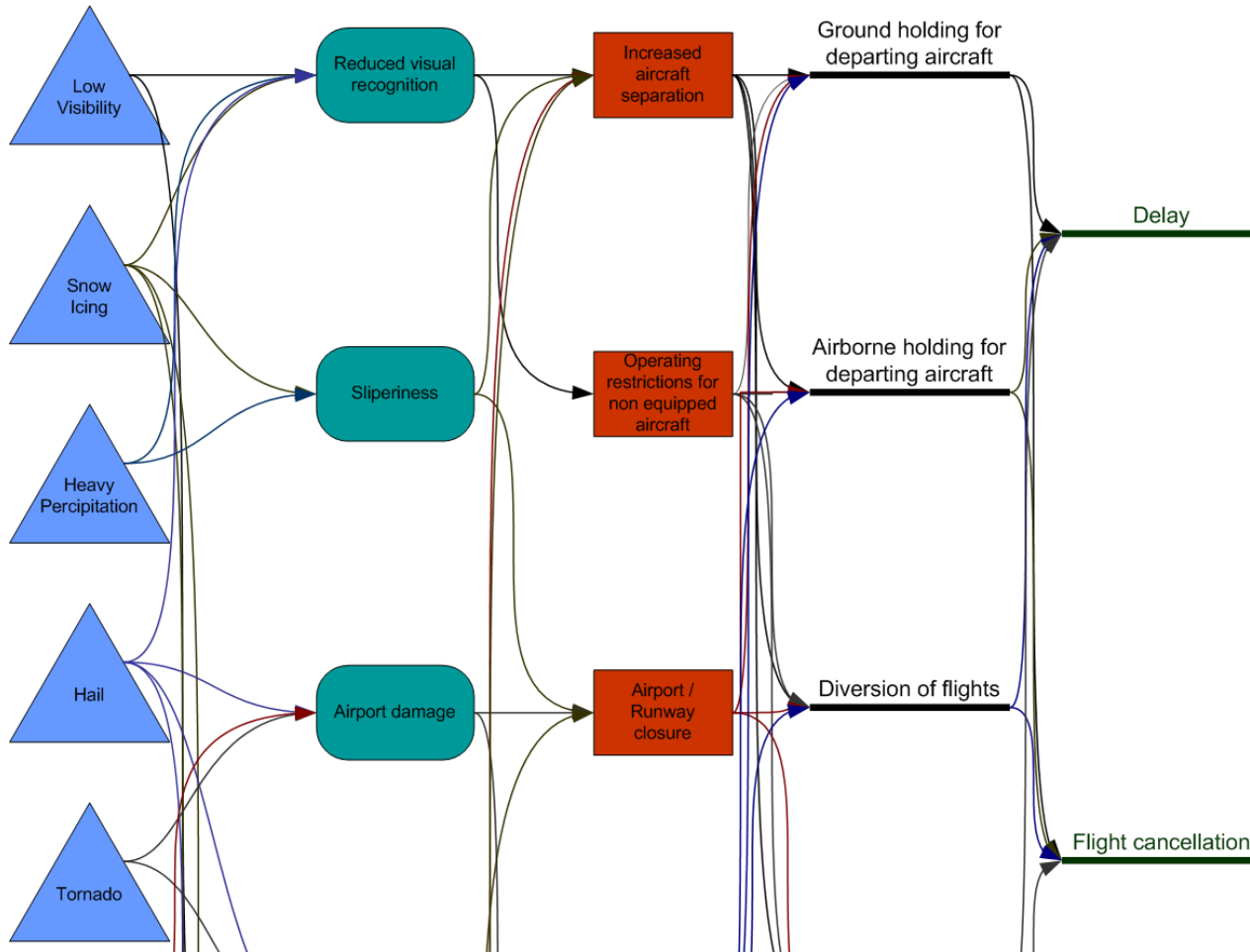
Selected major airports per climate zone **EWENT**



Visibility during winter month at different European Airports (METAR-analysis from 1997 to 2010, 05:00-23:00)



Causal diagram



Examples from Causal diagram

EWENT

➤ **Decreasing Fog** → Reduction of higher separation
→ Increase in capacity → Delay reduction



➤ **Increasing Wind / Thunderstorms** → Runway / Airport closure
→ Decrease in capacity → Delay / Cancellation



➤ **Higher temperature** → Less de-icing → Faster turnaround
→ Increase in capacity → Delay reduction



Traffic safety impacts on aviation



- Low weather thresholds to avoid situations resulting in a harmful event
- Significant influence of even slight weather phenomena on operations
- Adverse weather involved as a contributing or circumstantial factor in many accidents
- High safety level in aviation will not decrease in future



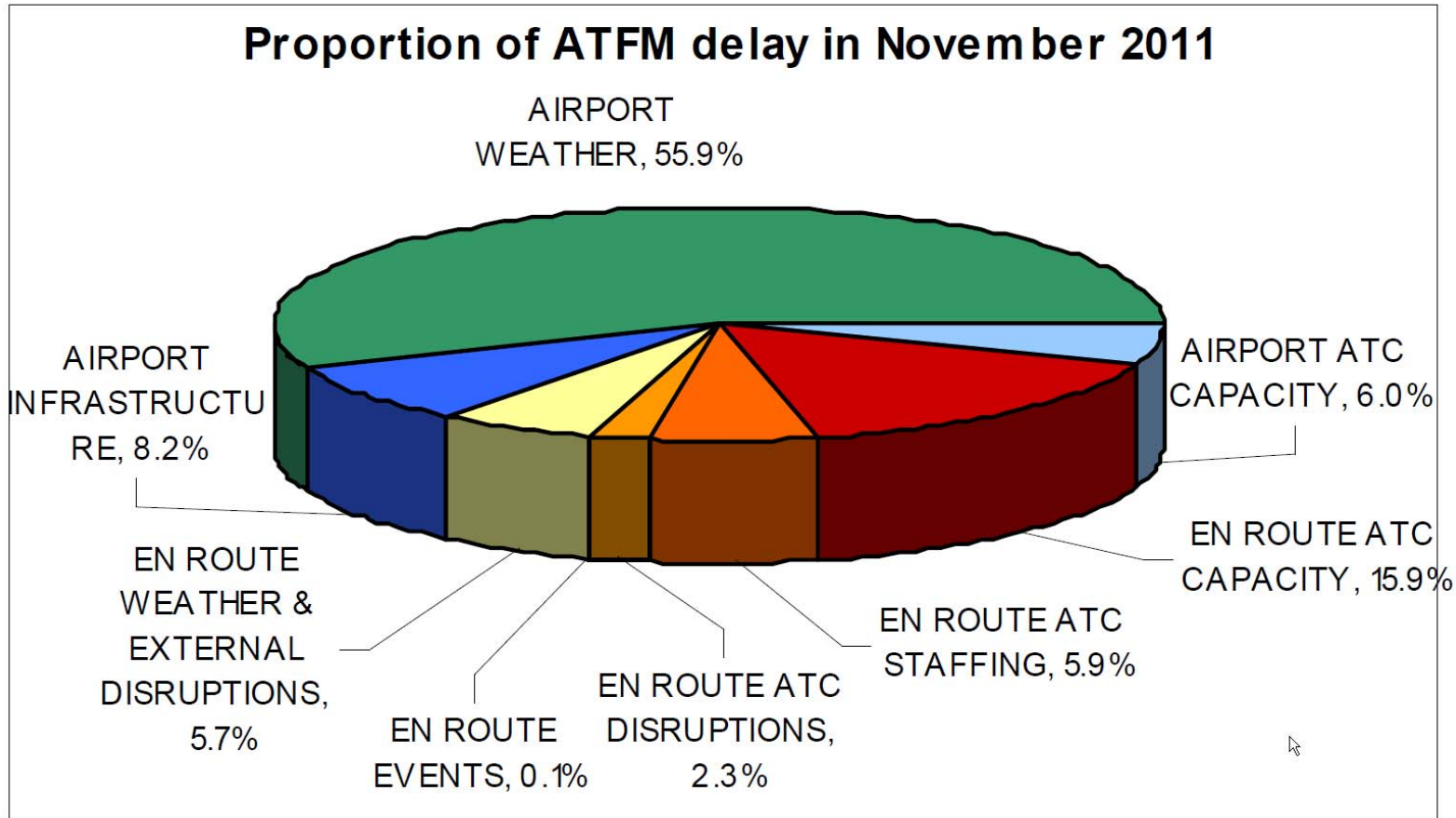
Situation



- Aviation is highly weather dependent
- Main area concerned are the approach, departure and ground operations, i.e. airport and TMA operations
- High safety standards result in change of operations procedures even for small weather effects
- The impact of climate changes on aviation is not predictable for the time being
- Nevertheless, weather will have an increased impact on aviation for another reason...



Weather related delay in air transportation



Source: Eurocontrol Network Operation report Nov. 2011

Example comparison London Heathrow (LHR) vs. Helsinki Vantaa (HEL)

EWENT

- LHR:

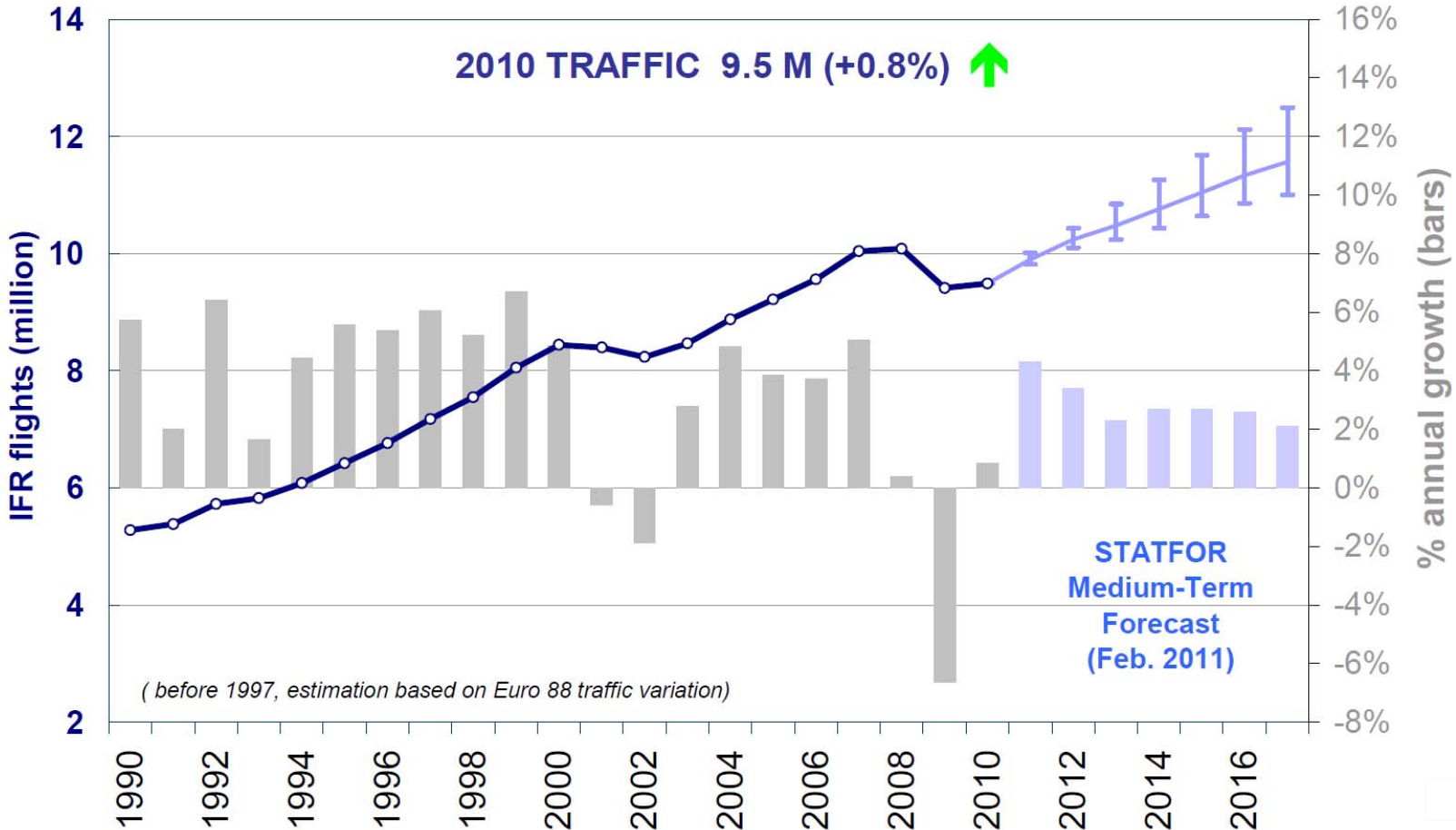
Declared capacity:	88 mv/hr
Departures per year:	239.280 mv (2008)
No. of runways:	2

- HEL

Declared capacity:	80 mv/hr
Departures per year:	92.651 mv (2008)
No. of runways:	3

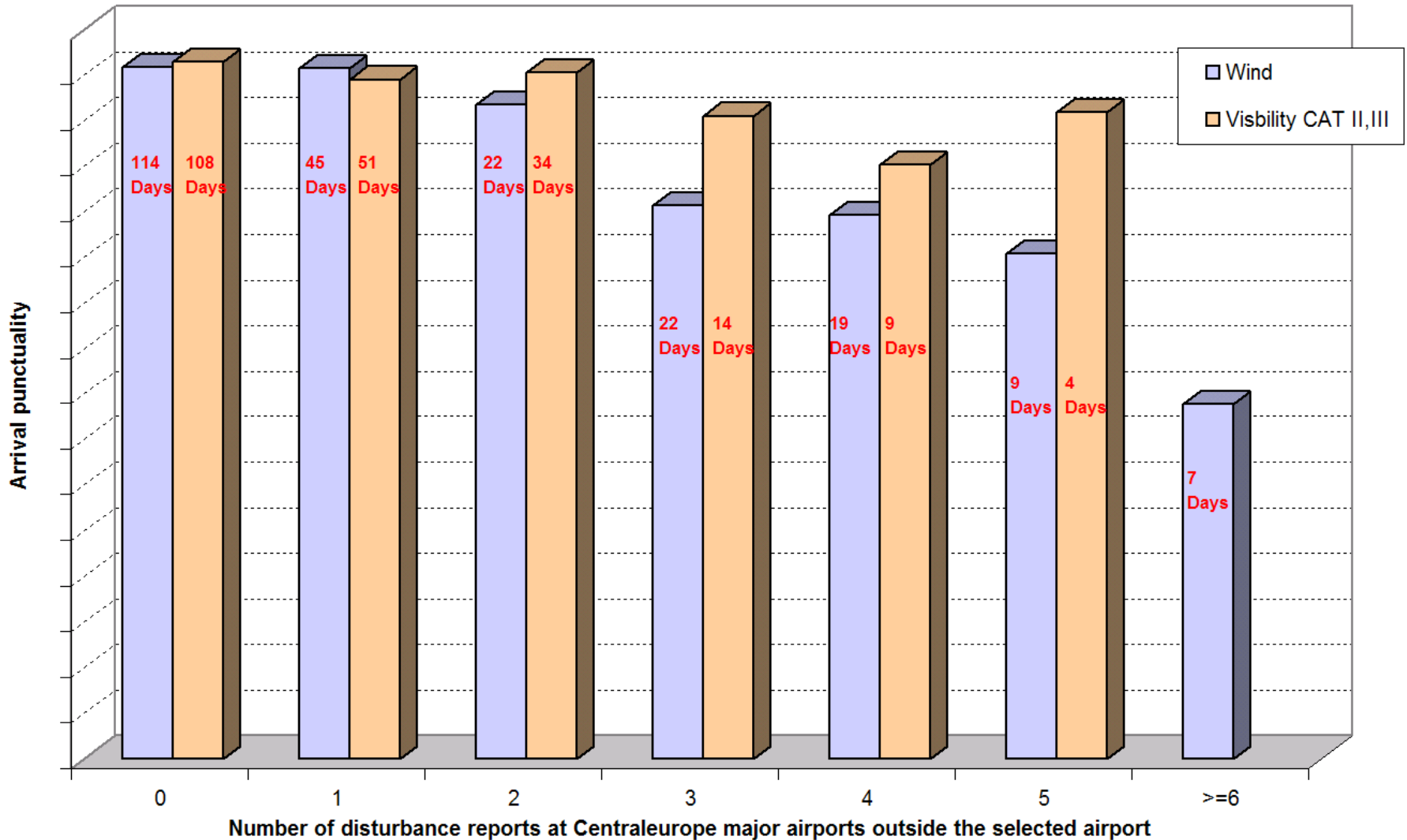
- LHR operates closer to the limit, i.e. is more sensitive for disturbance
e.g. Cleaning a runway from snow

Prognosis



source : EUROCONTROL/STATFOR (ESRA2008)

Weather disturbance reports over a wide area and arrival punctuality at a selected airport (Winter 06/07 und 07/08)



Increasing weather sensitivity



- Increasing number of airports will operate near the capacity limit
- Extension of airports very expensive and not accepted among the society due to environmental impact
- Room for measures against negative weather impacts will decrease
- Network effects worsen the situation
- Delay due to weather phenomena will increase
- New technical and operational options must be developed to reduce weather impacts

Conclusion



- Weather has a great impact on aviation
- Each airport has its own characteristic according to weather phenomena
- Network effects can be significant, i.e. analysis of local weather phenomena is not sufficient
- Quantitative analysis requires case-by-case studies
- E.g. for airports typical hour values can be used for quantifying the consequences of airport closure due to bad weather
- More information at <http://ewent.vtt.fi/>

