Verification and application of statistical forecasts of low visibility and ceiling at Amsterdam Airport Schiphol

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(I) Accurate, reliable and unambiguous information concerning the actual and expected (low) visibility conditions at Amsterdam Airport Schiphol is very important for the available operational flow capacity. Inaccurate and unreliable visibility forecasts have a negative impact on safety and operational expenses. (II) KNMI has performed an update of its visibility forecast system in close collaboration with the main users of the forecasts (Air Traffic Control, the airport authorities and KLM airlines). The automated system comprises NWP Model (Hirlam) output combined with an improved statistical post-processing module (TAF Guidance, TAFG). Output of both is supplied to a forecaster who issues a probability forecast, which is tailored to the operational use at Schiphol airport. (III) Verification of the original and updated system is carried out. (IV) Finally we consider the user's challenge of making an economically well-founded choice going from a complete probability distribution to a categorical decision.

I. Visibility classification and Flow Restrictions

Visibility class	Visibility / RVR[1] (m)		Cloud base (ft)	Capacity [movements per hour]	Flow restrictions
Good	VIS ≥ 5000	and	CLB ≥ 1000	68 arriv. or 74 depart. max 104/108 movements	No
Marginal	1500 ≤ VIS < 5000	or	300 < CLB < 1000	As above but with independent parallel runways	No
LVP [2] phase A	550 ≤ RVR < 1500	or	200 ≤ CLB ≤ 300	56 arriv. or 52 depart. max 80 movements	In general no
LVP phase B	350 ≤ RVR < 550	or	CLB < 200	44 arriv. or 52 depart. max 74 movements	Yes
LVP phase C	200 ≤ RVR < 350			30 arriv. and 17 depart. max 47 movements	Yes
LVP phase D	RVR < 200			16 arriv. and 20 depart. max 36 movements	Yes

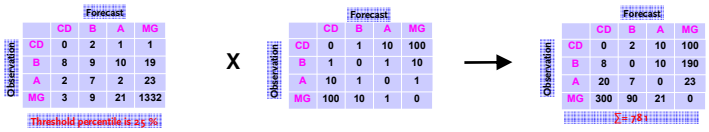
[1] RVR: Runway Visual Range. [2] LVP: Low Visibility Procedure.

IV. Expense analysis

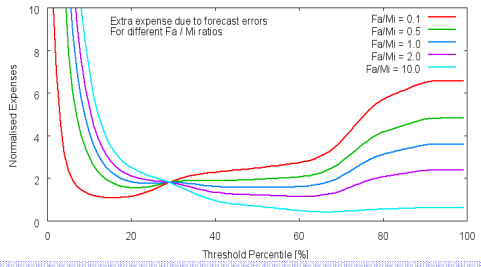
Optimizing the categorical decision

A conceptual methodology has been worked out which shows the potential benefits that can be gained by combining: a) the quality of the probabilistic forecasts and b) the user's sensitivity to false alarms and misses in his categorical decision.

System performance | **User's 'cost' estimation** | **Total expense**

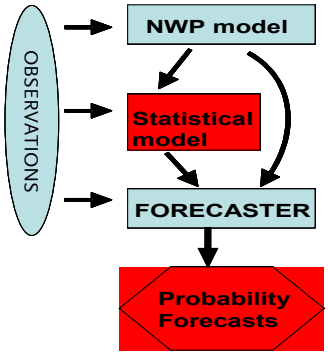


Below, expenses are shown for a number of fictitious users with different ratio of expenses for false alarms and misses (indicated by Fa/Mi) as a function of the threshold percentile that is used in transforming the probabilistic forecasts into categorical ones. The forecasts are the +4 of the new TAFG system over the period 2003-2007.



Minimal expense = Optimal threshold P

II. The forecast cascade



Developments included in the Statistical model TAFC

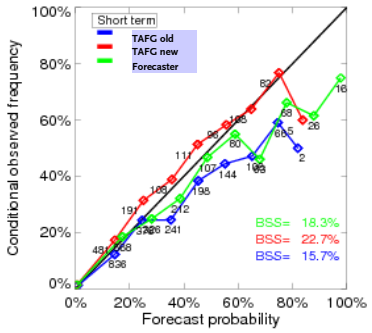
- Local upstream advection predictors
- Background Luminance (BGL) forecast
- RVR in addition to MOR (Meteorological Optical Range)
- Joint probabilities for RVR/CLB combinations

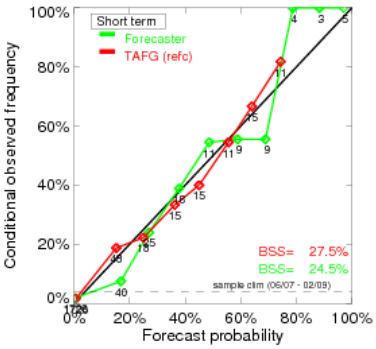
III. Verification results

P visibility class {A,B,CD} , (+3 to +9)

- Top: dependent (jun '03 – may '07)
- Bottom: independent (jun '07 – feb '09)

- **Increased reliability > less overforecasting of low visiblity**
- **Higher Brier Skill Scores (BSS)**
- **Forecaster adds Resolution to TAFG**





Reference KDC-project team (eds. R. ten Hove and J. Wijngaard), 2008: *Improved Low Visibility and Ceiling Forecasts at Schiphol Airport.* Joint publication of KNMI (publication nr. 222) and Knowledge Development Centre (nr. 2008/0089)

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