Evaluation of cloud base height provided by ceilometers and a proposal for a visibility-based quantitative definition for aviation

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General Comments:

This is an interesting and very useful paper concerning the subtle and perhaps sometimes not so subtle differences between Cloud Base Determination using available commercial systems.

It is of very significant importance: Aircraft operations are very significantly dependent on the combination of Visual Range (runway) and Cloud Base Height, providing clearance for taxying, take off and landing, depending on Pilot Certification and whether or not aircraft and Airports are instrumented for Auto-land procedures (dependent, of course, also on whether or not the Pilots are also suitable certified and current.

Private Pilots and Helicopter Operations (including "Rescue" helicopters) are in particular affected by Cloud Base. Regrettably, there have been and continue to be far too many very serious accidents where Pilots have lost control at low altitude, particularly attempting to land in marginal Cloud Base / visibility situations. The authors also rightly raise the matter of slant visibility (3 or 3.5 degree flight path to landing), often (from personal experience!) much worse than the CBH quoted by ATC.

In general: Aviation invariably uses "feet" not metres for everything from runway length, to altitude and "Flight Levels" and the critical information on Approach Charts (+ all charts for Standard Instrument Departure and Standard Arrival Routes for Commercial Aviation).

While for everything "scientific" – I always use metres (300+ fully-published research papers) – for everything involving aviation, I use "feet". The authors should note and accommodate – the aviation world which has potentially much to gain from this study.

The aviation world will totally ignore the paper and its valuable conclusions unless the relevant values are quoted in "feet"!

Detailed Comments:

Intro:

Line 38

….. In contrast, the large majority of helicopter pilots fly according to visual flight rules (VFR), as do the majority of private pilots.

….. The rules for low visibility operations are specified by EASA (2025) and by FAA and CAA recommendations. Rescue helicopters in particular need accurate and reliable reports on current weather conditions, as rescue operations cannot be carried out in "significant weather" conditions (e.g. low ceiling and dense fog). For private pilots, the vast majority of whom do not hold Instrument Ratings and who may not fly as regularly as holders of ATPL or Commercial Pilots, the issue of landing when the slant range visibility or cloud base conditions are at or below recommended limits involve very serious matters of personal safety. Thus, the issue of the accuracy of cloud base determination and slant range visibility extends far beyond the financial considerations that are important for airlines and freight carriers into critical real-time life/death decision making.

Line 125:

Measurements should help to ….. ???

Line135:

…. then a photo was taken every 1 min and otherwise every 10 min. ???

Figure 5: (similar for all the other related figures!

The two parts of this figure contain an enormous amount of highly relevant data.

Part A (above) in particular is very hard to interpret, due to the large number of parameters and the great difficulty for the reader (i.e. me!) to distinguish between the varied symbols.

I would strongly suggest making the symbols clearer and more distinguishable, perhaps by further sub-dividing the contents to separate displays (i.e. A, B, C, D??)

Secondly, universally within global aviation fleet, as opposed to metres is used for height.

- **The right-hand axis (all Figures!) must show the equivalent markers in feet.**
- **Similarly, key values in the text would be better with feet and metre values!**

Minimum heights are variably in the range 200 – 800 FEET. The values can be found on all approach charts and are always quoted by ATC in feet for landing clearance.

These values are sacrosanct – break the value and the pilot is automatically found to be at fault in the case of an accident.

Even if there is no accident, the Pilot may well be summoned to the Tower to explain his actions – followed by a severe reprimand (verbal by ATC, probably followed up by a letter from FAA, CAA etc. This may include a demand for an "interview" where the Pilot has to convince FAA, CAA why the Pilot Licence should not be withdrawn immediately!

For approaches to airports at "minimums", one finds the apparent conflict: For non-auto-land procedures, the values are always substantially higher for visual approaches performed by PPLs than (say) the values for holders of ATPL certificates (holding current IR certification).

"Get-home-itis" is the cause of far too many very serious landing accidents by PPLs in particular (but not exclusively!) – pushing the limit of slant visibility of the airport approach lights beyond reason, then failing to cope with the high work-load + stress and fatigue factors – all combining to then lose control at a low and unrecoverable height above ground.

A "go-around" using approved routing would almost certainly involve climbing into solid cloud and then following the IFR procedure meticulously – for which the vast majority of PPLs are simply not trained, not qualified and also totally mentally unprepared.

Thus "Get-home-itis" – a dive (in extremely limited forward visibility) toward where the Pilot "thinks" the runway should be, likely causes loss of orientation, a failure even to keep "wings level" – with far too often subsequent dire consequences.

- **Thus, the importance of this excellent piece of work!**

Lines 345 – 355:

Perhaps the values given here – which are important – would be easier to follow if presented in a Table?

Same for Lines 360 +/-.

Summary:

With the exception of the metres / feet issue, it states the case. Forecast for "Operational"??

Referee's note:

I've worked on many Atmospheric Lidar Systems since before 1970 Sodium – RMR – Doppler Lidar etc.

I still operate my own useful Aerosol Lidar and I have been significantly involved in each of the four ISO Lidar Standards (being project lead for No. 3).

I was also involved significantly in NASA's developments for ICEsat and in early development work on ESA's Aeolus and EarthCARE Lidar Receiver Systems.

I have a UK PPL with UK IMC, "complex" and Twin Ratings, plus obtained a US Single-Engine Instrument Rating, based on my US PPL. Among 1000 odd hours as PIC, I have logged 120 hours under IFR – all flown by hand, rather than using "automation". Given UK weather, I have considerable experience of flying at or very close to "minimums" on landing.

However, I have always swatted up the "Go-Around" procedure in advance and I always had the details of the full procedure "on my lap" in the event required! With the US IR, I had the experience and confidence to perform the procedure, as actually required on two occasions.