Review for Atmospheric Chemistry and Physics Discussions

Ceilometers as planetary boundary layer detectors and a corrective tool for ECMWF and COSMO NWP models, *by L. Uzan et al.*

General comments

This paper addresses the daytime summer PBL height throughout Israel, by combining measurements from eight ceilometers, radiosonde profiles (at one location), along with simulations from the global IFS and the regional COSMO models. In particular, it focuses on the analysis of three PBL height evaluation methods: the bulk Richardson method, the parcel method, and the wavelet covariance transform method.

Although there is no doubt that determining the mixing height is important, the scientific community has done extensive research and progress so far on the daily boundary layer. However, there are still significant problems as well as gaps in the night boundary layer (stable conditions) and in the transitional periods. These periods cannot be omitted in a study when referring to the importance of mixing height in the formulation of concentrations and even more when one of the main initiatives is to designate ceilometers as a correction for NWP. The statement on line 218 is not appropriate for the exclusion of the nighttime period. Also, the methodology applied by the authors for the reliability of PBL estimation from ceilometers data, raises many reservations. I personally could not find the value of this research effort. Concluding, I believe that the whole processing of the subject is rather limited, covers a very short period and it is of local interest only. Therefore, I do not agree that this study is published to the ACP Journal.

More specific comments

- I wonder if we could perform a similar exercise for an area with restricted characteristics, thus no general applicability. This is the case here, where local flows are developed but there are not taken into consideration. In particular, both sea breeze and/or anabatic winds are expected to develop in this area during the summer period. For this reason, I am not sure what ceilometer is measuring. For example, at the station of DB just 7km away from the shore, the PBL depth is measured at 1km. To my knowledge, this is an unrealistic value (too high) under the presence of sea breeze (or IBL). Thus, I wonder if this instrument finally shows the off-shore current of the sea breeze flow.
- The PBL depth is a non-specific parameter, the definition and estimation of which is not straightforward. The simulated PBL depths are mainly determined, based on the definition that each PBL scheme applies (*in this study, no information is provided regarding the PBL parameterization schemes considered by the two models*). This also applies between measurements from different instruments (ceilometer and radiosonde) as they do not have the same operating principles.
  The ceilometer measurements mainly present the mixed PBL that does not always coincide with the simulated PBL depth.

On the other hand, has it been taken into account that the radiosonde moves with the flow? As it ascends the measurements do not correspond to the vertical position above the launch point. This is another reason of possible discrepancy between the radiosonde and ceilometer measurements.

- Therefore, the same criteria should be used for the estimation of both measured and simulated PBL depth. In particular, the same criteria should be applied to the profiles of certain atmospheric parameters, such as temperature, wind and mixing ratio profiles that depict the atmospheric boundary layer structure. These criteria should not necessarily be the same for all the atmospheric conditions. For example, the gradient of potential temperature profile is inadequate to provide the turbulent ABL depth. Therefore, for the comparison with ceilometer, it would be more appropriate to consider the eddy-viscosity simulated profiles or even better the aerosol layering from chemistry transport model simulation.

- In particular, under convective conditions, the mixing height determined by ceilometer is strongly related to the aerosol stratification.

- How much value does the global model have in such a small analysis to take part in the comparison, especially in a strongly heterogeneous area?

Also, there are several arbitrary statements on the text, without any justification (no measurements of wind speed and direction are provided) or any reference. For example: line 105, As a result, the average PBL height is comparatively low (~ 1000 m a.g.l)

line 116, Through the day, the sea breeze circulation steers clockwise and the wind speed is enhanced by the west-north-west synoptic winds

line 119, Due to the large distance (~30-50 km inland), the SBF reaches the eastern elevated complex terrain only in the afternoon (~ 11-12 UTC)

line 170, However, the PBL detection algorithm utilized here (see Sect. 5.3) is based on a significant signal slope, therefore can be determined from uncalibrated ceilometers.

Line 203, Does the bulk Richardson refer to a certain height or a layer?

Lines 265-end of this paragraph. I am confused.