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***Interactive comment on* “Continuous atmospheric boundary layer observations in the coastal urban area of Barcelona, Spain” by M. Pandolfi et al.**

Anonymous Referee #2

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The paper deals with the investigation of the Surface Mixing Layer and the Decoupled Residual/Convective Layer (DRCL) at a coastal site in the west Mediterranean basin, by using a variety of instruments, such as ceilometer, radiosoundings, sunphotometer and an Optical Particle Counter. The effects of synoptic circulation are inferred by classifying the circulation patterns in three categories: - North African - Cold Atlantic - Regional/stagnation. The experiment is well described and the discussion is clear as well as the pictures. However, I have to report some observations: - Beyond the numerical characterization of the variables discussed (height of the SML, value of backscatter coefficient), diurnal cycles, the conclusions are not clear. It is not very clear which is the main aim of the work. - The diurnal cycles of the SML and the DRCL from fig. 1 are somehow strange. The lowest values of the SML are around 400 m even during nighttime. Is this reasonable? The nocturnal mixing layer is expected to be very shal-

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low, being the driving turbulence very weak. The dynamics is extremely low. In what measure can the incomplete instrument overlap contribute to an overestimation of the SML? - The SML does not reach the same height of the DRCL at midday. It seems that these layers never merge and interact. Please, discuss this point. - The backscattering values declared (between 0.3 and 1.2 Mm⁻¹ sr⁻¹) make sense, since the molecular backscattering at 1064 nm is around 0.07 Mm⁻¹sr⁻¹ at ground. This leads in a backscatter ratio ranging from 4 and 17. However, it is not clear how the backscattering coefficient is estimated from lidar data. Is any inversion procedure performed? In case yes, it should be discussed. In case not, the error arising from the aerosol extinction should be quantified. - How reliable is the Pm1 concentrations measured with the OPC? This could be a cause of underestimation of the PM1. This should be discussed in some detail. - On the basis of what indices are the atmospheric scenarios classified? Backtrajectories, Model wind fields, . . . - As far as I know, sea breeze in the afternoon cleans the atmosphere very efficiently, making the determination of the SML often very hard. How reliable are the automated inversions of the ceilometer data in such conditions? This could introduce a bias in the daily cycles, especially for the “Regional” scenario. - Fig. 1 is hard to read. Enlarge it if possible or find a different visualization. - The correlation between ceilometer-derived SML heights and radiosoundings does not add much to the study, apart from a validation of the algorithm. It looks unnecessary unless - In the discussion, some specific events are discussed. Anyway, the SML heights are always considered reliable, even in case of strong wind advection. Yet, the removal/advection of aerosols are known as the major source of error of boundary layer estimation from lidar data. The reliability of lidar-derived SML height should be discussed and proved for such cases.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 345, 2013.

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