The authors would like to thank the editor and reviewers for their constructive and valuable comments. Accordingly, point-by-point answer is given as follows:

Referee #2

(1) How the gravity wave hypothesis can explain the diurnal cycle of the BLH? Is this due to tidal effects similar to that of gravity waves, or due to tidal modulation of gravity waves through their interaction, or both?

Great thanks to the reviewer for this important question!

Basically, we believe that the interaction between gravity waves and the BLH might be similar to that between tide and gravity waves. Existing literature did not clearly focus on how the gravity wave hypothesis can explain the diurnal cycle of the BLH. However, concise review of the interactions between tide and gravity waves may help to understand the impact of gravity waves on the BLH diurnal cycle.

In fact, as reported by Williams et al. (1999), tide presents diurnal cycle in amplitude. Moreover, observational and modeling studies found that interactions between tide and gravity waves could result in significant modifications of the tidal diurnal cycle (Fritts and Vincent, 1987;Meyer, 1999). Momentum deposition by gravity wave could alter the background wind (by acceleration or deceleration), and significantly modulate the diurnal tidal structure (amplitude, phase and location of peaked amplitude and vertical wavelength etc.) as reported by Liu et al. (2013), Thayaparan et al. (1995), and England et al. (2006). Reciprocally, the evolution of gravity wave (breaking or saturating process) could also be profoundly modulated by the tidal wave (Liu et al., 2000;Preusse et al., 2001). In addition, eddy diffusion from breaking gravity waves was also found to have strong influence on tidal amplitudes (Meyer, 1999). Thus, by considering the fact that the BLH also presents diurnal cycle (same as tide), its interactions with gravity waves might plausibly be similar to those between tide and gravity waves.

England, S. L., Dobbin, A., Harris, M. J., Arnold, N. F., and Aylward, A. D.: A study into the effects of gravity wave activity on the diurnal tide and airglow emissions in the equatorial mesosphere and lower thermosphere using the Coupled Middle Atmosphere and Thermosphere (CMAT) general circulation model, J. Atmos. Sol.-Terr. Phy., 68, 293-308, http://dx.doi.org/10.1016/j.jastp.2005.05.006, 2006.

Fritts, D. C., and Vincent, R. A.: Mesospheric Momentum Flux Studies at Adelaide, Australia: Observations and a Gravity Wave–Tidal Interaction Model, Journal of the Atmospheric Sciences, 44, 605-619, 10.1175/1520-

0469(1987)044<0605:mmfsaa>2.0.co;2, 1987.

Liu, A. Z., Lu, X., and Franke, S. J.: Diurnal variation of gravity wave momentum flux and its forcing on the diurnal tide, J. Geophys. Res:Atmos., 118, 1668-1678, 10.1029/2012jd018653, 2013.

Liu, H.-L., Hagan, M. E., and Roble, R. G.: Local mean state changes due to gravity wave breaking modulated by the diurnal tide, J. Geophys. Res:Atmos., 105, 12381-12396, 10.1029/1999jd901163, 2000.

Meyer, C. K.: Gravity wave interactions with the diurnal propagating tide, J. Geophys. Res:Atmos., 104, 4223-4239, 10.1029/1998jd200089, 1999.

Preusse, P., Eckermann, S. D., Oberheide, J., Hagan, M. E., and Offermann, D.: Modulation of gravity waves by tides as seen in CRISTA temperatures, Adv. Space Res., 27, 1773-1778, http://dx.doi.org/10.1016/S0273-1177(01)00336-2, 2001.

Thayaparan, T., Hocking, W. K., and MacDougall, J.: Observational evidence of tidal/gravity wave interactions using the UWO 2 MHz radar, Geophys. Res. Lett., 22, 373-376, 10.1029/94GL03270, 1995.

Williams, P. J. S., Mitchell, N. J., Beard, A. G., Howells, V. S. C., and Muller, H. G.: The coupling of planetary waves, tides and gravity waves in the mesosphere and lower thermosphere, Adv. Space Res., 24, 1571-1576, http://dx.doi.org/10.1016/S0273-1177(99)00881-9, 1999.

(2) As mentioned in the paper, the topography and meteorological conditions were favorable for the generation of gravity waves. Is there any observational evidence showing the existence of the gravity waves and strong vertical mixing associated with the waves during the discussed observation period? Such evidence would be a strong support to the hypothesis.

Special thanks to the reviewer for such comment!

Actually, before officially disclosing the data for the present study, an intensive observation campaign of gravity wave evidence over Beijing was previously conducted from April 2010 to September 2011(Gong et al., 2013). Thus, during more than two years campaign, daily and seasonal vertical mixing wavelengths and phase velocities of 162 quasi-monochromatic gravity waves associated with the topography (impact of surrounding mountainous plateaus, in particular the Qinghai-Tibet Plateau) and meteorology were observed over Beijing from Lidar. Moreover, as reported by the authors, statistical analysis of the captioned campaign revealed that gravity waves were notably maximal in summer (June-August), corresponding practically to discussed observation period of the present study (1 July-15 September). In short, findings reported by Gong et al. (2013) serve as potential evidence of gravity wave and strong support of the present study on the development of new algorithm for BLH determination from Lidar. The present complementary information has been integrated into the manuscript (Section, 3.1 Rationale and Scientific Basis).

3 Development of a New Algorithm

3.1 Rationale and Scientific Basis

As evoked in previous Sections, heavy pollution and propagation of gravity waves critically limit the accuracy of current retrieval algorithm in determining the BLH from Lidar. Beijing is characterized by favorable conditions to generate and maintain gravity waves in particular due the presence of Qinghai-Tibet Plateau in the west, which is considered as potential source of gravity waves in Beijing (Gong et al., 2013). In fact, during more than two years campaign (from April 2010 to September 2011), daily and seasonal vertical mixing of wavelengths and phase velocities of 162 quasi-monochromatic gravity waves were observed over Beijing from Lidar (Gong et al., 2013). Moreover, statistical analysis of the captioned campaign revealed that gravity waves were maximal in summer (June-August), corresponding practically to discussed observation period of the present study (1 July-15 September). In clear, such finding serves as potential observational evidence of gravity wave and strong support of the present study. According to the research of Global Atmospheric Sampling Program, the gravity waves generated by the mountains are ~2-3 times higher than those generated by plains and oceans and ~ 5 times higher than those from other sources (Fritts and Alexander, 2003). Heavy air pollution episodes frequently occur in Beijing with stagnant meteorological conditions that maintain the gravity waves (Gibert et al., 2011).

Fritts, D. C., and Alexander, M. J.: Gravity wave dynamics and effects in the middle atmosphere, Rev. Geophys., 41, 10.1029/2001rg000106, 2003.

Gong, S., Yang, G., Xu, J., Wang, J., Guan, S., Gong, W., and Fu, J.: Statistical characteristics of atmospheric gravity wave in the mesopause region observed with a sodium lidar at Beijing, China, J. Atmos. Sol.-Terr. Phy., 97, 143-151, 10.1016/j.jastp.2013.03.005, 2013.

Gibert, F., Arnault, N., Cuesta, J., Plougonven, R., and Flamant, P. H.: Internal gravity waves convectively forced in the atmospheric residual layer during the morning transition, Quart. J. Roy. Meteor. Soc., 137, 1610-1624, 10.1002/qj.836, 2011.