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Determining Atmospheric Boundary Layer Height with Numerical Differentiation Method Using Bending Angle Data from COSMIC

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This paper presents a new method to estimate the height of atmospheric boundary layer (ABL) by using COSMIC radio occultation (RO) bending angle (BA) data: using the numerical differentiation method combined with the regularization technique, the first derivative of BA profiles is retrieved, and the height at which the first derivative of BA has the global minimum is defined to be the ABL height. To reflect the reliability of estimated ABL heights, the sharpness parameter is introduced, according to the relative minimum of the BA derivative. Then, it is applied to four months of COSMIC BA data (January, April, July, and October in 2008), and the ABL top heights estimated are compared with two kinds of ABL heights from COSMIC data products and with the heights determined by finite difference method upon the refractivity data. The results show: for sharp ABL tops (large sharpness parameters), there are little differences between different ABL heights, namely, the uncertainties due to different methods are small; for non-sharp ABL tops (small sharpness parameters), there exist big differences in ABL heights obtained by different methods, which means large uncertainties for different methods. The results in the present paper show that the application of the numerical differentiation method combined with the regularization technique to COSMIC BA data is a good choice, and has further application value.