We are grateful for the detailed revision of our manuscript and appreciate the valuable comments and suggestions that greatly helped us improve our work. We will address all the issues point by point.

Answers to Referee #2's comments:

1) ***The noontime SO_2 peaks have been already reported by several previous works in Beijing (e.g. Wang et al., 2006; Gao et al., 2013) and other locations in China (e.g. Ding et al., 2013). It looks that there may be some difference in rural and urban sites. In urban sites, SO_2 pattern generally have morning and evening peaks because of influence of local emission. This referee suggest that the authors make a throughout comparison on results at the two different type of sites.***

   We thank the referee for the valuable suggestion. We added further discussions on the noontime SO_2 peak phenomenon reported in past studies into the introduction part. Additionally, in the summary section we concluded that the different occurrence frequencies of noontime peak phenomenon and the different contribution of each process to each site are responsible for the distinct noontime peak occurrence times in the long-term averaged diurnal profiles at the different types of sites.

2) ***The authors mentioned about the Mountains Yan and Taihang, the North China Plain and mountain breezes, it will be better to add a topographical map in Figure 1, in which clearly demonstrate the geographical location of the study regions.***

   Thank you for this suggestion. Accordingly, we added several contour lines showing the topographical height of the terrain in the North China Plain and the location of the Taihang and Yan Mountains are marked in the revised Figure 1 (see below).

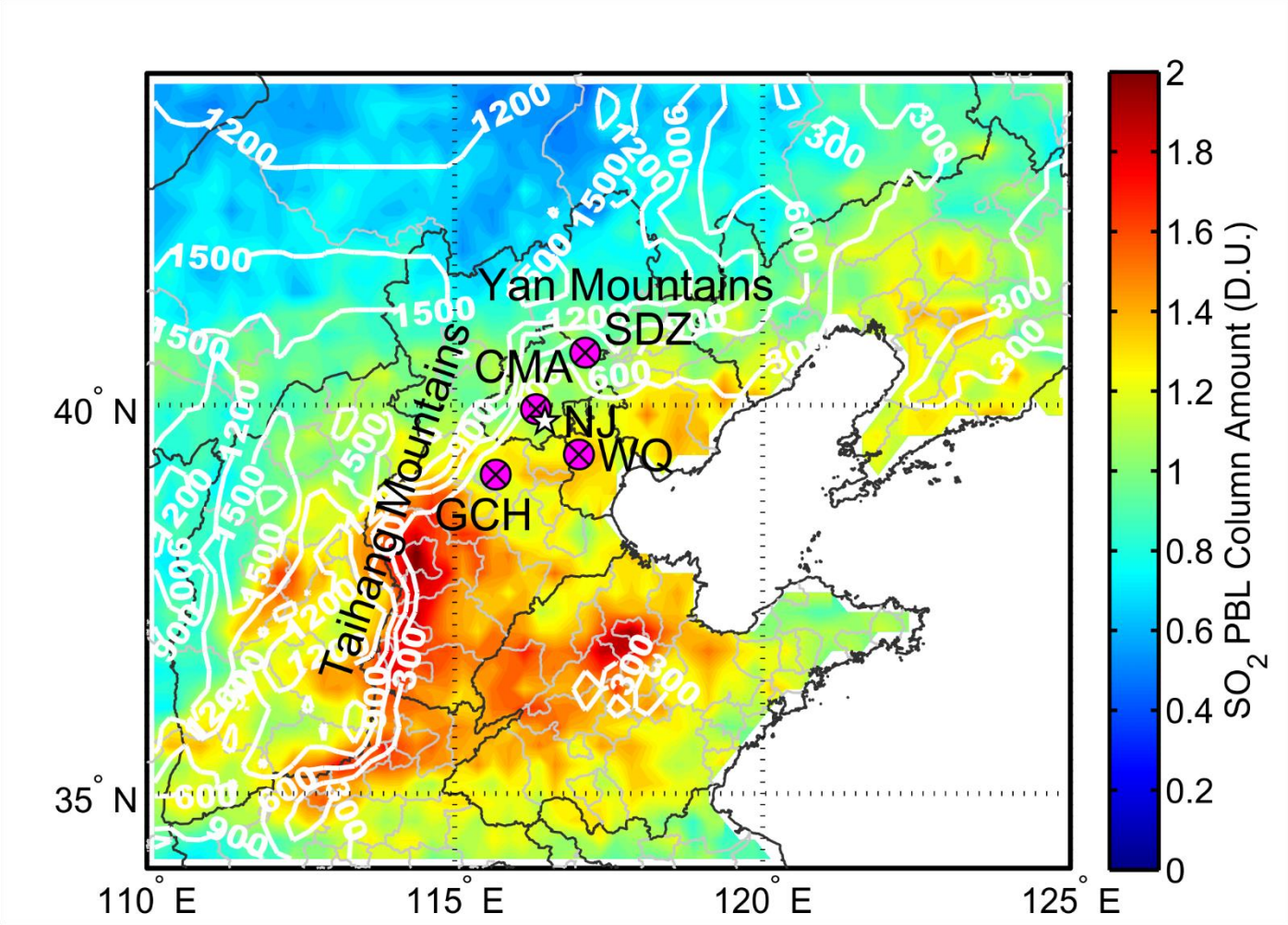

Figure 1 Location of the Shangdianzi (SDZ), China Meteorological Administration (CMA), Gucheng (GCH), Wuqing (WQ) site, the Nanjiao meteorological station (NJ) and the Yan and Taihang Mountains. The average distribution of OMI SO2 column concentration in 2009 is displayed as the shaded contour, while the white contour lines show the terrain height (m).

3) ***Figure 2: Were these plots made using monthly averaged diurnal profiles? If not, what is the data resolution in the y-axis (Month or weekly)? It looks that there are some strange bands, like synoptically scale variations, in these figures. How about using the normalized results to make these plots here?***

Figure 2 is plotted with 14-days moving averaged diurnal profiles, it aims mainly to display the season-diurnal variations of SO_2 concentrations. Synoptic scale variations should have been eliminated through the 14 days moving averaging process. The normalized diurnal variations are

already shown in Figure 3, therefore we would like to keep Figure 2 as it is.

4) ***Page 12: On the discussion of stack height (10-240 m), plume rise, an important fact for elevated sources, should also be mentioned here. The effective height of plumes could be much higher than the stack height.***

This is a very good point, thank you for pointing it out. We have added this into section 3.2, on the discussion of stack and plume heights.

5) ***Page 14, Line 16-19. Besides transpiration process, atmospheric turbulence mixing around noontime will also increase the dry deposition. The stronger turbulence mixing will cause more deposition to the surface.***

Thank you for this valuable comment. The sentence was accordingly revised as:
"For surfaces covered with vegetation, dry deposition processes are typically most dynamic during noontime due to transpiration and the strong turbulent mixing processes (Tsai et al., 2010;Raymond et al., 2004), thus noontime SO_2 peaks may create more acid deposition than common nighttime peak variation patterns."

6) ***Sect. 3.3: About the discussion of SO_2 oxidation, because the authors' analysis already suggested that the downward mixing was an important factor influencing the noontime peak of SO_2, its will be better to using some data above the ground surface (e.g. vertical profile in the PBL) to estimate the O_3 concentration for the model calculation.***

This is a good suggestion, unfortunately, the MM2.4 model is a 0-dimensional box model, which does not consider the vertical profile of trace gas concentrations. In past studies, O_3 concentrations were either well mixed or showed slight increases with height within the PBL (Chen et al., 2009;Dickerson et al., 2007;Chan et al., 2004;Geng et al., 2009), thus we believe that our assumptions will not have too much influence on our final conclusions.

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