# Diurnal variations and source apportionment of ozone at the summit of Mount Huang, a rural site in Eastern China

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Comprehensive measurements were conducted at the summit of Mount (Mt.) Huang, a rural site located in eastern China during the summer of 2011. They observed that ozone showed pronounced diurnal variations with high concentrations at night and low values during daytime. The Weather Research and Forecasting with Chemistry (WRF-Chem) model was applied to simulate the ozone concentrations at Mt. Huang in June 2011. With processes analysis and online ozone tagging method we coupled into the model system, the causes of this diurnal pattern and the contributions from different source regions were investigated. Our results showed that boundary layer diurnal cycle played an important role in driving the ozone diurnal variation. Further analysis showed that the negative contribution of vertical mixing was significant, resulting in the ozone decrease during the daytime. In contrast, ozone increased at night owing to the significant positive contribution of advection. This shifting of major factor between vertical mixing and advection formed this diurnal variation. Ozone source apportionment results indicated that approximately half was provided by inflow effect of ozone from outside the model domain ($O_{3\text{-}INFLOW}$) and the other half was formed by ozone precursors ($O_{3\text{-}PBL}$) emitted in eastern, central, and southern China. In the $O_{3\text{-}PBL}$, 3.0% of the ozone was from Mt. Huang reflecting the small local contribution ($O_{3\text{-}LOC}$) and the non-local contributions ($O_{3\text{-}NLOC}$) accounted for 41.6%, in which ozone from the southerly regions contributed significantly, for example, 9.9% of the ozone originating from Jiangxi, representing the highest geographical contributor. Because the origin and variation of $O_{3\text{-}NLOC}$ was highly related to the diurnal movements in boundary layer, the similar diurnal patterns between $O_{3\text{-}NLOC}$ and total ozone both indicated the direct influence of $O_{3\text{-}NLOC}$ and the importance of boundary layer diurnal variations in the formation of such distinct diurnal ozone variations at Mt. Huang.

Keywords: ozone, source apportionment, wrf-chem

 