Review comments on “Urbanization-induced urban heat heat island and aerosol effects on climate extremes in the Yangtze River Delta Region of China” by Zhong et al.

The influences of urbanization-induced land cover change and the aerosol concentrations on local and regional climate in the Yangtze River Delta in China were investigated by performing three sensitivity experiments using WRF-Chem model at convection-permitting scale (3km). Their separated and combined effects on precipitation and temperature were examined and compared. Moreover, the authors found the effects of external forcing were affected by the synoptic forcing. The manuscript is well written and contains some interesting results. Some comments are as follows.

1. Abstract L38-42: The role of synoptic forcing was not well summarized. These descriptions were too general.

2. One issue about the experimental design: the NCEP FNL reanalysis data with 1 degree was directly used to drive the WRF model at 3km. The ratio of the resolution of driving data to that of the regional climate model is about 40, which is quite large. The authors should justify this issue.

3. L152: how about the variation from 0800 to 1700? Linearly?

4. L198-L207: the authors evaluated the model performance in terms of the annual mean values. However, the changes of summer and winter climate were analyzed respectively in the following sections. So how about the model performance in simulating summer and winter climate?

5. Figure 6: the quality of this figure is poor due to its low resolution.

6. L403-L412: The authors stated that “the differences in the responses of moisture advection between two cases are related to different background circulation”. I am not very convinced about this argument. In fact, the changes in moisture advection could be further decomposed into three terms, as shown below:

$$-\Delta\langle V\cdot\nabla q\rangle=-\langle V_{ctrl}\Delta(\nabla q)\rangle-\langle(\nabla q)_{ctrl}\Delta V\rangle-\langle\Delta(\nabla q)\cdot\Delta V\rangle$$

Δ () represents the difference between the sensitivity and control simulations, and the

subscript ‘ctrl’ denotes the control experiment. The first term in the right-hand side of is associated with the change in water vapor, while the second term is associated with the change in circulation. The third term is a nonlinear term including the contribution of both the moisture and circulation changes. This decomposition could answer whether the background circulation is indeed very important as the authors stated.