Dear Editors and Reviewers,

Thank you very much for your careful review on our manuscript egusphere-2024-268. We appreciate very much your encouraging comments and constructive suggestions on improving our manuscript. We have accordingly made the careful and substantial revisions. The revised portions are marked up in the revised manuscript. Please find our point to point responses to the reviewers' comments as follows:

Responses to the reviewer #1

["Quantitatively, the authors conducted sensitivity simulations using a regional chemical transport model, WRF-Chem. They concluded that "this SI event made the absolute contributions of 9.61 ppbv to the near surface O3, accounting for 26.77% in the relative contribution" . However, this assessment of the SI impact seems higher than the observations showed in Figure 5 if the claim refers to the entire NCP area."

Can the authors also address my 2nd concern? I understand that the relative contribution of "26.77%" value is a simulated result. The authors can have some discussion about this estimation.]

Response : Thanks to the reviewer for the comments on our manuscript.

We understand the reviewer's concern on Fig.5 that the contribution of 26.77% of the SI impact seems higher than the observations showed in Fig. 5. We have explained the Fig. 5 in the revised manuscript (lines 256-261 and lines 339-343) as follows:

Although stratospheric O_3 intensely invaded the near-surface over the NCP region, the near-surface O_3 was strongly diffused downstream by the northwest wind. Meanwhile, the horizontal diffusion also prevented O_3 from the stratosphere from accumulating over the NCP (Figs. 2a-c and Fig. 4). Also, the routine ground observations cannot distinguish whether O_3 comes from the stratosphere or local generation. However, the near-surface O_3 observed on May 19 was slightly higher than the previous day under such facilitated diffusion conditions (Fig. 5c), which proves that the SI exerted additional contributions on the near-surface O_3 over the NCP region.

In addition, in terms of the simulation results, the contribution of the stratospheric O_3 to near-surface O_3 rapidly peaked at the beginning of the SI and then gradually decreased to about 20% under the diffusion of

horizontal wind (Fig. 8). It means that although the horizontal diffusion caused no remarkable increment in observed O_3 over the NCP during this SI event, stratospheric O_3 contributed a relatively high percentage to the near-surface atmospheric environment.