Elucidating the mechanisms of atmospheric new particle formation in the highly polluted Po Valley, Italy. New particle formation (NPF) is a significant source of aerosol particles and cloud condensation nuclei in the troposphere, playing an essential role in air quality and climate. Frequent NPF events have been observed in heavily polluted urban environments, contributing to the aerosol number concentration by a significant amount. This topic is suitable for publication in this journal. However, the manuscript needs an improvement before publication. Therefore, I would like to recommend publication with 'major revision.'

1. Line 34: What exactly does organic refer to? The scope of organic is too large and needs to be clarified.
2. Line 30-41: More quantitative results need to be given. In lines 30-41, the quantitative results of this part are less, and the highlighted conclusion of this article is not given. Need to clarify the characteristics of NPF in the highly polluted environment? What are the mechanisms? For example, in lines 35-37, what was obtained using ion cluster measurements and kinetic model results? This statement is currently too general.
3. Introduction: This section needs to be reorganized. The summary of global NPF researches in the second paragraph is insufficient, especially the summary of NPF-related researches in polluted atmospheric environments. The importance and uniqueness of Po Valley is not adequately explained in the third paragraph. What makes Po Valley unique compared to other polluted areas? What are the differences, especially compared with relevant researches in China and India? In addition, what is special about the so-called highly polluted environment selected for this study? How does the highly polluted environment compare to studies in China and India? What are the existing NPF formation and growth mechanisms in polluted environments? How does this study differ from these previous studies?
4. In Section 2.3.2, Condensation sink, nucleation and growth rate calculations should give the calculation formula.
5. Sections 3.1 and 3.2 are merged.
6. Section 3.3: It is necessary to add some in-depth analysis of mechanisms. For example, what are the commonalities compared with research results in Shanghai, Beijing and New Delhi? What are the differences in the Po Valley's meteorological conditions, chemical compositions and aerosol background concentrations compared with these polluted areas? What impact do these differences have on the NPF incident? Is the growth mechanism of new particles in the NPF event in Po Valley similar to that in other polluted environments? What are the effects of being highly polluted?
7. The discussion in Section 3.4 is too simple and requires in-depth analysis to compare the similarities and differences in the generation and growth mechanisms under different atmospheric environments. In particular, the unique results of Po Valley need to be highlighted instead of simply comparing the differences in data values as currently done.
8. Line 268, "concentrations" should be "concentration." Pay attention to other similar singular and plural expressions in the manuscript.
9. Line 259, Please add citations for Beijing and Shanghai (59 cm-3 s-1 − 225 cm-3 s-1),
10. Line 344, The unit expressions in “GR=6.1 nm h-1” and “(1.0– 2.4) nm/h, 4.6 (2.9 – 5.8) nm/h, and 5.1 (3.8 – 8.8) nm/h” in line 323 should be consistent, which should also be noted in other parts of the article.
11. Conclusion. The authors should give unique conclusions on the formation and growth

mechanism of NPF in the highly polluted environment of Po Valley, especially compared with other polluted environments. Needs to focus on giving quantitative results.