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Referee comment on acp-2020-1249

Anonymous Referee #1

Referee comment on "Seasonal variation in atmospheric pollutants transport in central Chile: dynamics and consequences" by Rémy Lapere et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1249-RC2, 2021

This is a modeling study that examines the transport of ozone and its precursors and PM2.5 between Santiago and its surroundings in summer and winter. Specifically, the work investigates: (i) the contribution from emissions from Santiago to ozone and PM2.5 in central Chile, (ii) the contribution of regional emissions to the ozone and PM2.5 in Santiago, and (iii) the advection patterns prevalent in the region. The authors find that emissions from Santiago affect pollutant concentrations over a wide area, particularly for PM2.5 in winter; the effect on summertime ozone is mostly limited to the vicinity of Santiago. Regional emissions contribute some of the PM2.5 in Santiago in winter, but do not significantly affect summer ozone. The simulations show an ozone maximum aloft over Santiago, which is explained by the diurnal patterns of vertical transport of ozone precursors.

Central Chile is a heavily polluted area due to a combination of urban emissions from Santiago and neighboring cities, synoptic-scale circulation patterns, and surrounding topography. Few prior studies have analyzed the transport patterns of pollutants in areas, which is what makes this paper an important contribution. The paper is well-written and has high-quality figures. The main conclusions are well-supported by the results presented in the paper.

My specific concerns about the paper as follows:

1. The study is focused on the average transport patterns and the average contribution of emissions from Santiago to regional pollutant levels, but there is considerable variability in these numbers, which is not discussed. For example, the average contribution of Santiago emissions to wintertime PM2.5 in Rancagua is 1-2 μg/m3 but the maximum is as high as 20 μg/m3. The authors could identify what kind of transport patterns cause such high contributions downwind of Santiago, and what kind of transport patterns bring the most pollution from the surroundings into Santiago.

2. The simulated ozone and PM2.5 concentrations showed significant disagreement with observations for the Santiago station (Fig 2; 22 ppb for ozone and 16 μg/m3 for PM2.5). The authors could discuss the possible causes of this disagreement and, more importantly, implications for the subsequent results about the contribution of Santiago emissions to regional pollutant levels.

3. The analysis is based on just 1 month of simulation in each season, which is a major limitation. The authors briefly discuss this point in section 4, but a more thorough discussion will be appreciated, particularly of the synoptic-scale circulation patterns in relation to ENSO. Analysis of the NCEP FNL data could help in this.

Minor & technical comments:

4. Line 45 states that wildfire emissions are not considered. This is not clear. Are they completely ignored, even in the baseline simulation? That wouldn't make sense. The authors should clarify this.

5. Section 2.1: The method for the calculation of biogenic VOC emissions needs to be specified. A map of biogenic VOC emissions (maybe isoprene) would be useful.

6. Section 2.1: It is not obvious which species are included in PM2.5. Does it include primary as well as secondary species? Does it include aerosol water? This could be clarified.

7. Lines 135-147: This paragraph is confusing. I understand the point the authors are trying to make about the lack of data to evaluate the simulated NOx and VOC. The authors should consider rewording this paragraph and be direct about it.

8. Fig. 6(b): The colorbar's maximum value is missing.