Reviewer #1: This is a detailed study using WRF and 4 microphysics schemes for 8 snow events during ICE-POP for the 2018 Winter Olympics, focusing on one of each of 3 types of events, cold-low, warm-low and air-sea interaction. The inner domain is at a relatively high resolution of 1 km. Observations used in addition to the surface AWS stations include disdrometers and radar from which particle types were derived. The paper distinguishes some large differences in particle types between the schemes and verifies them against observations. Some additional understanding is gained by evaluating the importance of every process as a source and sink for each particle type in each case. This is a large amount of data that is presented, and a good attempt is made to derive the most important points and distinctions between the schemes from it. I think the paper is acceptable after minor revisions. The level of detail may appeal mostly to microphysics parameterization developers, and is probably more than most would read through, but the conclusions are of more general interest. I have itemized my Minor Points below, the response to some of which may help to improve the paper.
: We appreciate the valuable reviews. The manuscript has been revised in accordance with reviewer's comments and suggestions. Please find the answer for each comment below.

Minor points
1. line 33. What is meant by "inefficient melting"? Less efficient?
: The corresponding phrase has been revised as "by reducing the melting efficiency in all schemes".

2. L52. convections -> convection here and several places. Common English error.
: Revised accordingly throughout the manuscript.

3. L76 Thompson.
: Revised accordingly.

4. L76 "snow efficiently affects precipitation efficiency for" rephrase to not include efficient twice.
: In response to reviewer's comment, the word, efficiently" has been deleted.

5. L114 "of precipitationi systems" typo.
: Revised accordingly.

6. Table 2. Refers to Morcrette. I am sure this is not the correct reference.
: In response to reviewer's comment, we have deleted that reference in Table 2.

7. Table 4. WDN typo.
: Revised accordingly.

8. L213 and Figure 5. Case color code should be mentioned in the text too.
: In response to reviewer's suggestion, we have added the following sentences in the revised manuscript.
"White, black, yellow, and blue-colored bars represent the results for the simulations with the WDM6, Thompson, and Morrison schemes. The cold-low, warm-low, and air-sea interaction cases are shaded in blue, red, and green color."

9. L216. How is a rate used for an accumulated amount in the whole period? It says mm h^{-1}.
: For the total cumulative precipitation [mm], any threshold value for the rain rate is not adopted.

10. L218 and Figure 5. Hard to interpret biases without absolute totals which vary from 6 mm in Case 3 to 57 mm in Case 4. Perhaps put totals from Table 1 on Figure 5.
: In response to reviewer's suggestion, we have added the total precipitation amount in Figure 5a and modified the caption.

"Figure 5. ... The total cumulative precipitation [mm] for each case, obtained from the AWS (Table 1), is also noted in Figure 5(a) using red dots together with the scale in the right y-axis."

11. L222. Hard to tell from Figure 6 that these schemes have more liquid rain. I would suggest finding a different way to show precip type. Either a separate plot of type, or shading by type and contouring amount.
: We have added the contour lines presenting the rain-type precipitation in the Figure 6. Accordingly, the manuscript and figure caption have been modified as below.
The following sentences, "All schemes simulate the precipitation as a type of snow <u>and rain</u> over the northeastern part of the domain. WDM6 and WDM7 simulate more liquid rain at the surface precipitation than Morrison and Thompson.", are modified to ""All schemes simulate the precipitation as a type of snow over the northeastern part of the domain."
"Figure 6... <u>Black,</u> red, blue, and <u>purple</u> contours represent the <u>rain,</u> snow, graupel, and hail-type precipitation at the surface. <u>The contour intervals for CASE 3, CASE 6, and CASE 7 are 3, 5, and 10 mm.</u>"

12. Figure 8. It was hard to find qc because the dash length does not match the key. Make the key pattern exactly match the plot. Also hard to see that qs is a dot pattern in the key.
: In response to reviewer's comment, we have modified the figure to make the key pattern match with the plot.

13. L262. Important to note that schemes with QCGEN have condensation mostly there while those without combine condensation and evaporation in QCCON. Is there much separate condensation in QCCON in the QCGEN schemes or is this all just evaporation?
: To deliver the results clearly, we have added the following sentence in the revised manuscript. "QCGEN includes only the condensation, but QCCON includes both condensation and evaporation. The negative sign of QCCON means that the magnitude of evaporation is greater than that of condensation."

14. Figure 9a-d. Maybe QRWET should be QCWET in labels. Check all these against Table 4 names.
: In response to reviewer's comment, the notation of QCWET has been changed to QRWET in Table 4. In addition, other notations have been checked again.

15. Table 4. QRAUT in cloud section could be QCAUT? I am not sure about the rules for naming when the same processes may have different names. QCACR for example has the same name.
: The identical microphysical processes have the same notation. QRAUT is the source of rain, but the sink of cloud water. This is same for QCACR.

16. Figure 9, etc. Can a scaling number be put on these plots to show relative size? L270 points out an important scale difference that would not have been seen in the Figure. For example, add what 100 equals in absolute terms.
: In response to reviewer's comment, we have added the scaling number in Figures 9, 11, and 13 in the upper left corner. In addition, the figure caption has been modified as below.
"Figure 9. Relative contribution of time-domain averaged production <u>tendency</u> term during the analysis period. From the left column, figures indicate the simulation results with the WDM6, WDM7, Thompson, and Morrison schemes. (a)–(d) are the terms for cloud water, (e)–(h) for rain, (i)–(l) for cloud ice, (m)–(p) for snow, and (q)–(t) for graupel, and (u) for hail. The hail is only predicted in WDM7. <u>The scaling number, sum of the absolute value of each production tendency, which corresponds to 100%, are noted in the upper left corner of each figure.</u>"

16. L301. As in note 11 above, this is hard to see.
: As noted in our response for the comment #11, we have added the contour lines presenting the rain-type precipitation in the corresponding figures.

17. L372. Should be Fig. 7l.

: Revised accordingly.

18. L373. Westerly wind is weak. The model clearly has an onshore wind that must be mainly northerly. This component should be mentioned.

: Thank you for the comment. When we investigated the u and v wind components over the cross-sectional area in all simulations, it was confirmed that the v component is smaller than the u component. As we noted in the original manuscript, the wind is mostly westly.

Figure 5. Statistical skill scores of bias, root mean square error (RMSE), probability of detection (POD), and false alarm ratio (FAR) for the simulated precipitation, with respect to the AWS observation. The units of bias and RMSE shown in Figures 5(a) and (b) are [mm]. White, black, yellow, and blue-colored bars represent the results for the simulations with the WDM6, Thompson, and Morrison schemes. The cold-low, warm-low, and air-sea interaction cases are shaded in blue, red, and green color. The total cumulative precipitation [mm] for each case, obtained from the AWS (Table 1), is also noted in Figure 5(a) using red dots together with the scale in the right y-axis.

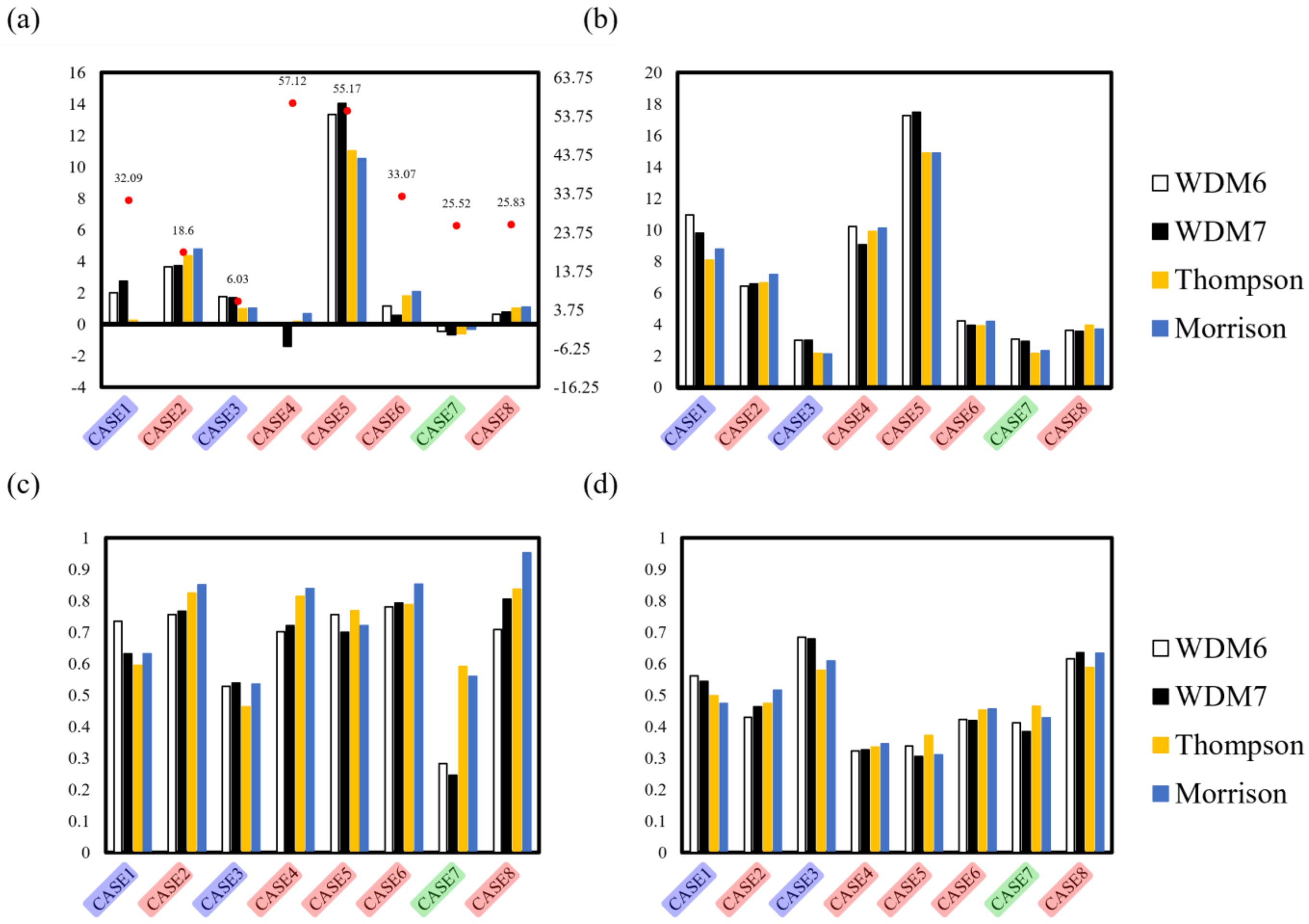

Figure 6. Accumulated precipitation [mm] of the simulations using different cloud microphysics parameterizations during the analysis period. (a)–(d) are for CASE 3, (b), (e) for CASE 6, and (c), (f) for CASE 7 during the analysis period. (a)–(d) are for CASE 3, (e)–(h) for CASE 6, and (j)–(l) for CASE7. The simulations in the first and second columns are conducted with the WDM6 and WDM7 schemes. The ones in the third and fourth columns are conducted with the Thompson and Morrison schemes. Black, red, blue, and purple contours represent the rain, snow, graupel, and hail-type precipitation at the surface. The contour intervals for CASE 3, CASE 6, and CASE 7 are 3, 5, and 10 mm.

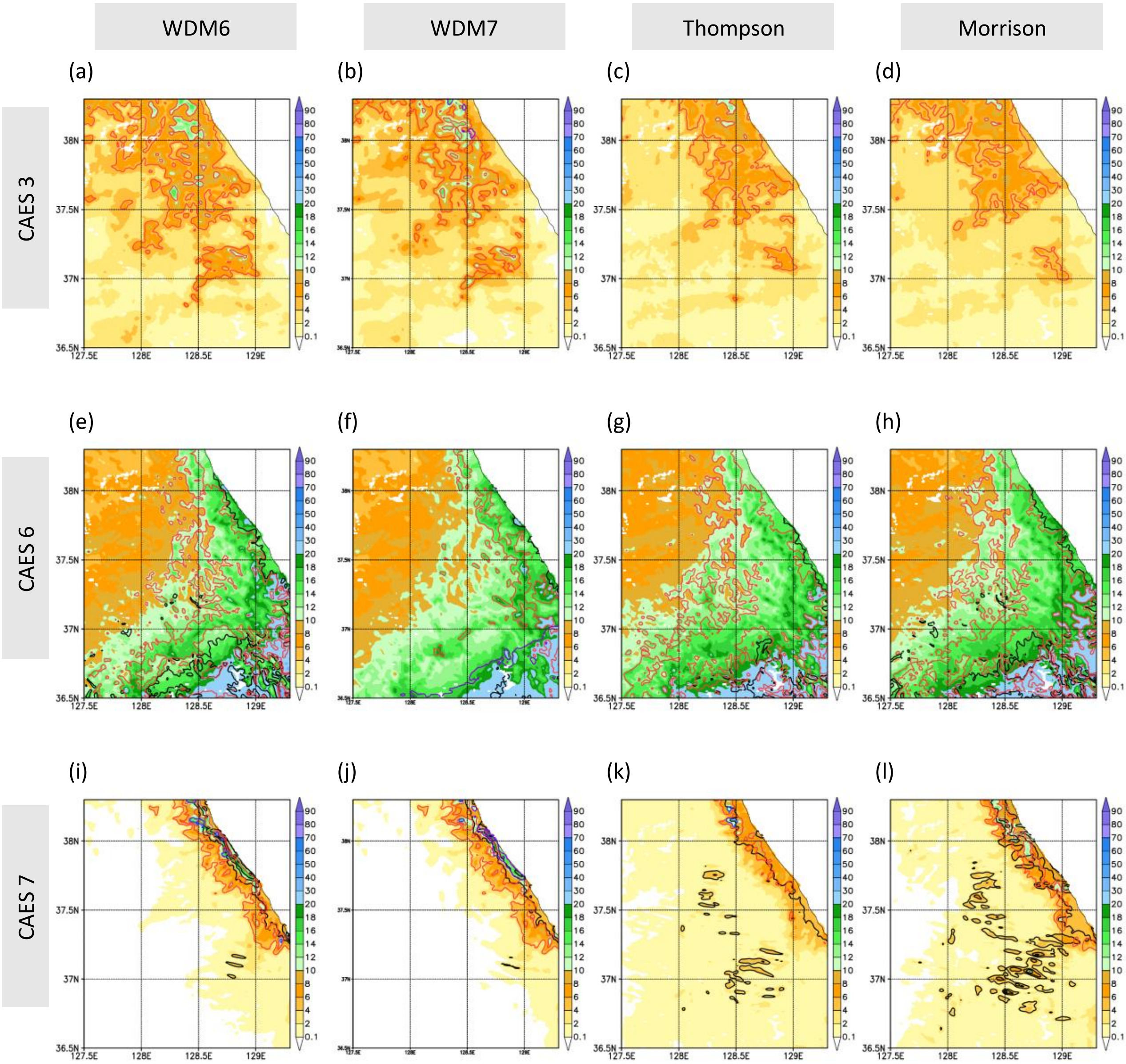

Figure 8. Time-domain averaged vertical hydrometeor mixing ratio profiles from the simulations using (a) WDM6, (b) WDM7, (c) Thompson, and (d) Morrison schemes for CASE 3. The averaged time and domain are the same as Figure 6. The sum of snow and cloud ice mixing ratios is drawn with a red line in all simulations.

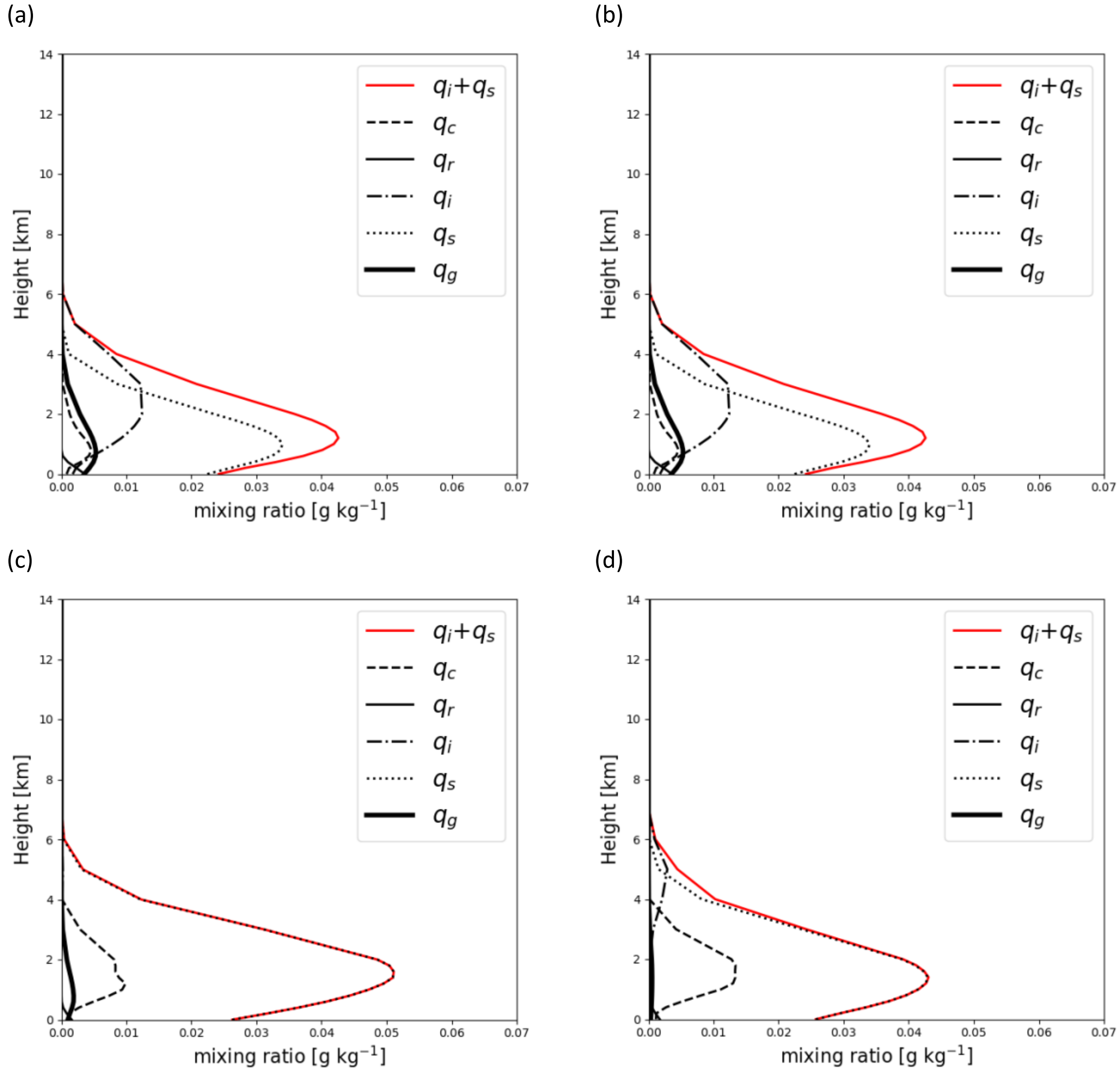

Figure 9. Relative contribution of time-domain averaged production tendency term during the analysis period. From the left column, figures indicate the simulation results with the WDM6, WDM7, Thompson, and Morrison schemes. (a)–(d) are the terms for cloud water, (e)–(h) for rain, (i)–(l) for cloud ice, (m)–(p) for snow, and (q)–(t) for graupel, and (u) for hail. The hail is only predicted in WDM7. The scaling number, sum of the absolute value of each production tendency, which corresponds to 100%, are noted in the upper left corner of each figure.

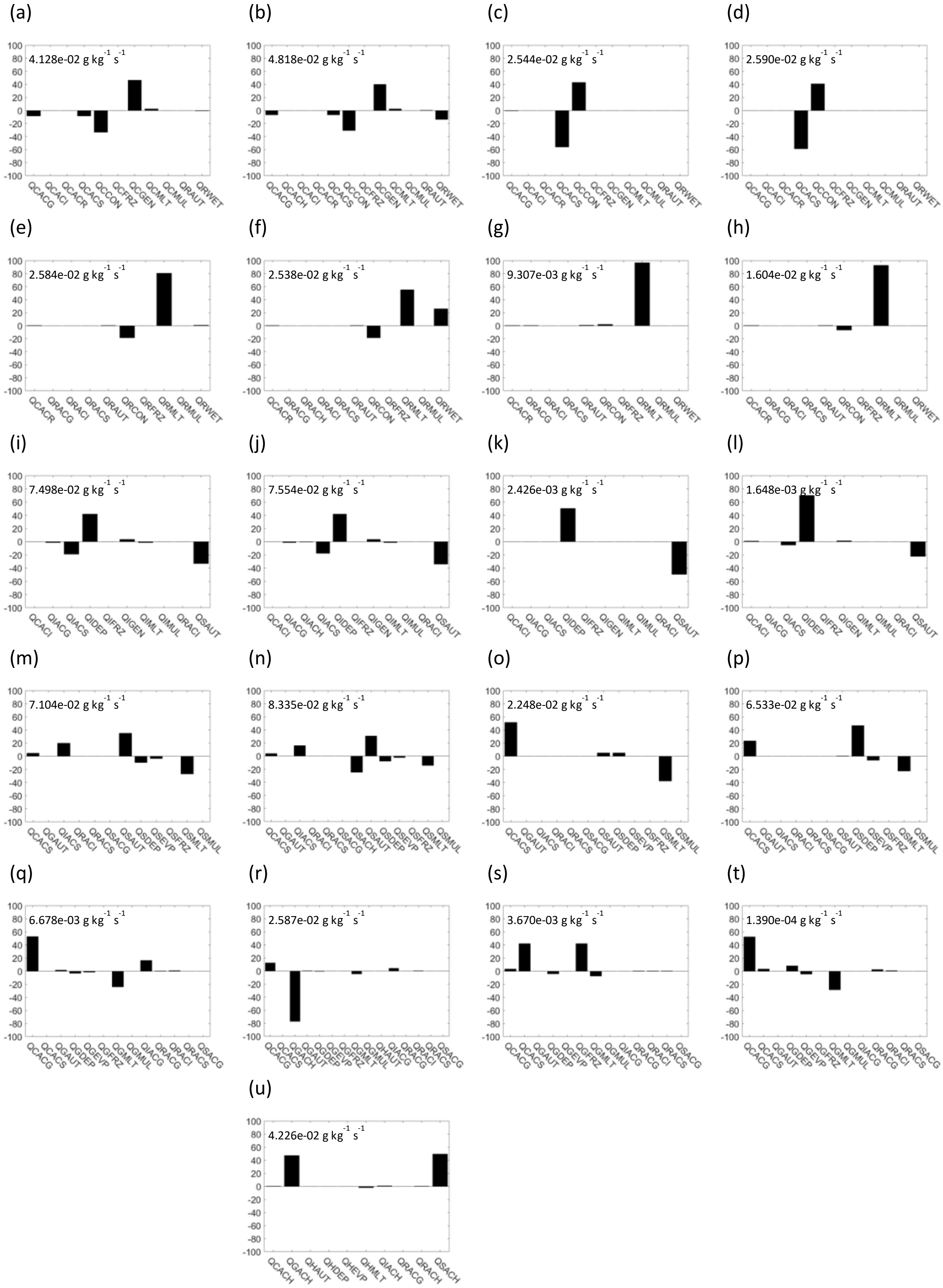

Figure 10. Same as Figure 8 but representing the results for CASE 6.

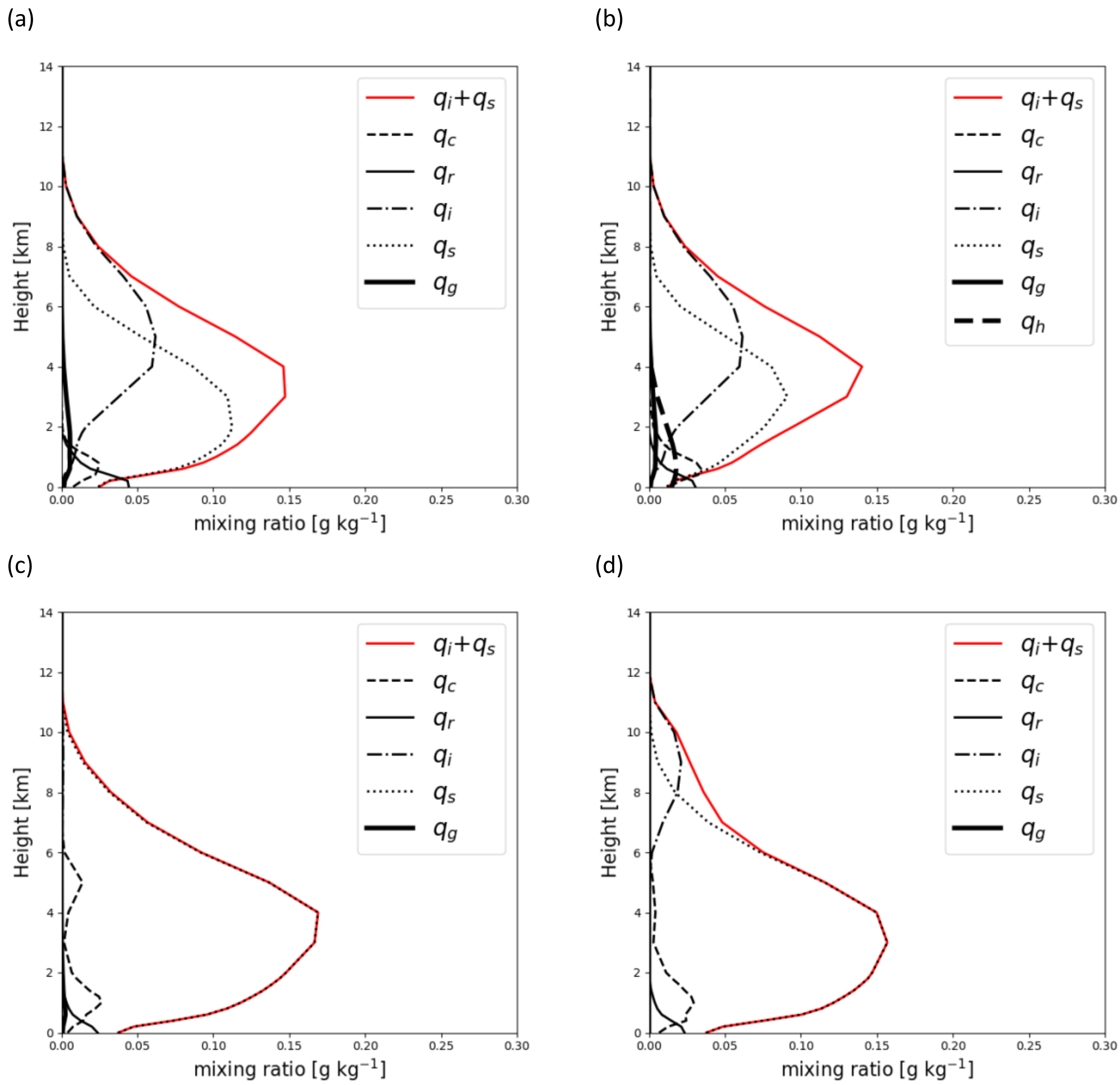

Figure 11. Same as Figure 9 but representing the results for CASE 6.

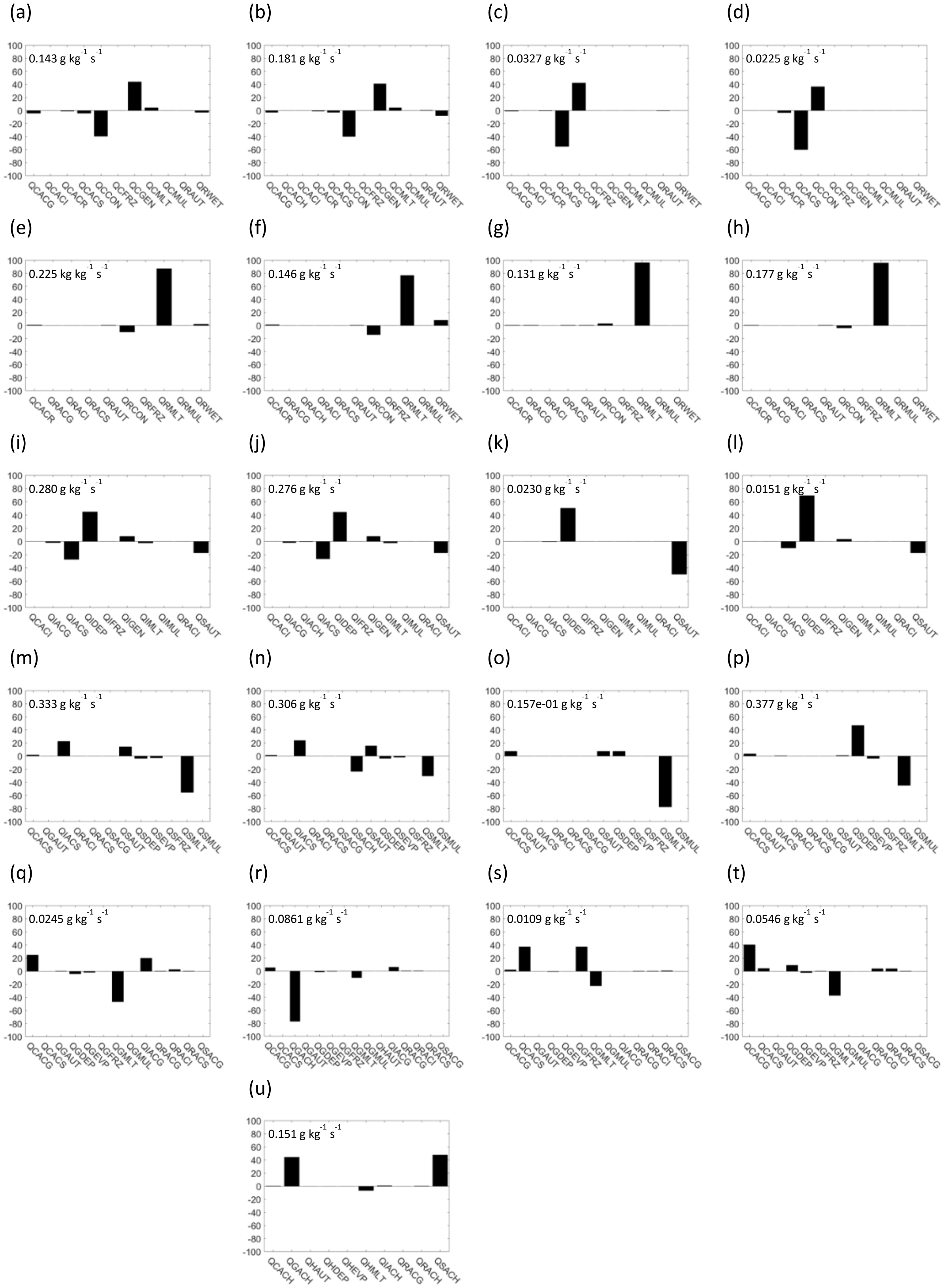

Figure 12. Same as Figure 8 but representing the results for CASE 7.

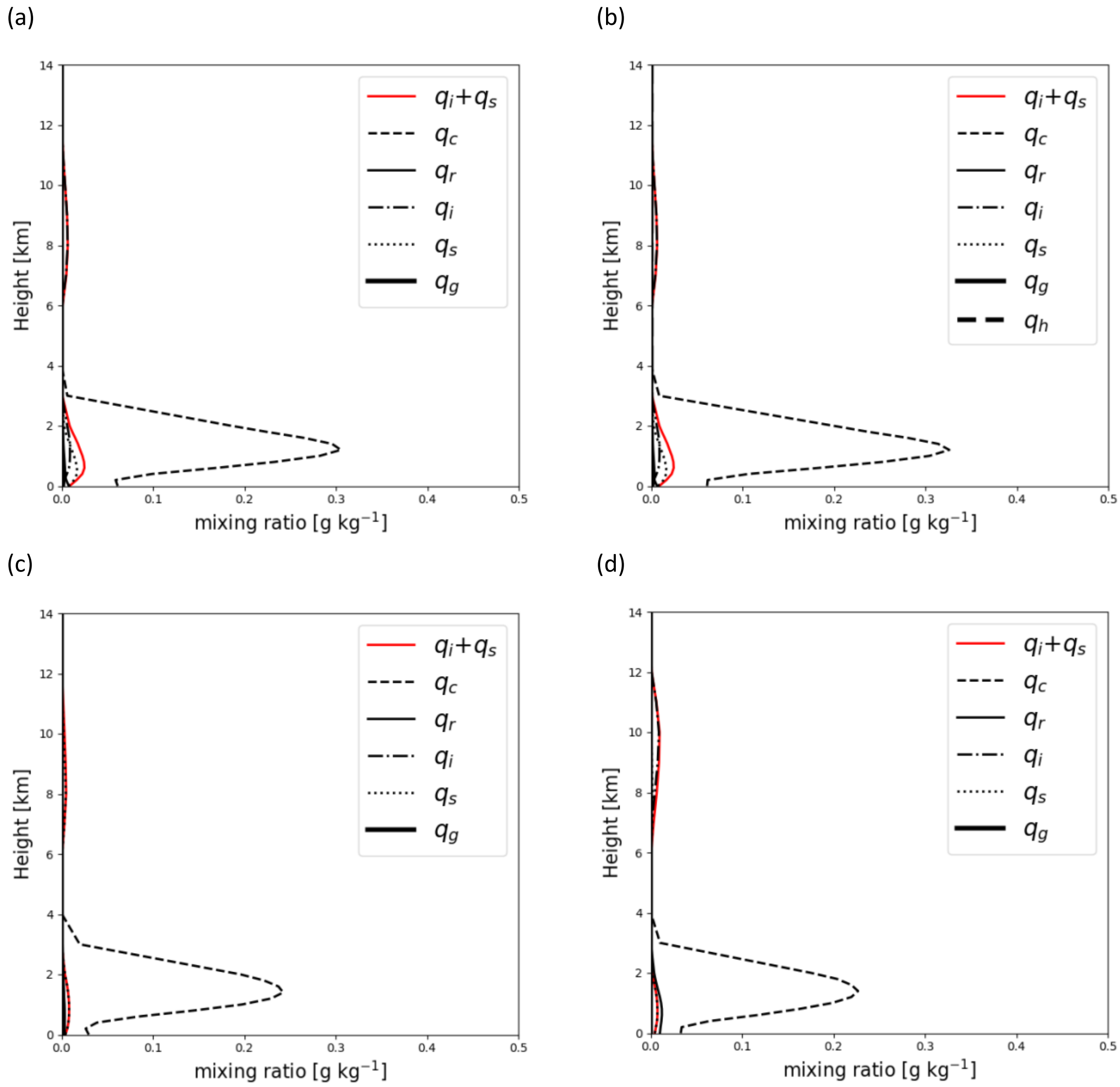

Figure 13. Same as Figure 9 but representing the results for CASE 7.