Dear authors,

Many thanks for your revised submission. Please take note of the reviewers' comments and my comments below when your prepare a revised manuscript.

There are various problems with the dimensions of quantities in equations 1, 4, 5 and 8, and in case of equations 5 and 8, this may result in large changes to some of your results.

Section 2.7 does not state how the various fractions *f* have been calculated. Please give explicit equations that clarify this, including what the input terms (reaction rates, $\Delta(^{17}O)$ values) are and how these input terms have been calculated themselves.

The reviewers have also raised a number of points that need to be addressed. In particular, points 1 and 2 of reviewer 2 (source of the air; role of O3 as oxidant) need some careful discussion. Table S7 should be moved to the main text.

There are still a few problems with missing units in equations – please refer to the first chapter of the IUPAC Green Book (https://www.iupac.org/fileadmin/user_upload/publications/e-resources/ONLINE-IUPAC-GB3-2ndPrinting-Online-Sep2012.pdf) or chapter 5 of the SI brochure (https://www.bipm.org/en/publications/si-brochure/) for examples of correct quantity notation.

The term "concentration" is not interchangeable with "mole fraction". Please use the term "mole fraction" where you refer to the latter (e.g. l. 197 and 198).

Data availability: Please include a table with the data from Figures 1, 4, 5 and 6 and the individual input values used for each sample in the ISORROPIA model.

Yours sincerely
Jan Kaiser

l. 67: A quantity symbol (e.g. *R*) must be used to define the isotope ratios and the index must follow immediately after the quantity symbol, e.g. $R_{\text{sample}}(^{x}O/^{16}O)$. "*X*" should be written in italics because it is a quantity symbol.

l. 92: Please replace "ppb" with the corresponding SI unit "nmol mol$^{-1}$", throughout the manuscript. Atmospheric Chemistry and Physics requires the use of SI units. Also, please write the equation in line with the rules of quantity algebra, i.e. $[H_2O_2]$ / (nmol mol$^{-1}$) = $0.1155\ e^{0.0846T/^{\circ}C}$.

l. 125/Eq. 1: Please use quantity algebra for all equations, see IUPAC Green Book (https://www.iupac.org/fileadmin/user_upload/publications/e-resources/ONLINE-IUPAC-GB3-2ndPrinting-Online-Sep2012.pdf). Where quantities are given as explicit values, they must carry units (e.g. 96 g mol$^{-1}$, 3600 s h$^{-1}$).

Eq. 1 is dimensionally not correct; it has units of g $m^{-3}$ $h^{-1}$ $atm^{-1}$, but is supposed to have g $m^{-3}$ $h^{-1}$. Presumably the equation needs to include atmospheric pressure.

l. 127: The non-SI unit "atm" should be replaced with an SI-accepted unit, e.g. bar or Pa (or a derivative of them).

l. 129: The uptake coefficient has the unit "1"; it is not "unitless".

l. 132: Again, units are missing from this equation. Also, the quantity that "PM2.5" refers to must be identified, e.g. $\gamma$(PM2.5) or $\rho$(PM2.5), if it is a mass concentration. Both symbols are not ideal because they clash with the uptake coefficient and the bulk density. Perhaps the uptake coefficient should be given a different symbol than $\gamma$.

l.136: The quantity that PM2.5 refers to must be identified, e.g. $\gamma$(PM2.5). The extraneous factor $10^{-6}$ and the multiplication symbols (×) should eliminated from the equation.

l. 137 & 205: Please choose a suitable single-letter symbol for relative humidity in these equations, e.g. $\Psi$.

l. 152: see l. 125: "3600 s $h^{-1}$","96 g $mol^{-1}$"; correct dimensions (presumably multiplication by atmospheric pressure).

l. 160 & 246: These equations is wrong in a bad way. The units on the right hand side are "$g^2$ $m^{-3}$ $h^{-1}$", but are supposed to be "g $m^{-3}$ $h^{-1}$". Again, it should be "3600 s $h^{-1}$" and "96 g $mol^{-1}$". Finally, the SI requires quantity symbols to consist of a single (Latin or Greek) letter, so LWC is not an acceptable symbol in an equation and should be replaced by a suitable one. (LWC as an abbreviation is fine, just not as a quantity symbol).
These errors suggest that $P_{cloud}$ values may be fundamentally wrong. Please discuss, using numerical examples, the impact of correcting the equation on your results.

l. 167 & l. 180: Include "‰" after 6.5 and 0.7

l. 196: This equation requires quantity symbols for the mole fractions and the unit "nmol $mol^{-1}$" needs to appear in the right place, e.g. "$y(NH_3) = 0.34y(NO_x) + 0.63$ nmol $mol^{-1}$".

l. 197: Replace "concentration" with "mole fraction" – also other occurrences of the word "concentration" in the text may need to be replaced with "mole fraction". Concentration implies an amount per volume.

l. 205: "MF" should be replaced with a suitable single-letter symbol, e.g. "$x$(metastable)".

l. 211: The terms involving logarithms of concentrations and ion strengths in equations need to be divided by the standard concentration ($c^{\ominus}$ = 1 mol $dm^{-3}$), to make them dimensionally correct. The units of $\beta^*$ need to be identified.

l. 258: Please use appropriate symbols, e. g $c(SO_4^{2-})$ for sulfate concentrations.

p. 11: Remove unnecessary brackets around pH expressions, e. g. 7.6±0.1. The brackets are only required where similar such expressions have units.

Figure 2: In the figure caption, please include an explicit link to the newly added equations in the main text that give explicit solutions for the fractions shown in this figure.

Table S1:
$k_{0\mathrm{low}} = 3.3\times10^{-31}\ (T/300\ \mathrm{K})^{-4.3}\ \mathrm{cm^6\ s^{-1}}$ [$T$ has units of K; molecule is not a unit]
$k_{0\mathrm{high}} = 1.6\times10^{-12}\ \mathrm{cm^3\ s^{-1}}$ [since $(T/300\ \mathrm{K})^0 = 1$]

Table S4:
Did you only use these mean values in your thermodynamic calculations? Or did you use sample-specific input parameters?