Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2022-551-RC2, 2022


# Comment on acp-2022-551

Anonymous Referee #2

Referee comment on "Role of K-feldspar and quartz in global ice nucleation by mineral dust in mixed-phase clouds" by Marios Chatziparaschos et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-551-RC2, 2022

This study by Chatziparaschos et al. used a 3D chemical transport model to predict global concentrations of ice nucleating particles based on an emission model accounting for quantities of quartz and feldspar emitted and parameterisations of the ice nucleating effectiveness of quartz and feldspar. The results of this process are shown to agree reasonably well with field measurements of ice nucleating particle concentrations. The study concludes that the high abundance of quartz particles means that their contribution to INP concentrations is significant, despite the lower ice nucleation ability of quartz compared to 'K-feldspar'. Conclusions are also drawn about the contributions of the different minerals to low and mid-level clouds. The study is interesting and appears to be well-conducted. I have a few suggestions below but support publication once these are considered. While mostly well-written, the study would benefit from thorough proofreading. I have highlighted various issues below but there are likely more.

**General comments:**

I think it is worth noting that a great deal is still not known about why quartz and feldspar nucleate ice. In the absence of proper physico-chemical understanding of how these minerals nucleate ice the parameterisations of Harrison et al. remain entirely empirical. It may still turn out that they are not representative for unforeseen reasons. This doesn't detract from the study but is probably worth mentioning briefly. Relatedly, I think a few words clarifying why it is alkali feldspar (I think use of K-feldspar throughout is fine, although worth noting that some Na-rich feldspar also nucleate ice well), rather than plagioclase feldspars, that are important may be helpful e.g (Kiselev et al., 2021;Whale et al., 2017;Harrison et al., 2016).

The abbreviation INP, is used in various ways throughout. While what is meant is mostly clear it would probably be best to pick a definition and stick with it.

Suggest checking the format of references throughout the text, there is some variation.

**Specific comments**

Line 23 – INP usually abbreviates Ice Nucleating Particle, with an 's' added for 'Ice Nucleating Particles'

Line 23 is confusing. Ice nucleation is the first step of ice formation, remove reference to 'homogeneous formation'

Lines 25 – The word 'efficient' implies a ratio. 'Effective' or similar would be better here.

Line 26 – It isn't clear what is meant by 'ice nuclei' (Vali et al., 2015). 'Ice nucleation activity' would be more typical I think.

Line 34 – I wonder if it might be possible to briefly explain why differences are seen between cloud regimes? This isn't really discussed in the text either. What causes the differences between quartz and k-feldspar as regards the cloud types they influence?

Line 71 – '….concentration of INP' maybe?

Line 86 – Doesn't read well if INP means 'Ice nucleating particles'

Line 89-90 – Kiselev et al. was in 2017 I think?

Line 105 – The singular approximation assumes that each droplet contains a single ice nucleating particle active in a given temperature interval. I don't think the statement regarding site density is necessarily true.

Line 125 – may be worth briefly noting that solution environment may well substantially impact the ice nucleation effectiveness of both quartz and feldspar e.g. (Kumar et al., 2019;Whale et al., 2018;Klumpp et al., 2022;Whale, 2022).

Line 187 – I wouldn't call the samples used 'soil'. Mostly they are mineral samples that have been selected for purity. The point that the samples may not be representative of atmospheric conditions is very true however.

Line 339 – I don't think Spracklen and Heald looked at marine organic aerosol?

**References**


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