

Summary/Recommendations

“Retrieving ice nucleating particle concentration and ice multiplication factors using active remote sensing validated by in situ observations” is a thorough and well-written manuscript that verifies ice nucleating particle (INP) lidar and radar estimates to in situ measurements to then provide estimates of ice multiplication factors (IMFs). Along the way, the authors carefully work to test different existing parameterizations and offer updates/recommendations based on their findings. Finally, they compare their findings to previous studies (at times estimating IMFs when this information was not provided explicitly in the original work). This paper should be of interest to INP specialists and also to lidar/radar specialists. However, these groups may not have strong expertise in each other’s work - for example, an INP specialist may not immediately know the definition of LDR and a lidar/radar specialist may be confused when INP concentrations at a specific temperature are presented. I recommend that the authors take a critical read-through of this manuscript with only their “INP” or “lidar/radar” hat on to find places where brief explanations or reminders could be helpful. I have highlighted a few instances in my general comments below, but strongly encourage the authors to define field-specific terminology throughout. I recommend that this paper be published after addressing these comments.

General Comments

I recommend frequently reminding the reader what acronyms stand for. For example, the authors could re-define an acronym in a new section if that acronym doesn’t occur in the previous section. I could see readers jumping around between sections so this can ease the burden of keeping track of everything. I also would remind the reader that n_{ice} is a variable name for ICNC and n_{INP} is a variable name for INP throughout (check your figure captions!). Especially be sure to define acronyms in figure captions for readers who are mainly scanning through figures.

Similarly, it could be helpful to remind the reader throughout that WOP is the valley site and that WFJ is the mountaintop site when the distinction is important (e.g. lines 215-219).

Section 2.1 - why was the aerosol line so warm? Wouldn’t 46C drive off many semi volatile compounds, leading to a particle size distribution that is different (shifted to smaller sizes) than the ambient SD? Possibly this was characterized/discussed in another of the RACLET papers. I recommend briefly summarizing those findings, if previously discussed, or discussing here. I would suspect that the uncertainties introduced by aerosol evaporation are less than general INP uncertainties but still good to acknowledge, as many of the parameterizations used in this paper rely on particle size.

Section 2.1 - I recommend explicitly splitting out the APS and SMPS size ranges. What did you do for size overlaps, if any? Later on you discuss using only the APS measurements for the D10 parameterization, which relies on particles >500 nm. Was the SMPS completely below that size range?

Line 254 - this is off-line INP at -13 degC, not retrieved INP? Good to make that distinction throughout.

Line 292 - reference the table that D15, H19, U17d are described in

Section 4 - redefine acronyms (e.g. line 529 - INP , IMF)

Figures/Tables

I generally enjoyed all of the figures - the colors chosen were pleasing and a large amount of information was summarized well throughout. I will note that the labels on many of the figures were quite small (e.g. figure 2). If the authors feel confident that the figures will be sufficiently large and readable upon publication, I am fine with them being left as is - but redoing some of the labels to be larger may be a big improvement.

Figure 1 - caption has discrepancy between how OCEANET/OceaNet is written.

Table 2 - why is there a 9(11) in the first row? Describe in caption.

Figure 10 - remind reader in the caption that $ICNC = n_{ice}$ (x axis label)

Figure B1 - explain the green patch in each panel.

Technical comments

Line 139 - update the second ‘APS’ to ‘SMPS’

Line 240 - missing a word or phrase, update to something like “Despite *the fact* that the comparison in this section was purely qualitative...” (italics mine to point out the change)

Line 474 - missing a word or phrase, update to something like “...using the IMF itself does not allow *us* to infer the underlying SIP process...”

Line 540 - update to “(within a factor *of* ten)”