Comments on "Using a region-specific ice-nucleating particle parameterization improves the representation of Arctic clouds in a global climate model" by Gjelsvik et al.

General comments:
The authors use a recent temperature dependent INP parameterization constrained by the observations from a field campaigns in Norway. They found that the recent parameterization with new constrains causes a CLWP increases, which is better consistent with observations. The cloud induced surface fluxes changes are also larger than before and better agree with observations. Overall, I think this is very nice work. The overestimation of INP and subsequently induced uncertainties is necessary to be examined and documented. I recommend publishing it after addressing the comments below.

Major:
- The authors show that using the observationally based A21 parameterization induce CLWP increases and associated with changes of surface flux and air temperature, compared with Meyers et al., 1992. The constrains comes from the measurements in Andenes, March 2021. How do you justify that measurements at one cite are representative to the entire Arctic region? Here is another related question. The observations in Figure 2 align with the measurements form Li et al., 2023 and Sze et al., 2023 very well. Do you think similar overall and spatial changes could be induced if deriving the parameterization using their measurements? If so, do you think it better to constrain the parameterizations using as many as observations occurring in Arctic as the next step? If not, what do you think the potential reason that other measurements in high latitudes show different results?
- The authors mentioned in many places that the surface temperature is fixed. However, the interplay with surface temperature is very important in examining the cloud effects. Why not use the option with interaction surface temperature?

Minor:
- Line 146-147: why do you turn off the ice detrainment? How does that influence the results?
- Line 153-154: how do you justify that the deposition and condensation freezing are negligible for this specific case?
- Line 229-230: Why does the total aerosol surface area and INP freezing temperatures show a low correlation? The INP concentration depends on the temperature based on Figure 2.
- Line 235-236: Clarify how you implement the parameterization with temperature dependence only.
- Line 246-247: how do you infer that Figure 3a implies two different cold cloud populations? What are the two populations?
- Line 266-269: Did you evaluate the decreases in CIWP with observations? Does this seasonally variations leads to better agreement with observations?
- Some paragraphs have indents in the first line but others not. Better to be consistent.