Review of “Giant Cloud Condensation Nuclei enhanced Ice Sublimation Process: A potential mechanism in mixed phase clouds”, by Ji et al., egusphere-2025-1932.

Many Cloud Physicists and of course Chemists know that the relative humidity with respect to water (RH) over a pure sodium chloride flat surface is about 76% and ammonium sulfate is about 80% (see table below). Due to the Kelvin effect, the RH over a spherical pure sodium chloride solution is higher. The Kelvin effect becomes more important as aerosol particle diameter decreases due to the increasing curvature of the aerosol surface which impacts the saturation vapor pressure of aerosol constituents at the surface. Therefore, the larger the pure salt sodium chloride cloud condensation nuclei, the lower the saturation vapor pressure over the resulting particle surface; the equilibrium RH is calculable. The effect is represented by Eq. (3) in the article.

Figure 1 shows pictorially how the vapor pressure over a salt solution droplet of different sizes compares to the saturation vapor pressure over ice, and where the crossover between the vapor pressure over the solution droplets becomes less than the vapor pressure over an ice surface.

In this study, the authors have clearly demonstrated the potential effect whereby droplets containing giant salt CCN can sublimate ice crystals.

Saturated Salt Solution	**Temperature *(°C)***										
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**50**	**60**
	Relative Humidity over the Salt Solution *(%)*										
Ammonium sulphate - $(NH_4)_2SO_4$	82	82	82	82	81	81	81	80	80	79	
Sodium chloride - NaCl	76	76	76	76	75	75	75	75	75	74	75

The authors have used a model and data from the AFLUX campaign to determine the CCN size/droplet size under which the Giant Cloud Condensation Nuclei-Enhanced Ice Sublimation Process (GCCN-ISP) can be operative.

How are the giant CCN produced in high latitude regions such as Svalbard where the AFLUX measurements were made? The authors propose two processes. Primary sea salt aerosols emitted directly from blowing snow or surrounding open waters. A second possible process to cause these giant CCN particles is the collision between supercooled water droplets.

Primary Comments

2.1 and elsewhere saturated to saturation

Lines 124-125. You mention no new water supplied by turbulent mixing. First, you mean by updrafts. Second, you should discuss the implications of having updrafts on your model calculations.

125. decreases at a rate
Should be changes at a rate as follows.

125. Mention that S is dependent upon the droplet/ice particle size distributions and vertical velocity.

127-128. It also changes due to S. You assume that S decreases.

177-186 What if vertical velocities of let's say 10, 50 and 100 cm/s are assumed

225. What you mean here is the curvature effect

4.1 Numerical Simulation How is the growth of the ice particles considered. That is, things like ventilation coefficient, particle mass, etc

271 particle size distribution. How about the ice particle size distribution, which is interesting and relevant. Also, effective diameter usually considers both the liquid and ice phase together

What are the implications of the proposed process?

Minor Comments

100 Combining

196 Spitzbergen, Norway