General comments:

In this manuscript, the authors present an innovative method for detecting regions of hazardous aircraft icing conditions over the Korean peninsula, based on high-resolution 3D weather radar data and on fields of thermodynamic variables obtained from observations and an NWP model. Their AIDER algorithm then indicates regions where caution is adviced or more severe icing warnings are assigned in real-time to inform aviation operations. I particularly like the inclusion and strong weighting of radar data in the AIDER algorithm, in contrast to other methods for issuing icing warnings that rely exclusively or mostly on atmospheric variables.

Overall, the manuscript sections are well-organized, but in some parts the manuscript could still benefit from more careful editing to improve the grammar and the clarity of the arguments made. The case studies in Section 5 should still be discussed in more detail to clarify further how the retrieved icing categories correlate with the algorithm inputs of radar and atmospheric variables for different weather situations (see also specific comments on Figs. 7 – 9 below). Another important point that should still be addressed is what the current limitations of the AIDER algorithm are, or how the accuracy of the icing warnings may still be improved in the future.

I would therefore suggest to publish the manuscript after these points and the following specific comments are addressed.

Specific comments:

l. 2, l. 14 f, 16, etc: Is 'icing potential area' a proper name? While it fits the acronym in the title, maybe it could be better rephrased as 'area of potential icing' or 'potential icing area' or simply 'icing potential' throughout the text, i.e., apart from the title.

l. 26 ff: I do not fully understand this sentence. Maybe it would be better to split this sentence into two sentences and then stress that the crucial icing hazard is caused by structural icing, because this type of icing cannot be overcome by clever aircraft engineering and instrument design.

l. 40 f: devoid of what systems? De-icing systems or a certaint type of weather systems, or something else?

l. 46: 'undertook acquired'? Maybe delete 'undertook'?

l. 57: What is 'the 1994 icing incident'? Can you describe this incident (I assume this was an accident caused by aircraft icing) in a few words?

l. 64ff: Can you give a droplet size where SLDs start as opposed to smaller cloud droplets? Are drizzle droplets large enough to qualify as SLDs? Even if freezing drizzle can be detected by radar, does this really mean that ALL freezing scenarios due to SLDs can be detected (it seems SLDs also include larger freezing raindrops, and not only drizzle)?

l. 87ff: The current version of ADWICE also includes satellite observations to mitigate overforecasting and over-diagnosis of icing conditions present in many expert systems. See current ADWICE reference: Kalinka et al. (2017), DOI: 10.1127/metz/2017/0756

l. 149: … mark the locations of KMA …

l. 152: Do you also use these 'other' atmospheric variables in the analysis? If so, name them, if not, it would be best to delete 'and others'.

l. 175ff: If AIREP data of only 'light' icing intensity was used, did you use any 'strong' icing intensity data from the research aircraft to cover a wide range of icing intensities for developing the AIDER algorithm? If you did, you should mention this explicitly. If you did not, how confident are you that the results can be extrapolated to other icing intensities that were not included in the algorithm development stage, or whether the results can be extrapolated to other icing intensities at all?

l. 222: It is probably better to rephrase this part as something like '…, probably caused by smaller and nearly spherical hydrometeors.'

l. 232 f: delete redundant clause starting with 'associated with …'. This does not seem to add anything to the statement.

l. 273 ff: How do those values compare to accuracy metrics of other algorthms that are used for detecting and predicting hazardous icing conditions (some of those that you listed in the introduction)? Is there any data available from those methods that you could compare with your results?

l. 300: What do you mean by 'pertinent radar variables'? Maybe you mean '… conducive to icing, with radar variables of Z_H below ….'

l. 301 f: Can you define already here in the text what hydrometeor classes the three colors yellow, pink and cyan inside the red box correspond to?

Fig. 7 (f): 'LWC' instead of 'LCW'

Fig. 7 (i): Can you discuss this profile of icing potential in more detail? For example, why are there relatively sharp structures (i.e. 'holes' without icing caution rating)? Are these holes related to the exceptionally high Z_DR values observed in Fig 7 (b) or due to some atmospheric variables?

Fig. 8: Can you discuss/explain in more detail why there is a large region of icing caution detected but no icing warnings along transect A to B? Is this mainly due to the absence of wet snow here or is the relative humidity consistently low in this region? In other words, what additional characteristics of the radar data and/or atmospheric variables would trigger an icing warning instead of only a caution notice for these cases?

Fig. 9 (i): Again, can you discuss these results in more detail? In particular, it seems that the regions of icing warnings are closely correlated to regions of wet snow, but only if reflectivity Z_H is not 'too' high within the wet snow. How realistic is this result? For example, do the aircraft icing data also indicate that icing intensity suddenly decreases with increasing radar reflectivity, or does the 'same' icing intensity persist in the aircraft icing data across the transition from low to high reflectivities instead of the sharp jumps in icing potential that the AIDER algorithm suggests?

Conclusions:

How could the relatively high false alarm ratio be reduced? Would the inclusion of satellite data help, similar to how they are applied in ADWICE, for example, or could it help to include more polarimetric variables or atmospheric variables (if the authors already tested some of these ideas and found some improvement or also if they found no improvement, this information should be included here)?

What would be needed to give a more quantitative estimate of the icing hazard, or to at least provide an additional category like 'extreme' icing risk that should be avoided by aircraft at all costs?

Could the AIDER algorithm with the listed threshold values of radar and atmospheric variables be adopted by other weather services in different parts of the Earth? And, which parts of the algorithm would have to be modified before implementing a similar algorithm for different weather radar networks and atmospheric models?