

Collective geographical eco-regions and precursor sources driving Arctic new particle formation, J. Brean et al. Responses to RC1.

Note: Review comments are displayed in **blue**, and sections that have been added to the text are coloured **green**. We thank the reviewer for their insightful comments and provide responses below.

1) For improved readability, the sentence at lines 73-78 could be divided into 3 sentences at the two occurrences of the words ‘however’.

Thank you for the suggestion, this has been done

2) Figure 1 – please correct BAR to UTQ on the horizontal axis for consistency with the remainder of the manuscript. Also consider adding to the caption a few words to define the abbreviations used to labels the horizontal axis.

This has been done. We provide the updated figure and caption below

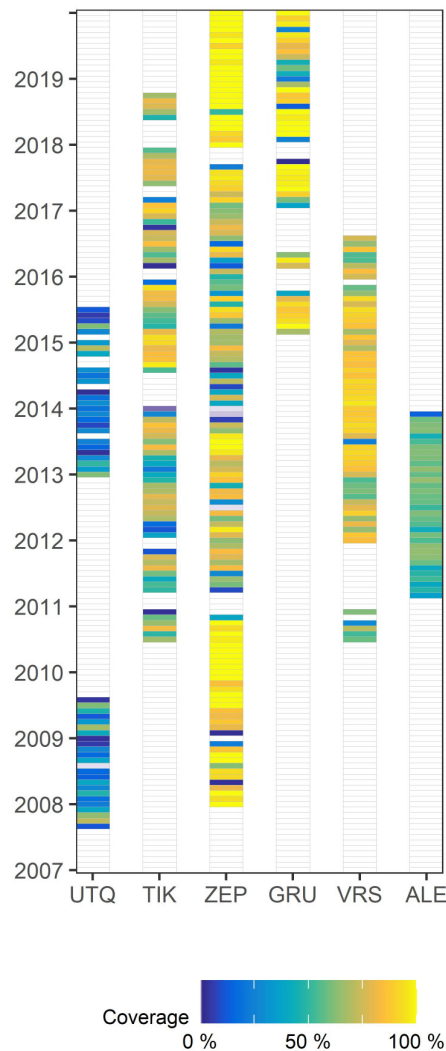


Figure 1: Data coverage for each of the sites. Each individual cell corresponds to one full month of measurements. Fill colour corresponds to the total number of available hourly data as a percentage of the

total hours within that month. The abbreviations along the bottom axis correspond to Utqiagvik, Tiksi, Mt. Zeppelin, Gruvebadet, Villum research station, and Alert.

3) Figure 6 caption, do you mean ‘drawn’ as opposed to ‘drown’?

Yes. We edit this caption slightly to read better. It now reads as follows

“Figure 6: Schematic illustrations of the sea-ice, microbiota, sea-to-air emissions and New Particle Formation (NPF) occurring in the typical summertime stratus-topped Arctic boundary layer. Vertical red and grey bars broadly indicate Cloud Mixed Layer (CML) and Surface Mixed Layer (SML) as inspired by Brooks et al. (2017). The grey box indicates known possible gas-phase NPF precursors from the potential Arctic natural terrestrial and marine sources drawn below”

4) Line 43 acknowledges the historical overestimation of low clouds in the models. Please consider if the text should also acknowledge uncertainties in the retrievals of Arctic low cloud coverage e.g., Sect. 4 in Browse, J., Carslaw, K. S., Arnold, S. R., Pringle, K., and Boucher, O.: The scavenging processes controlling the seasonal cycle in Arctic sulphate and black carbon aerosol, Atmos. Chem. Phys., 12, 6775–6798, <https://doi.org/10.5194/acp-12-6775-2012>, 2012.

Thank you for the suggestion, this section now reads as follows

“[R]ecently there has been shown a different temporal trend in predicted and observed cloud cover at a high Arctic site (Gryning et al. 2021) continuing a historical overestimation of low-level clouds in the Arctic by climate models, particularly in the wintertime, most particularly in daily data (Quan et al., 2012). Uncertainties also exist in cloud coverage retrieved by satellites, arising from similarities between clouds and ice-snow surfaces, and frequent temperature and humidity inversions (Browse et al., 2012)”

5) Line 300 appears to be missing the word ‘at’ before the words ‘each of these sites’.

This has been amended.

6) Line 343: ‘alongside permafrost and precipitation’ – is there a word or two missing here? Do you mean ‘alongside permafrost thawing and precipitation changes’.

Yes, thank you. This has been amended.

7) Line 359: This sentence reads somewhat awkwardly – consider adding the word ‘along’ before the words ‘with sources of organic and inorganic iodine’.

This has been amended also.