Reviewer comments in black, author responses in blue

Congratulation to the authors, a good contribution to the field, adding important Cold air outbreaks CAO information. Particularly appreciated is the comparison among two monitoring sites and the good number (49) of event reported. Overall, it is a good contribution to the field following the important papers well cited of Abel 2017, Sanchez 2022 and Llloyd 2018.

We thank the reviewer for their insightful comments. We have revised our manuscript accordingly (see below) and believe that the manuscript has benefited from the addition of background information, discussion of literature, and references in response to the reviewer's specific comments.

Two main small comments:

1. Please expand the introduction and explain better what the COA events are and why they are important, perhaps a conceptual diagram or a figure explaining better the event, poorly explianed in the current literature.
We have revised the first paragraph of our introduction to include a more detailed description of CAO events and their relevance and importance. Additionally, we have included more literature references and included a citation directly to Figure 1 of Geerts et al. (2022) which illustrates through satellite imagery one of the CAO events we analyze in our study. The revised paragraph now reads:

" The equatorward transport of polar air masses brings cold air over a relatively warmer open ocean, spurring large turbulent surface fluxes of heat and moisture and creating so-called marine cold-air outbreak (CAO) events. The forming clouds often appear first in the shape of rolls (Brümmer, 1999) before filling in towards a near-overcast deck and then transitioning into a more broken, open-cellular state further downwind (Abel et al., 2017; Lloyd et al., 2018; McCoy et al., 2017; Geerts et al., 2022). Such a cloud regime transition during CAO events is often seen in satellite imagery (e.g. Fig. 1 of Geerts et al. (2022)) and has important implications for the regional radiation budget (McCoy et al., 2017). Climate and numerical weather prediction models struggle to accurately capture the clouds associated with CAO events. Such model limitations emerge since important dynamical aspects are unresolved (Field et al., 2017). In addition, there is evidence of strong cloud and aerosol microphysical processes that may modulate the macrophysical structure of clouds. For example, Tornow et al. (2021) found that mid-latitude CAO cloud transitions which resembled observations could only be simulated when the number concentration of aerosol serving as cloud condensation nuclei (CCN) was allowed to evolve with time, as aerosol can control the onset of transition-driving precipitation (Abel et al., 2017; Tornow et al., 2021). For polar CAOs of lower temperature, aerosol may additionally provide a reservoir for ice nuclei (IN; e.g. Bigg (1996)). Previous modeling of cold-air outbreaks have typically relied on sparse observational constraints (e.g. Field et al. (2014); Abel et al. (2017); Tornow et al. (2023)), illustrating a need for observations of aerosol properties associated with CAO events in order to inform, constrain, and improve model simulations and forecasts."

2 I was surprised by the sea spray mode at 450nm, sensibly larger to what I understand being the "referement" mode at 160nm (Prather et al 2013, etc). Perhaps a discussion on this and an appropriate small summary of the art on the typical sea spray aerosol mode may be necessary.
Thank you for pointing this out. We have added the following sentence to Section 2.2 of the revised manuscript: "This sea spray mode centered at diameters between 0.3 and 0.8 μm is consistent with

previous reports of sea spray mode mean diameters ranging between 0.14 and 0.6 µm in field measurements (Russell et al., 2023; Modini et al., 2015; Dedrick et al., 2022).” Our median sea spray mode during CAO events centered at 450 nm is consistent with previously observed sea spray mode mean diameters in field measurements. The sea spray mode mean diameter is found to be 300 nm in Lewis and Schwartz (2004), 300 nm in Quinn et al. (2017), 500 nm in Saliba et al. (2019), 600 nm in Sanchez et al (2021), and 400 nm in Dedrick et al. (2022). See Table 3 of Russell et al. 2023 for further details (https://doi.org/10.1016/j.earscirev.2023.104364). Prather et al. 2013 reports a mean sea spray mode at 160 nm, but it is worth noting that it is based on laboratory wave simulations rather than field measurements. In agreement with this, Salter et al. (2015; https://doi.org/10.5194/acp-15-11047-2015) also report a smaller mean sea spray mode centered at approximately 100 nm when using a sea spray simulation chamber.

Congratulation, it is a well described paper with a very good dataset collected at two stations.
We appreciate the reviewer taking the time to review our manuscript.