This manuscript systematically investigates the impact of sea surface temperature (SST) on sea spray aerosol (SSA) production by a combined wind–wave facility (the Scripps Ocean–Atmosphere Research Simulator, SOARS). SSA is the most prevalent aerosol and is essential to the radiation budget and climate system. The authors characterized the connection between SST, seawater bubble concentrations, SSA number concentrations, and SSA emission fluxes using measurements in the SOARS. This topic is a classic topic in ocean-atmosphere interaction and it is becoming more and more important in the future because of the ongoing global warming. The dataset presented in this study will be of broad interest to the modeling community. Nevertheless, I have several concerns that need to be addressed before the manuscript can be recommended for publication.

Major comments:

1. Section 2.4: Different measurement periods were used for submicron and supermicron PNFDs. Submicron PNFDs were derived from the first 5 minutes of observations, while supermicron PNFDs used the full time series. Would the results change substantially if the full time series were also adopted for submicron PNFDs?
2. In many figures (e.g., figures 3, 5, 6, figures S4, S6, etc.), the coefficients of determination are high (close to 1.0). However, several data points clearly deviate from the fitted lines. Please explain this discrepancy.
3. I'm confused about the influence of SST on SSA production. Lines 250-251 state that 'increasing SST reduces the amount of SSA produced without substantially altering the size distribution', but lines 259-260 state that 'This suggests a mechanistically driven (i.e., film vs. jet drop) size-dependent shift in production and indicates that increasing SSTs have a complex influence on the resulting SSA.' Could the authors clarify whether the impact of SST on SSA production is straightforward or complex?
4. Two SST-dependent emission correction factors are derived in this study: CFN for number flux and CFM for mass flux. These factors represent valuable outcomes. My question is: when applying them separately to the number and mass flux calculations within an SSA emission scheme, do the two corrected fluxes remain mutually consistent?

For instance, if CFN is first applied to the number flux dF/dr, the corrected number flux is written as dF/dr×CFN. The corresponding mass flux is then calculated as dF/dr×CFN×3/4 πr^3×SSA_density.

Alternatively, if the number flux is first converted to mass flux as dF/dr×3/4πr^3×SSA_density, and CFM is applied subsequently, the final mass flux becomes dF/dr×3/4πr^3×SSA_density×CFM.

Could you clarify whether I am using these correction factors correctly? I tested the two approaches using the Gong (2003) scheme, and the results differ.

Additionally, could the authors discuss how these new factors differ from previous correction factors adopted in earth system models, such as those presented by Jaeglé et al., Grythe et al., and Sofiev et al.?

Minor comments:

1. Lines 64-65: The statement "typically incorporate a positive correlation with SST (Grythe et al., 2014; Jaeglé et al., 2011; Song et al., 2023)" appears inconsistent with the content in Lines 53–54, where non-monotonic relationships are noted with the same reference: *Jaeglé et al. (2011)*.
2. Line 355, 'particles whose emission rates increase with SST (Figure 7a, d)', figure 7d dose not

support this statement.

3. Supplement section S5, equations S1 and S2 (lines 72 and 81) should be S2 and S3.