RC1 Response

The paper presents details about SASSIE including instruments onboard the ship, the many uncrewed marine system assets, and the aircraft. General objectives of the study are discussed along with the sampling strategy employed for all assets deployed. Finally, the five major “plays” of the campaign are described where each one targeted a particular set of ocean conditions and regions. Data presented from each play indicate the vast amount of data that is available from SASSIE and how it will likely be used to understand links between salinity, near-surface stratification, upper ocean heat content, and sea ice freeze and melt. The paper presents a useful “catalog” of SASSIE data sets which will aid both the authors and future readers in using and interpreting the data. The few comments I have are listed below.

Thank you for taking the time to review our work. Please find responses to each of your comments below.

Figure 1: What does the color indicate (white vs. blue)?

The blue coloring indicates the extent of the ice field from the MASIE-NH National Ice Center Product. We have added this detail to the caption. (Line 78)

Line 118: Delete second “within the ice”

Deleted. Thank you. (Line 127)

Line 145: Just to clarify – the “previous ship and buoy computational fluid dynamics studies” refers to previous comparisons between ship and buoy measurements for a variety of ship-relative wind directions? A little more detail could be helpful here.

More details have been added to the ‘wind speeds’ part of this section (Lines 154-170):

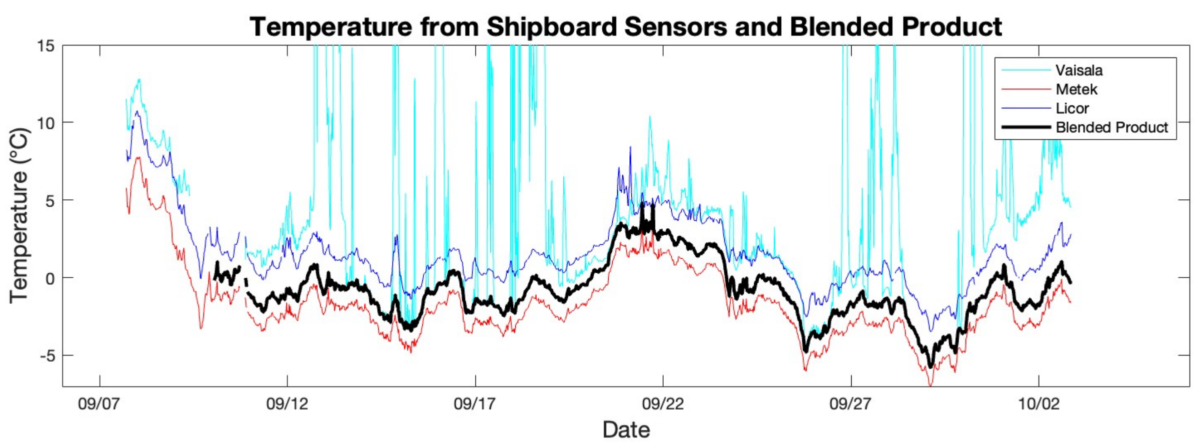
“The ship’s flow distortion was found to be a strong function of apparent wind angle, with a large blockage caused from the forward radar mast (roughly +150 degrees from bow for the port-side sensor, -150 degrees from bow for the starboard-side sensor). A linear average of the two wind speeds would effectively distribute the bias evenly between the two sensors. A study using multiple wind sensors on a buoy showed a similar bias pattern with apparent wind angle (Schlundt et al., 2020) and highlighted that the difference between the two sensors’ wind speeds was distributed such that the upwind sensor accounted for roughly 75% of the difference, and the downwind sensor accounted for roughly 25% of the wind speed difference. We followed these percentages of (Schlundt et al., 2020), reducing the upstream sensor by 75% of the wind speed difference, and increasing the downwind sensor by 25% of the wind speed difference, with the error determined from the average percentage difference between the two wind sensors at relative direction from +100 to -100 degrees. For directions where one sensor was obstructed by the radar mast (near +/-150 degrees), this correction was not considered (since the nature of the flow distortion was different), and the unobstructed sensor data was used uncorrected.”

The following reference was added to the paper:

Schlundt, Michael, et al. "Accuracy of wind observations from open-ocean buoys: Correction for flow distortion." *Journal of Atmospheric and Oceanic Technology* 37.4 (2020): 687-703.

Lines 150 – 154: There is not much quantitative information here, so the reader does not get a good sense of the accuracy of the blended temperature product. Could a time series comparison be provided so it is possible to see how the different instruments agreed or disagreed?

A time series of the temperature data is below. As noted, each of the three sensors had its own issues: the Vaisala temperature was unstable (had numerous positive spikes) and therefore was excluded from the blended product, though its agreement with the Licor helped visually confirm the validity of the Licor. The Metek sonic temperature showed a mean bias compared to the other two sensors. The Licor showed a warm bias when the downwelling shortwave solar radiation was large (a known issue with unshielded temperature measurements).



At night, the Licor temperature and the Metek temperature agreed well (with a linear offset) indicating that they are usable data. We therefore used the Metek sonic temperature time series, and adjusted the linear offset to effectively “tune” the bulk sonic temperature flux to the directly measured sonic temperature flux.

The following was added to the text in the ‘air temperature’ section of the shipboard meteorology measurements (Lines 176-185).

‘Sonic temperature measured from anemometers is known to differ from the true temperature due to the sensitivity of the speed of sound in air to water vapor. In most cases, sonic temperature is subject to sensor drift to a variety of factors, including the temperature of the sensor itself. For this deployment, the Metek sonic temperature was relatively stable due to the generally low absolute humidity in cold temperatures, and because the sensor head was temperature controlled through a heating element. This lack of temperature drift was apparent through a high correlation between the night-time Licor air temperature (when the Licor sensor was not subject to radiative heating) and the Metek sonic temperature. Day-time air temperature values between the Licor and Metek were still correlated, however showed a bias with the Licor temperatures larger than the Metek temperatures consistent with radiative heating of the Licor sensor.. A corrected temperature product was created by finding the constant offset between the Metek Sonic temperature and the night-time Licor air-temperatures values to replace the biased day-time Licor air-temperature values. This corrected temperature product resulted in much better agreement between bulk and direct buoyancy fluxes than if any of the three raw air temperatures were used uncorrected.'

Figure 8: The uncertainties in b) and d) seem to be depicted by faint lines rather than dashes as indicated in the caption.

The caption has been changed to reflect the image (Line 210)

Figure 17: An indication in the text describing what the isotope data analysis shown in the figure reveals about the sources of freshwater during SASSIE would be helpful.

We have added a brief discussion about the isotope analysis results (Lines 370-374):

"$\delta^{18}O$ values of -5 to -2 mL L^{-1} were observed throughout the SASSIE domain, except for higher values (-2 to -1.5 mL L^{-1}) in the sea ice samples (Figure 17). While these values are generally consistent with previously observed $\delta^{18}O$ values observed in Beaufort Sea upper halocline water and sea ice meltwater, and significantly higher than $\delta^{18}O$ values of meteoric water (e.g., Lansard et al., 2012), further analysis is needed to quantify the sources of freshwater in the area."