Elementa: Science of the Anthropocene

Supplemental Material for

Insights on Sources and Formation Mechanisms of Liquid-Bearing Clouds over MOSAiC Examined from a Lagrangian Framework

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Figures S1 and S2

Introduction

The supplemental material includes 2 figures:

- **Figure S1** depicts the cumulative distribution function of relative humidity (RH) from sounding measurements at high spectral resolution lidar (HSRL) liquid cloud base heights.
- **Figure S2** shows the net surface longwave radiation (LW_{net}) histogram for the full MOSAiC deployment.

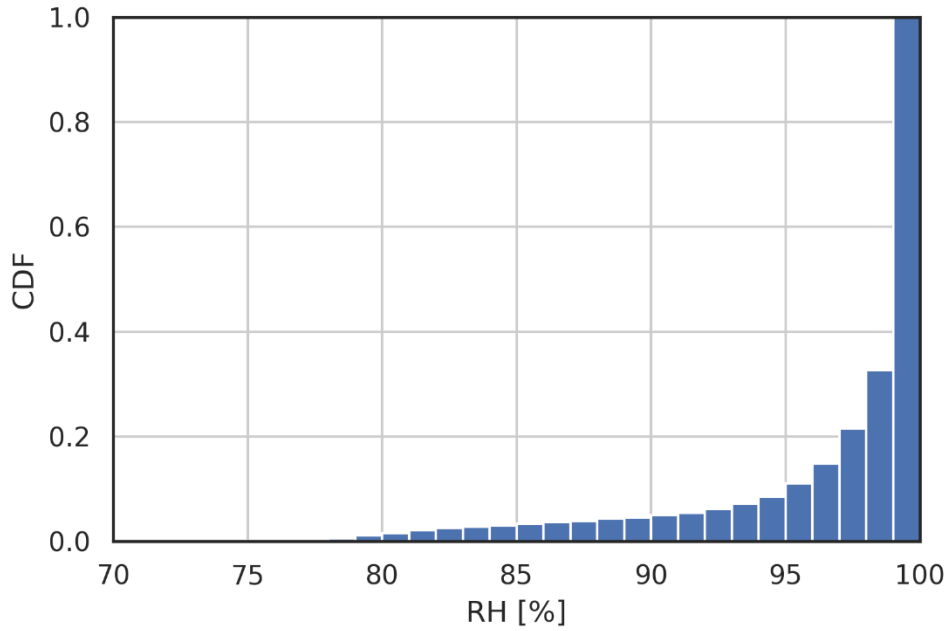

Figure S1: Cumulative distribution function of relative humidity (RH) from sounding measurements at high spectral resolution lidar (HSRL) liquid cloud base heights (LCBHs; Silber et al., 2021) (N = 29,375). For this comparison, all LCBH detections up to 15 min following radiosonde release times are used, while excluding LCBHs at temperatures between -20 and -8 °C, thereby mitigating the potential influence of specular reflection artifacts in the HSRL data (see Silber et al., 2018, Appendix A). The 15 min window covers the radiosonde ascent up to ~4.3 km, and hence, generally represents the vast majority of liquid-bearing clouds detected over MOSAiC (see Figure 3c in the text). More than 85% of all HSRL LCBH detections correspond with RH values greater than 96% (liquid-bearing cloud detection threshold used in the text). Silber et al., (2018) have demonstrated that the HSRL LCBH algorithm typically determines the LCBH just above the level of aerosol deliquescence. This algorithm property combined with the RS-41 radiosonde RH measurement response time of a few to several seconds at sub-freezing temperatures (see Holdridge, 2020) could explain, in addition to the influence of different probed HSRL and sounding regions, the remaining 15% of samples in which RH is high but smaller than 96%.

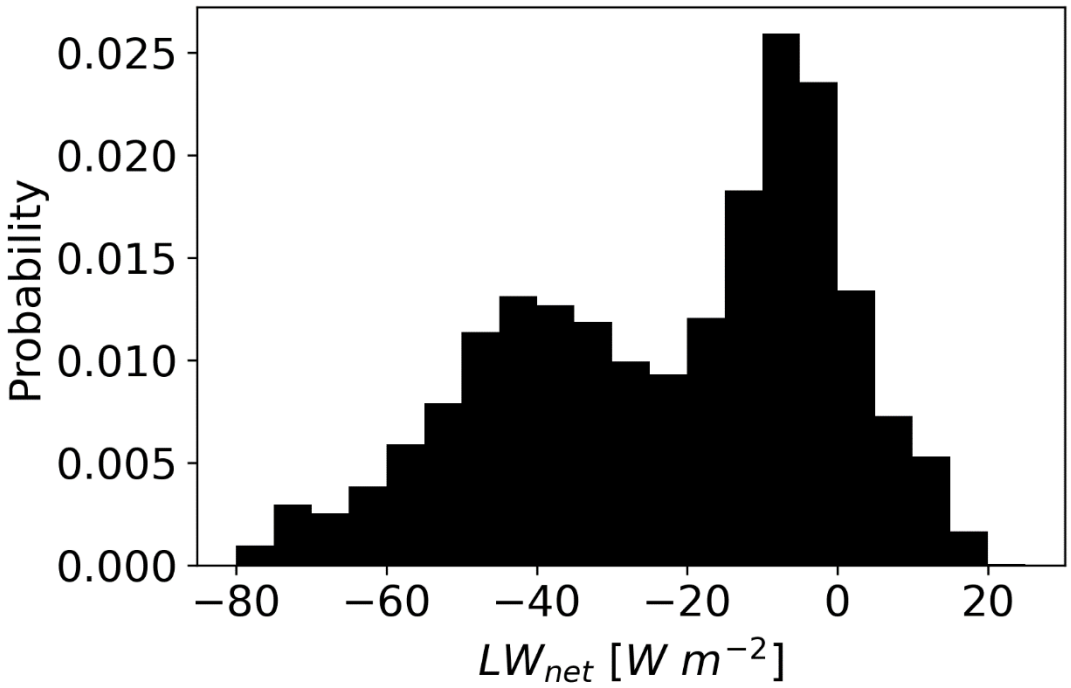

Figure S2: Net surface longwave radiation (LW_{net}) histogram for the full MOSAiC deployment based on measurements from the central observatory (see text; bin width of 5 W m^{-2}). The "radiatively cloudy" state threshold discussed in the text is determined based on the histogram's local minimum at -25 W m^{-2}.