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A Study of the Interactions between ICE Algae and Springtime Arctic Clouds Using Cloud Microphysics Properties Derived from Synergistic MODIS and CALIPSO Measurements

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A neural-network algorithm that uses synergistic CALIPSO and MODIS measurements to infer droplet effective radius, extinction coefficient, liquid-water content, and droplet number concentration for water clouds is described and assessed (Hu et al., 2022). These results are verified against values inferred from High-Spectral-Resolution Lidar (HSRL) and Research Scanning Polarimeter (RSP) measurements made on an aircraft that flew under CALIPSO. The global cloud microphysical properties are derived from 14+ years of CALIPSO lidar measurements, and the droplet sizes are compared to corresponding values inferred from MODIS passive imagery. This new product will provide constraints to improve modeling of Earth's water cycle and cloud-climate interactions.

One of the findings from this new data product is that the droplet number concentrations of springtime Arctic boundary layer clouds over sea-ice are three times higher that over land surfaces, and the correlations between ice algal biomass and cloud droplet number concentration is significant. A potential physical mechanism of ice algae – cloud – Arctic sea ice feedback is thus suggested and its impact on the Arctic amplification is discussed.

Keywords: clouds, ice algae, feedback, Arctic

References

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