Supplement:

Figure S1: Cloud phase vertical profile on November 21 1997 collected in the Surface Heat Budget of the Arctic Ocean (SHEBA).
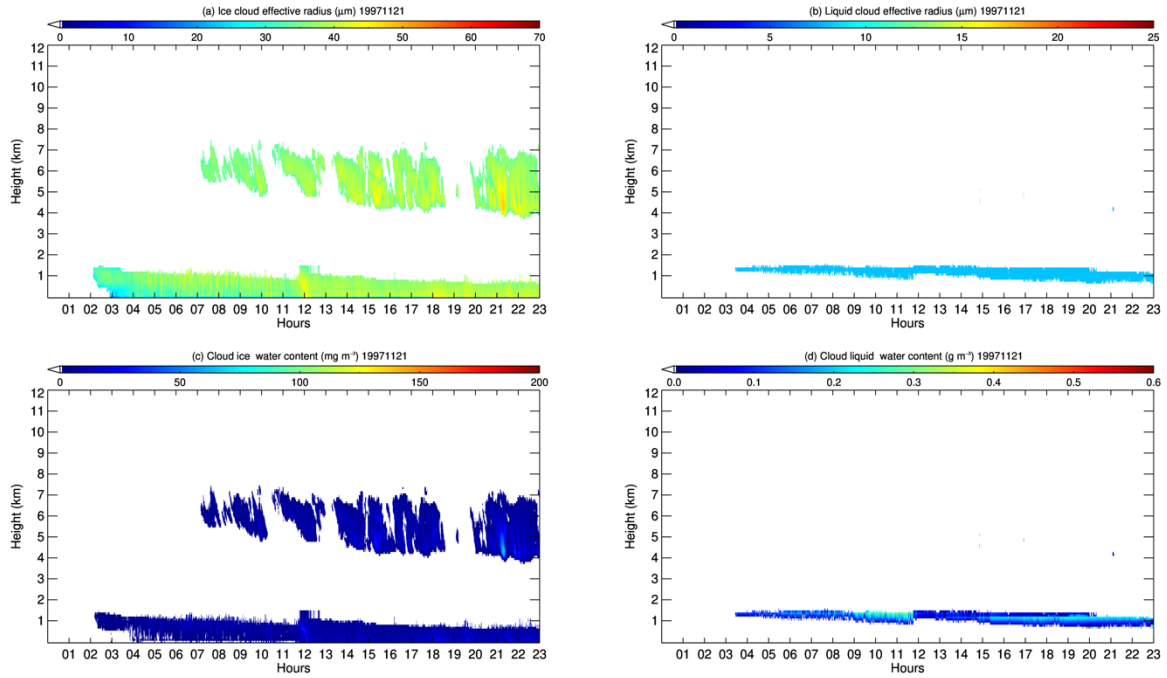
Figure S2: Cloud vertical profile on November 21 1997 collected in the Surface Heat Budget of the Arctic Ocean (SHEBA), including (a) ice cloud effective radius, (b) liquid cloud effective radius, (c) cloud ice water content, and (d) cloud liquid water content.
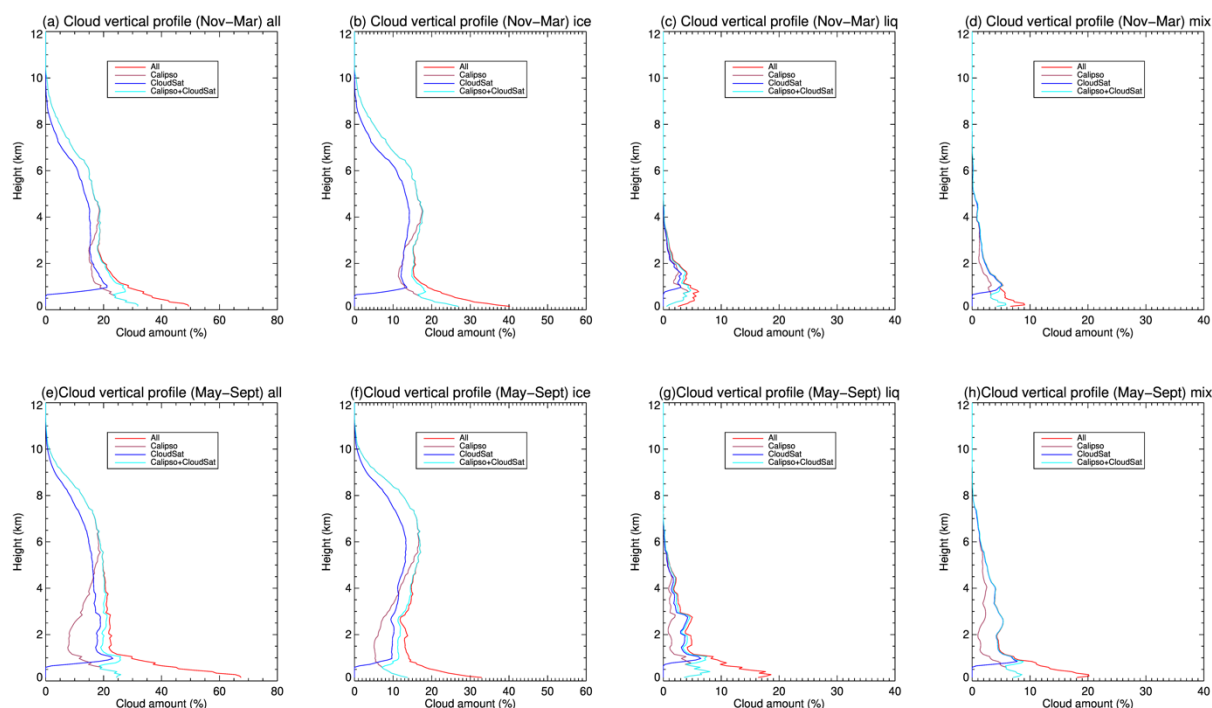
Figure S3: Mean cloud amount vertical distributions from surface observations during the Surface Heat Budget of the Arctic Ocean (SHEBA) and from estimated CloudSat, CALIPSO, and combined CloudSat and CALIPSO for (a) ice (b) liquid and (c) mix phase cloud from November to March, and for (d) ice (e) liquid and (f) mix phase cloud from May to September.
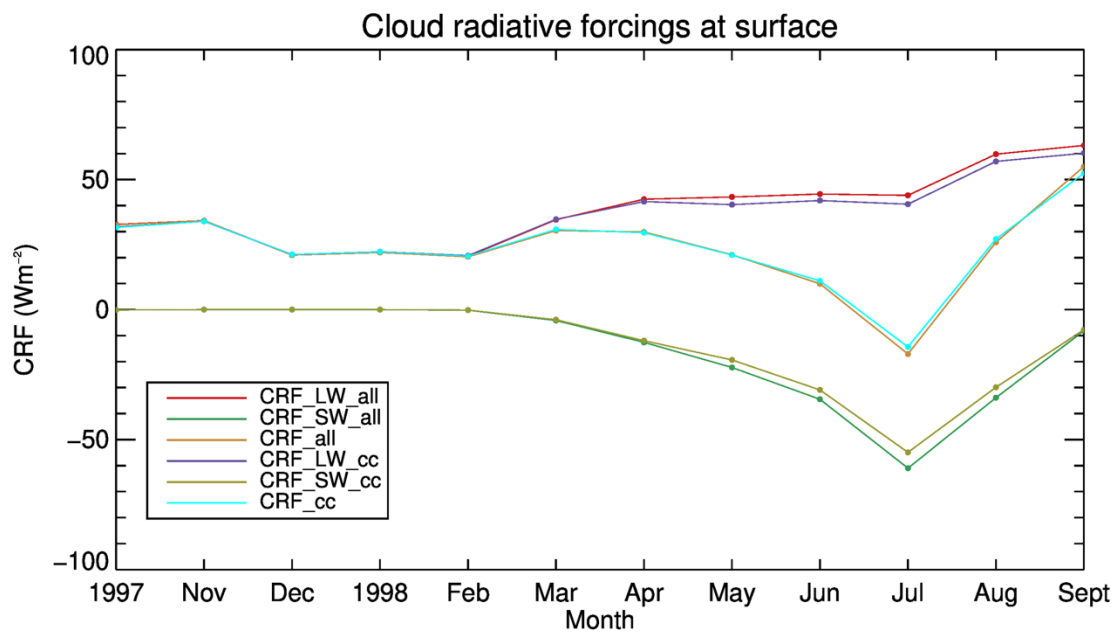
Figure S4: Monthly mean cloud radiative forcing (CRF) at surface for longwave (LW) and shortwave (SW) with cloud from surface observations collected during the Surface Heat Budget of the Arctic Ocean (SHEBA) (all) and with cloud from combined CloudSat and calipso (cc)..
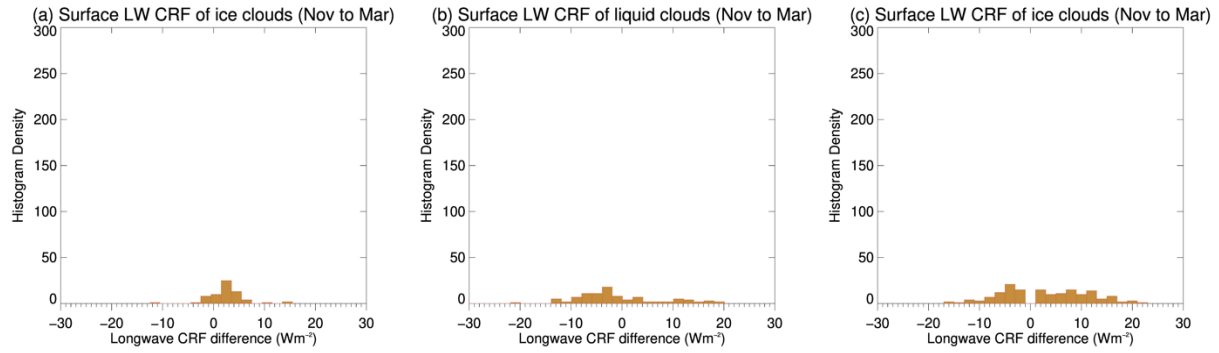
Figure S5: Histogram of longwave cloud radiative forcing at surface between using clouds from the combined CloudSat and CALIPSO and clouds from the surface observations during the Surface Heat Budget of the Arctic Ocean (SHEBA) from November to March for (a) ice cloud (b) liquid cloud and (c) mixed cloud near surface not being detected in the combined CloudSat and CALIPSO.
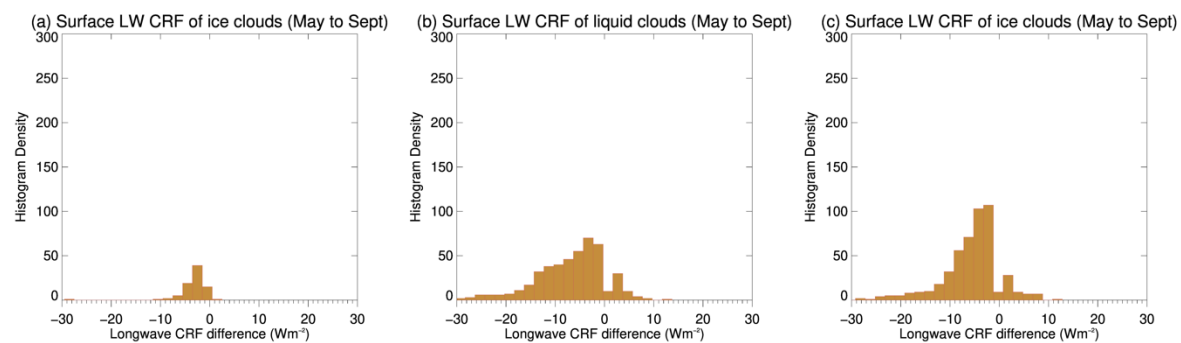
Figure S6: Same as Figure S5 but for from May to September.
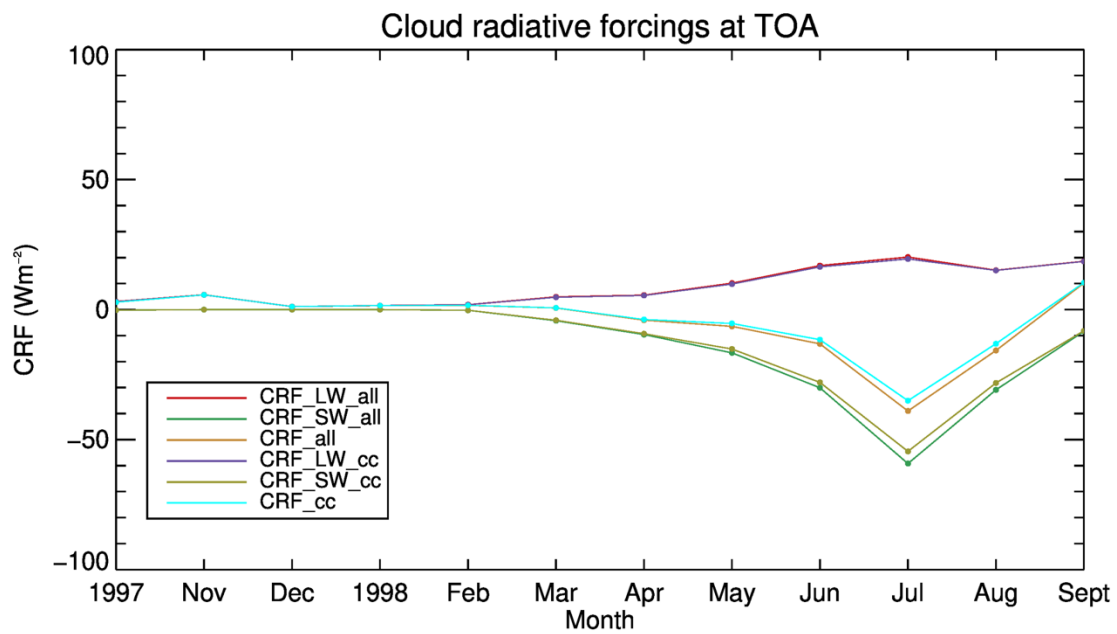
Figure S7: Same as Figure S4, but at the top of atmosphere (TOA).