IASOA Radiation Working Group
September 7, 2016

Attendees: Sara Crepinsek, Chris Cox, Von Walden, Bob Stone, Ariel Morrison, Taneil Uttal, Allison McComiskey, Chuck Long, Jeff Key, Gijs de Boer

Introduction of group members

Presentation on CALIPSO Observations of the Cloud Response to Recent Arctic Sea Ice Loss – How do Arctic clouds respond to sea ice loss, sea ice loss and the cloud sea ice feedback, CALIPSO satellite, observed Arctic sea ice loss = partly attributed to human greenhouse gas emissions, observed September sea ice extent (1979-2006) vs modeled September sea ice extent (1900-2001), trending downward, fall/winter/spring = longwave effect dominates as clouds warm the Arctic ocean, summer = shortwave effect dominates as clouds cool the Arctic ocean, all dependent on surface albedo, liquid = most radiatively important cloud phase, height at which clouds form are important to determine cloud radiative forcing, as sea ice melts how will cloud formation be affected, if clouds form in response to sea ice loss then sea ice – cloud feedback = negative in summer and positive in fall, observational data and methods with the CALIPSO satellite, CALIPSO/CALIOP lidar is an active “surface blink” sensor = detection based on laser pulses and not on thermal or albedo contrasts between clouds and surface, misses some clouds but still the best option thus far, vertical cloud fraction from CALIPSO, defining seasons in the Arctic, methods: 333m horizontal, 240m vertical resolution, clouds collocated with daily sea ice concentration from NSIDC, instantaneous cloud location and phase retrievals every 3 hours, 2008-2015, looking at clouds over water and over sea ice and only clouds with liquid droplets, vertical liquid cloud fraction = liquid cloud counts/total cloud counts + clear sky counts + uncertain counts, pan-Arctic cloud response, need to isolate the cloud response to sea ice loss, eliminate always ice-free or always ice-covered ocean for cloud response to sea ice loss, accounting for geographic differences: seasonal mean sea level pressure, atmospheric stability, sea ice concentration, and cloud fraction, study region = intermittent mask where summer and fall sea ice concentration varies from 2008-2015, eliminates potentially confounding influence of different synoptic regimes (consider using the same mask for both summer and fall seasons), summer results: within the intermittent mask no difference between vertical cloud profiles over open water and over sea ice; no observed summer cloud response to sea ice loss, small air-sea temperature gradient = enhanced near-surface stability and reduced turbulent fluxes, fall results: unlike in summer we see more liquid clouds over open water than over sea ice within the intermittent mask; robust fall cloud response = clouds for over newly open water, sea ice loss = large turbulent heat and moisture fluxes from ocean, cool and form low-level clouds, summer signal is robust to different regions of the Arctic ocean, over the top half of the intermittent mask no cloud response to sea ice loss, fall results are robust to geographic sub-sampling, still more clouds over open water than over sea ice when low pressure is removed, most summer opaque clouds = over open water with some over sea ice, no climatological response to sea ice loss in a region when CALIPSO is not attenuated, if CALIPSO misses clouds because of attenuation the missed clouds are over open water → adding “missed” clouds back to profiles increases the clouds over open water and supports cloud response to sea ice loss, more summer clouds in response to more open water could have slowed the rate of sea ice loss → but observations show this is not the case, clouds reduce the strength of the ice-albedo feedback, the intermittent mask isolates the cloud response to sea ice loss from the cloud response to atmospheric circulation, no observed summer liquid cloud response to sea ice loss, more fall liquid clouds over open water than over sea ice, summer clouds will not accelerate or decelerate sea ice loss, increasing fall clouds in response to sea ice
loss is the first observed human-caused cloud change in the Arctic

*Update on Cold Weather Working Group Projects* – brief update of cold weather working group meeting, goals of YOPP/BSRN science review and workshop: 1) ensure all polar stations are caught up in archiving as a service to YOPP and to elevate BSRN exposure, 2) development of a traveling inter-comparison station, and 3) ice mitigation strategy inter-comparison campaign, need to identify funding sources for building inter-comparison system AND future ice mitigation experiment/campaign, overlap with cold weather working group and IASOA radiation working group is beneficial, IASOA working group should continue to focus on synthesis research and publications but is also beneficial to work on some of these instrumental areas, possibility of creating a technical working group to focus on cold weather instrument functionality, hesitate to separate a technical group from the scientific discussion, determine if these three goals are attainable (i.e. have funding for to proceed)

**Action Items:**

- Morrison to follow up with Jeff Key wind product to determine advection (Key, Uttal, Morrison)
- Morrison to follow up with Walden on boat measurements/sondes to compare to CALIPSO (Morrison, Walden)
- Follow up with funding sources for cold weather working group (Long, Uttal, McComiskey)
- White paper for ice mitigation strategy, statement of work (Crepinsek, Cox, Uttal)
- Schedule an IASOA meeting of group chairs (or steering committee) to discuss future of groups and goals and whether or not to combine some of the groups for collaboration (Uttal, Crepinsek, Starkweather)