Breakout Notes: High-latitude processes

Notes by Anastasia Piliouras

Rudong Zhang (*Unraveling driving forces explaining significant reduction in satellite-inferred Arctic surface albedo since the 1980s*): What is the primary contributor to arctic albedo reduction? CAM5 sims + satellite-based analysis
Surface albedo trend attribution - 38% of trend (reduction) attributed to snow cover fraction decrease over land, 32% attributed to snow cover fraction decrease over sea ice, remaining from sea ice retreat. 70% of observed albedo reduction from reduced snow - snow clearly important

Chad Thackeray (*Assessing prior emergent constraints on surface albedo feedback in CMIP6*): Looking at robustness of these constraints using CMIP6 ensemble. Two ECs (emerging constraints): Loss of northern hemisphere snow and loss of arctic sea ice - future surface albedo feedbacks that drive uncertainty. Emergent constraints from CMIP5 don't hold up in 6 - lack confidence in these. Intermodel spread still very large, not much improvement. Both identified ECs still exist in CMIP6.

Matthew Watts (*An assessment of pan-Arctic sea ice and regional limitations in CMIP6 historical simulations*): Integrate ice-edge error. Mis-represented feedbacks in models? Sea ice is removed by melting or advection faster than is observed. Sea ice extent and volume - collective skill in CMIP6 models. IIEE as a useful diagnostic/metric - improvement of sea ice biases.

Q&A:
Lots of GCMs struggling with snow cover extent.

Detelina Ivanova (*Evaluating the sea ice volume solution in a high-resolution climate models*): Metric for sea ice area and volume - longitudinal grid, accumulating in meridional sectors native grid sea ice variables. Reduces uncertainty due to compensation errors. Use CryoSat-2, icesat, GIOMAS reanalysis. E3SMv0 + v1. Found large uncertainty in the NASA/ESA ice thickness/area retrieval algorithms. Need for ensemble of satellite estimates.

Wieslaw Maslowski (*The role of sea ice physics in modeling and prediction of Arctic climate change*): Use RASM for dynamical downscaling and to evaluate physics. Changing ice rheology in two runs - everything else the same in the two runs. EAP has sharper features than EVP in divergence map. EAP more similar to observations from radarsat. Grow ice in leads in winter - frazil ice growth. After 40 years: anisotropic produces 17% more ice volume (more ridging). 6 month ensemble forecasts. EAP vs EVP: EAP thicker ice by 0.5 m. No data assimilation.

Difference persists in ice thickness field. Ice volume 1700 km^3 difference. Almost no difference in extent, so extent not sufficient metric to evaluate skill.

Wieslaw Maslowski (*Regional Arctic System Model: An approach for dynamical downscaling of global climate reanalyses and projections at timescales from sub-seasonal to decadal*): Using RASM for dynamic downscaling of GC reanalysis and projections, seasonal to decadal. CESM forcing, different initial conditions than RASM. RASM improves ice area simulation compared to CESM. Exact cover not well-modeled, but overall area okay. Sea ice thickness CESM has ice thickness very low, RASM corrects a bit. RASM inherits and maintains some biases associated with WRF physics. Dominance of RASM WRF physics near surface is dominating the state of the sea ice and surface climate. Variability more dictated by CESM model output. CESM DPLE downscaling eval - RASM successful downscaling ESM projects but maintains benefits of higher res and lower cost.

Jing Zhang (*Modeling Studies on Blowing Snow Processes Associated with Extreme Arctic Weather*): Snow/ice enhanced WRF model (WRF-ice). Model Feb 23-26 2018. N Greenland polynya. High winds blow snow. Increased water vapor 10-30%, up to 50% increase in cloud. Enhanced cloud cover - warms surface temp up to 8-12 degrees. Blowing snow sublimation matters a lot. Reduced lower atmosphere stability.

Xiangdong Zhang (*An Arctic Summer Intense Storm and its Role in Accelerating Sea Ice Decrease*): Long-term upward trend in storm intensity. What are impacts on sea ice? Increase in sea ice outflow when number of intense storms occurs. Decrease in ice concentration and thickness. Korean icebreaker observed intense storm. Analyze ocean response to storm forcing. Storm accelerated sea ice area decrease. Heat into ocean water surface and sea ice surface. Net heat loss on sea ice surface and heat gain through open water surface. Increase upward transport of heat by Ekman pumping.

Younjoo Lee (*Understanding the Evolution of Polynyas Along Northern Greenland*): Winter latent heat polynya due to southerly wind. Lost 200 km3 sea ice during 2 week event. No winter polynya in satellite before 2010. Why more frequent now? Southerly winds stronger, more prevalent, more persistent. Another polynya 6 months later in 2018. August 8 biggest polynya that month. Volume loss thermodynamics vs dynamics. Thermo component increase 50%, dynamics component decrease 50%. Lost 1 m thickness ice over 35 years. Thermo component more critical to create polyna in this area.

Q&A:

Anastasia Piliouras (*Arctic deltas modify riverine fluxes*):

Vladimir Alexeev (*Water balance response of permafrost-affected watersheds to changes in air temperature*): River discharge to the arctic ocean is increasing. Model experiments: see increase in river runoff. Warming - decrease ET. Cooling - increase ET. With same amount of precip + warmer winters, get more river runoff and lower ET. High sensitivity to hydraulic conductivity and microtopography.

Q&A:

Bart: assuming only winter temp changes? Or summer too?

Summer temps not changing, just winter. No veg changes either - big problem.

Thicker active layer - larger bucket - water avoids ET. More subsurface connectivity - water into river.