PIOMAS-20C: An Arctic Sea Ice Reanalysis for 1901-2010
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- What: We created a 120 year spanning data set of sea ice and ocean variables for the Arctic
- Why: Study of long term forced and internal variability. 37-year satellite record is still short. Put recent changes into longer term context.
- How: Forced the Panarctic Ice Ocean Assimilation and Modeling System (PIOMAS) with atmospheric reanalysis data from the ECMWF ERA-20C project. Ice concentrations from HadISST2 (v2) are assimilated

Step 1: Assess ERA-20C in the Arctic relative to observations and other reanalyses. Forcing variables: Surface Radiation, Surface Air Temperature (2m) and Wind Velocity (10m)

Step 2: Evaluate Results

- Sea ice Drift: Observed and Modeled Sea Ice drift for the Maud expedition (1922-1924). Rosette shows frequency of direction and drift speed. Colors indicate drift speed.
- Time series of PIOMAS-20C and observed sea ice thickness for the sea ice thickness climate data record (http://psc.apl.uw.edu/sea_ice_cdr/)

Results:
- ERA-20C realistically captures variability of forcing variables
- PIOMAS-20C Ice thickness variability over 20º Century matches observations
- Recent (1979-2010) sea ice loss 5 times larger than during 1901-1940 warming period. Thickness trend patterns show increasing thickness in the Pacific during early period
- 2017 winter time Beaufort Gyre reversal is an outlier in the 120 year record. Sea ice motion variability has increased drastically in recent years

PIOMAS-20C Sea Ice Volume and trends for 1901-1940 and 1979-2014
How does recent ice motion variability compare with the 120 year record ?
2017 Jan-Feb-March Sea ice motion a) and corresponding 1979-2016 average

Surface air temperature measured during the Maud expedition from 1922-1924 and ERA-20C surface air temperatures.

Note: ERA-20C only assimilates surface pressure

Sample Map of PIOMAS-20C sea ice concentration and a transect from a historical ship log (Bear 1914) which provides sea ice information. Model sea ice maps are checked against newly digitized ship logs for consistency. Hundreds of ship logs were transcribed with support from this project