

Arctic Cyclones and the Influence on Short-Term Changes in Sea Ice

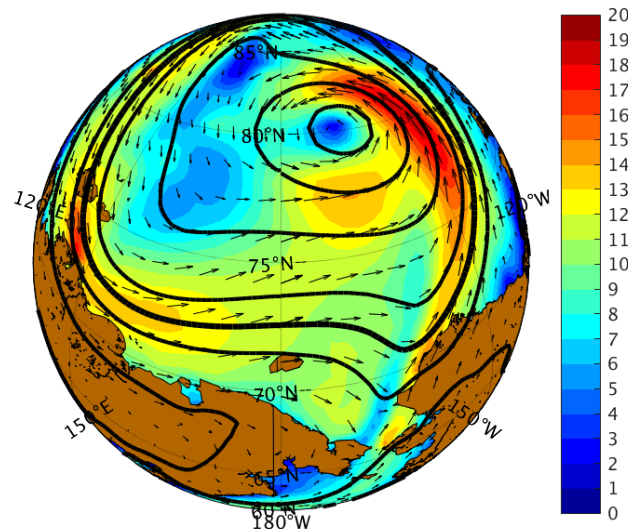


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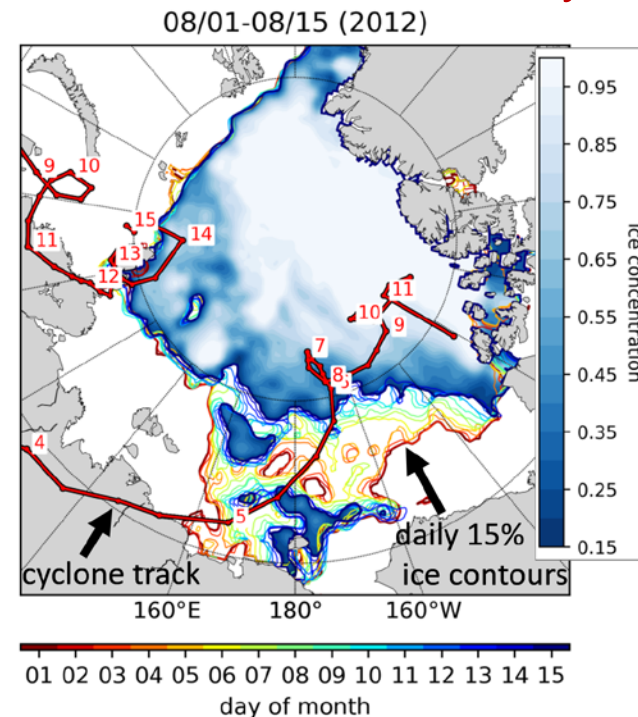
- Do Arctic cyclones typically accelerate sea-ice loss during the summer melt season?
- Office of Naval Research (ONR) initiative focused on understanding the influence of Arctic cyclones on sea ice loss and to identify sources of sea ice predictability in the Arctic.
- Coupled Navy ESPC model and ERA-5 reanalyses are used to explore Arctic cyclones and sea ice

Strong Arctic cyclone in August 2012 that significantly reduced the Arctic sea-ice extent and volume over the course of 5-10 days.



ERA 10-m WSPD (m/s), 06 Aug 2012, 00 UTC

Arctic Cyclones are synoptic-scale
baroclinic waves



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Coupled Navy ESPC Model (Aug. 2012 Cyclone)

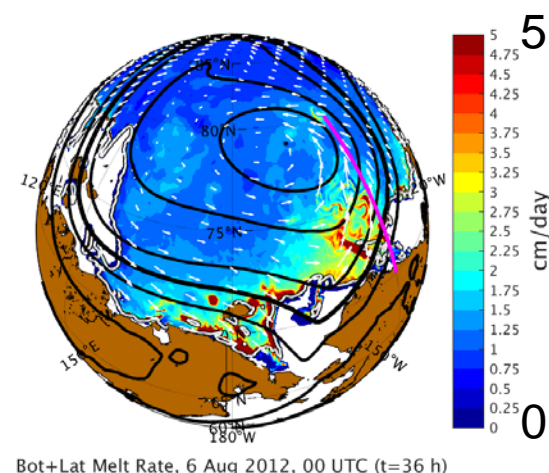
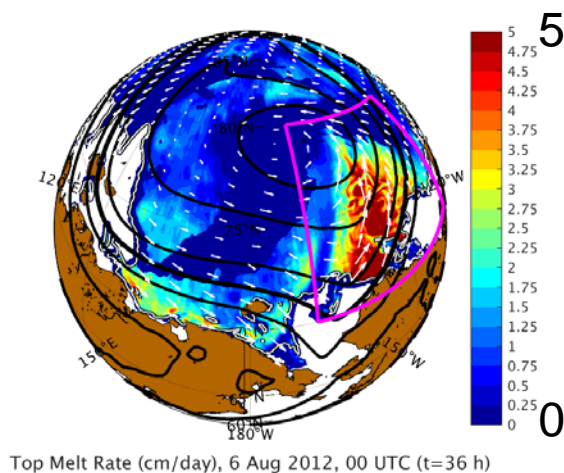
- Enhanced surface melting occurs in the warm sector (strong winds) of the cyclone.
- Sea ice melt is enhanced by the cyclone through turbulent mixing of warm water from below, and sensible heating from above.

ERA-5 Reanalysis (20 Years)

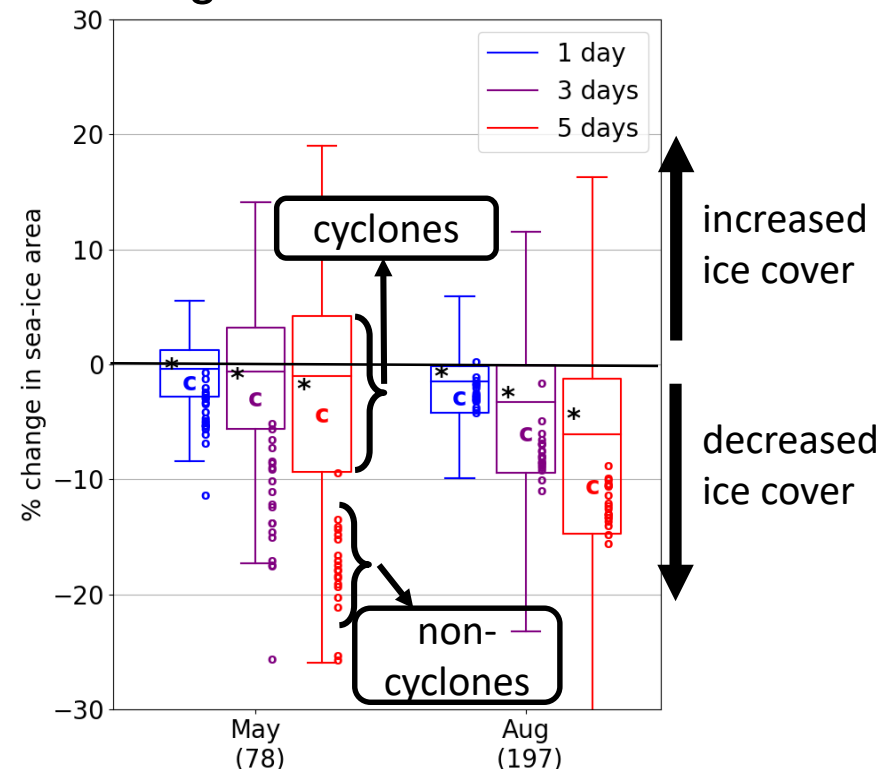
- May-June cyclones have less short-term loss of local sea-ice cover than non-cyclones due to cyclone clouds that reduce solar radiation.
- Strong mid-summer cyclones enhance sea ice melt, but most cyclones do not.

Surface Melting

Ice Bottom Melting



Change in Sea-Ice Cover



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Summary

Melting of sea ice is substantially enhanced by the intense cyclone in Aug. 2012

- Melting occurs through turbulent mixing of warm water from below, and sensible heating from above.

Based on a large sample of Arctic summer cyclones located near the sea-ice edge using ERA-5

- May-June cyclones slow ice loss by reducing shortwave radiation; Strong cyclones enhance ice loss.

Impact of summer Arctic cyclones on sea-ice loss remains complex and uncertain, due to offsetting physical effects, representativeness, and model and remote-sensing errors/uncertainties

Arctic cyclones are an important and complex component of sea ice variability and likely have important implications across time scales from sub-seasonal to seasonal to climate.

- A greater understanding of Arctic cyclones will help to better prepare indigenous communities for current environmental conditions, and future impacts of cyclones as sea ice thins.

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References

- Stern et al. 2020 *Geophysical Research Letters*, 47, e2019GL085580.
- Finocchio et al. 2020: *Geophysical Research Letters*, 47, e2020GL088338.