



Investigating the correlation between air temperature and meltwater runoff through the Pitugfiup Kugssua river, northwest Greenland.

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Motivation

Correlate air temperature with meltwater runoff data to statistically reconstruct long-term Greenland Ice Sheet runoff records.

Background

Greenland Ice Sheet surface meltwater runoff is an important control on total ice sheet mass balance and is therefore a significant contributor to global sea level change. Surface melting is projected to accelerate through at least the end of the 21st century, therefore a better understanding of ice sheet hydrologic processes is important to sound understanding future behavior of the Greenland Ice Sheet.

Data Set

Air Temperature

- METAR reports from Thule Airport
- URL: https://mesonet.agron.iastate.edu/request/download.phtml?network=GL_ASOS

Water Depth

- Measured during summer 2019 using Solinst Levellogger,
- Corrected using barometric pressure record collected using Solinst Barologger data

Methods

Data Filtering:

- Remove air temperatures values $< 0\text{ }^{\circ}\text{C}$
- Remove water depth values $< 2\text{ cm}$

Time Averaging:

- Calculate daily averages of air temperature and water depth

References

Aschwanden, Andy, et al. "Contribution of the Greenland Ice Sheet to Sea Level over the next Millennium." *Science Advances*, American Association for the Advancement of Science, 1 June 2019, [advances.sciencemag.org/content/5/6/eaav9396.full](https://doi.org/10.1126/sciadv.aav9396).

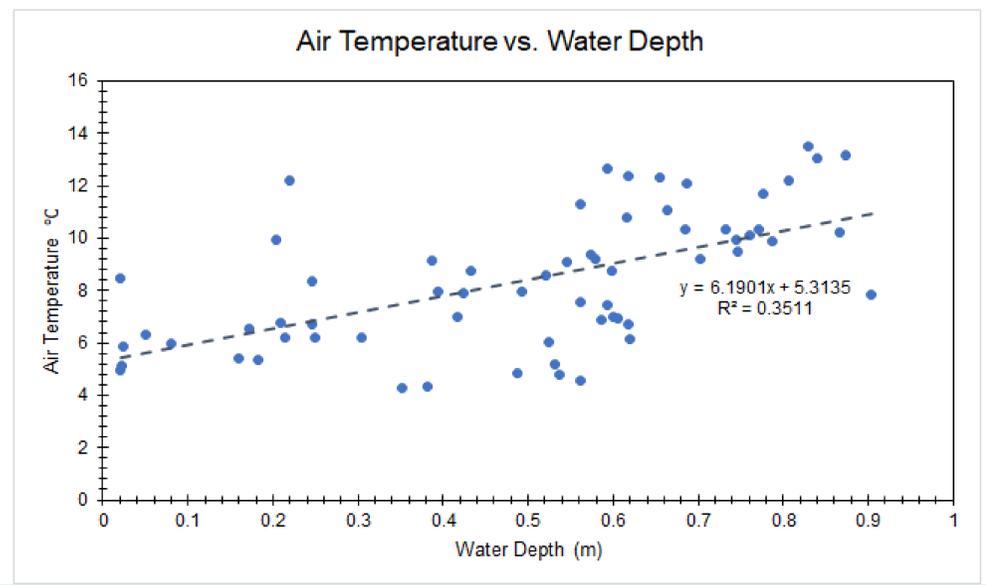
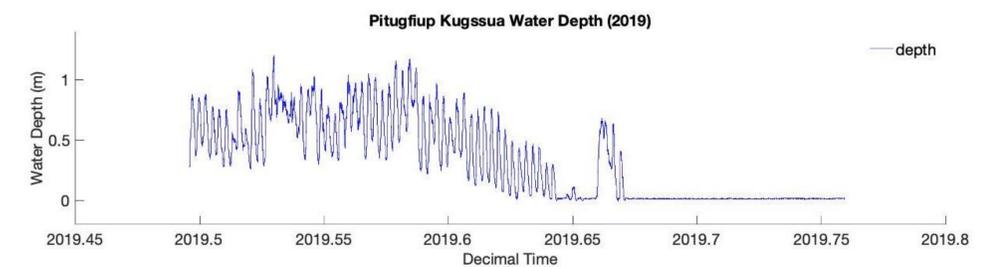
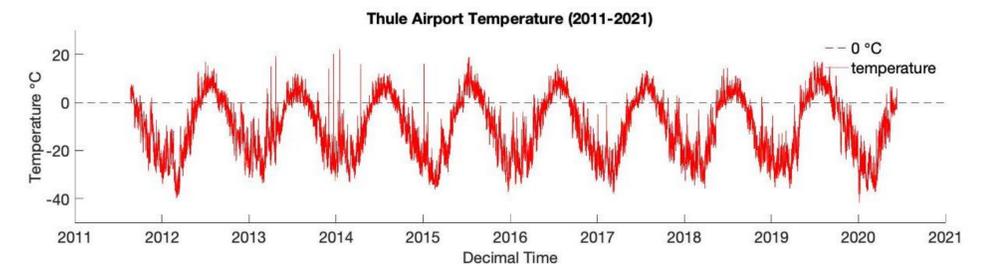
Lenaerts, Jan T. M., et al. "Observing and Modeling Ice Sheet Surface Mass Balance." *AGU Journals*, John Wiley & Sons, Ltd, 13 June 2019, [agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2018RG000622](https://doi.org/10.1029/2018RG000622).

Van, Dirk, et al. "(PDF) Reconstructing Greenland Ice Sheet Meltwater Discharge through the Watson River (1949–2017)." *ResearchGate*, 13 June 2018, www.researchgate.net/publication/326442744_Reconstructing_Greenland_Ice_Sheet_meltwater_discharge_through_the_Watson_River_1949-2017.

Study Area



Results



Future work

- Preliminary comparison of daily average air temperature and water depth suggests there is a weak linear correlation between temperature and stream flow.
- Additional investigations into temporal averaging and longer records of water depth and air temperature are needed to robustly reconstruct runoff for the Pitugfiup Kugssua river in northwest Greenland.
- Our work does suggest that future analysis could establish a method to reconstruct runoff from air temperature.

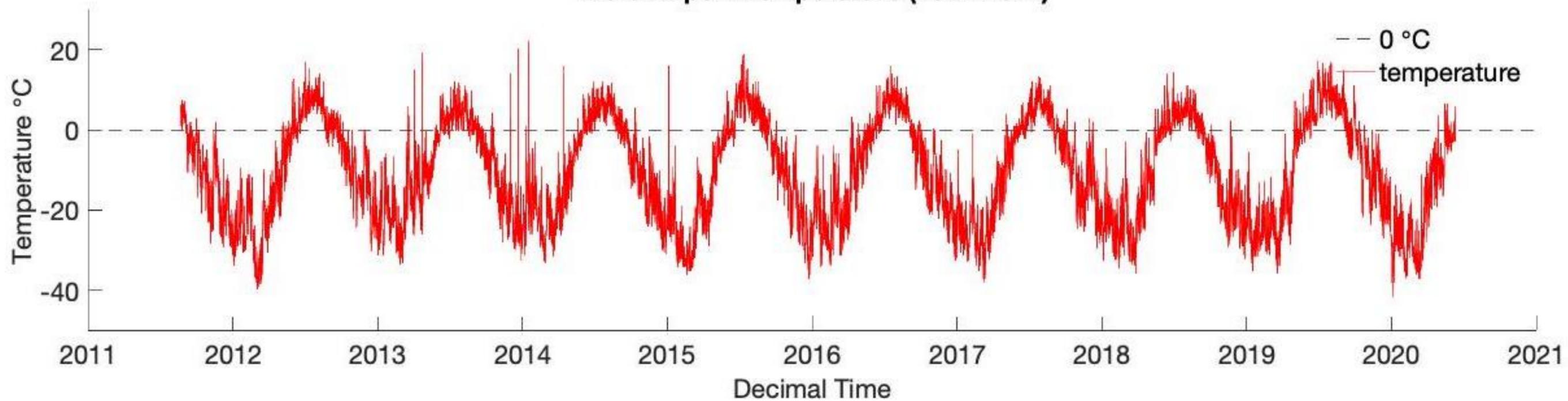
Conclusions

- We find evidence of strong seasonal and interannual air temperature variability.
- We find a weak linear relationship between daily average air temperature and daily average water depth for the Pitugfiup Kugssua river in northwest Greenland.
- Linear regression analysis finds that daily average air temperatures $> \sim 4\text{ }^{\circ}\text{C}$ results in meltwater runoff.

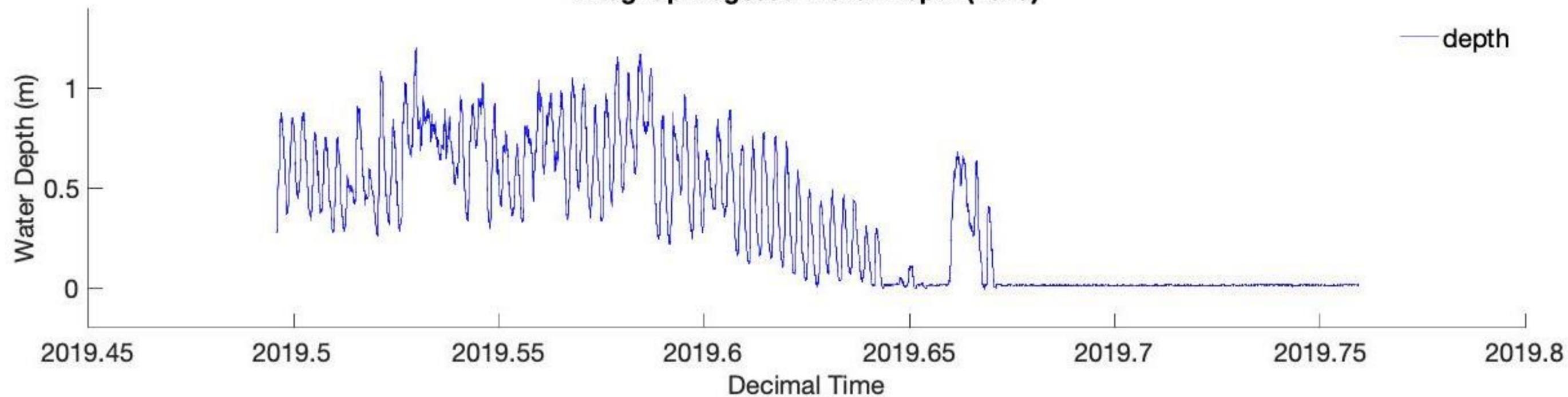
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Thule Airport Temperature (2011-2021)



Pitugfiup Kugssua Water Depth (2019)



Air Temperature vs. Water Depth

