Large-Scale Midlatitude–Polar Flow Interactions Leading to Rapid Surface Ice Melt over Greenland and Sea Ice Volume Loss over the Arctic Ocean in June 2019

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1) Background, Purpose, and Data

- **Background:** Massive Greenland surface ice melt event occurred in June 2019.
- **Purpose:** Investigate upstream antecedent atmospheric conditions associated with massive Greenland surface ice melt event of June 2019.
- **Data:** CFMR gridded analyses at 0.5° resolution (Saha et al. 2010).

2) Negative NAO

3) Upstream North Pacific Flow Evolution

4) North America Flow Evolution

5) Northeast Canada and Greenland Ridging

6) Potential Vorticity (PV) Advection

7) Trajectories, Time Series, and Sounding

8) Discussion

- The massive Greenland surface ice melt event of June 2019 (Fig. 1) occurs during a persistent negative NAO regime that began in late April (Fig. 2).
- The melt event is linked to a Tibetan Plateau “heat burst” that triggers NPAC Rossby wave breaking, which subsequently leads to EPAC ridging, a CA tropical moisture surge, and a deepening progressive western North American trough (Figs. 3a–h).
- The progressive western North American trough eventually interacts with a trough over the MS Valley, and the trough interaction produces a strong moist southerly flow that allows deep tropical moisture to reach northeast Canada (Figs. 4a–h).
- Strong ridging occurs over northeast Canada ahead of a now negatively tilted trough over the Great Lakes lifting to the northeast, and strong ridging occurs over northeast Greenland to the northeast of a cutoff cyclone that forms to the northeast of Labrador (Figs. 5a–h).
- Both ridging events are associated with the transport of deep tropical moisture toward the Arctic (Figs. 5a–h; Figs. 7a,b).
- Negative PV advection by the nondivergent and irrotational winds contributes to building the Canada high, as shown by the trajectory analysis (Fig. 6).

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