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Identifying and assessing the role of warm air advection (Atmospheric Rivers) along the west coast of Greenland comparing various reanalyses for the period 2000-2012

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Neff et al. (2014) examined the 2012 summer Greenland melt episode and compared it to the last episode in 1889 using the Twentieth Century Reanalysis (20CR, Compo et al. 2011). A key factor in both 2012 and 1889 was the presence of an Atmospheric River (AR) that transported warm air over the Atlantic Ocean and thence to the west coast of Greenland. ARs are thin filaments of high-moisture air occurring at frontal boundaries and represent an efficient poleward transport mechanism for warm moist air (Newell et al. 1992) to the Arctic (Bonne et al. 2015; Neff et al. 2014) and the Antarctic (Gorodetskaya et al. 2014). The cases in 1889 and 2012 share a similar synoptic situation with lows just south and/or west of Baffin Island and highs to the southeast of Greenland. Although the details in the position of the moisture plumes are different, they both produce an anomaly in integrated water vapor (IWV) just off the southwest coast of Greenland suggesting this location as a key diagnostic location for potential AR impact on west Greenland. As part of a long-term goal to assess the frequency of such events that affect the surface energy budget of Greenland back to 1871 using the 20CR, we have compared in more detail transport signatures using 20CR, ERA-I, and NCEP-NCAR reanalyses for the period 2000-2012. In particular, we used reanalysis data at 50oW, 60oN, which lies just off the southwest coast of Greenland. These data included wind speed and direction, integrated precipitable water vapor (IWV), and specific humidity (q) at 850 hPa (which is a nominal height for the southerly coastal jet identified in previous AR events (Neff et al. 2014).) We found substantial agreement in the various reanalyses in terms of wind direction and speed distributions. We found IWV spatial distributions during southerly wind speed and IWV maxima that range from “blobs” to well-organized transport events. Using compositing techniques we also have examined the subsequence evolution of transport events from their initial focus to subsequent diversion into the north Atlantic. In addition, we have found that ice melt maps of the Greenland ice sheet reflect well the role of ARs impinging to various degrees over the ice in summer.