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TUNDRA BURNING IN 2007: DID SEA ICE RETREAT MATTER?

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The goal of this study was to assess the importance of the 2007 sea ice retreat for hydrologic conditions on the Alaskan North Slope, and how this may have influenced the outbreak of tundra fires in this region. This study concentrates on two years, 2007 and 1996, with quite different sea ice conditions in the Arctic Ocean, as well as differing amounts of tundra fire activity on the North Slope of Alaska. The year of 2007 is characterized by a low summer sea ice extent (second lowest) and high fire activity in the tundra on the Alaskan North Slope, while 1996 had a relatively high sea ice extent, and very few tundra fires. Atmospheric lateral boundary forcing from the NCEP/NCAR Reanalysis was used to drive the Weather Research and Forecast (WRF) model, along with varying sea ice surface forcing designed specifically to delineate the role of sea ice. Soil moisture was used as an indicator for fire danger. WRF runs successfully reproduced the soil moisture difference between 1996 and 2007 obtained from the North American Regional Reanalysis (NARR). Surprisingly, replacing sea ice conditions in 1996 run by those from 2007 and vice versa (2007 run with 1996 sea ice) did not change the overall picture for the moisture difference between the two years. Other ice conditions were used (ice-free and completely ice-covered ocean) for the surface forcing and the results were the same. The atmospheric circulation in August of 1996 was characterized by a significant low-pressure system over the Beaufort and Chukchi Seas next to the Alaskan coast. The situation in 2007 was almost completely opposite – a high-pressure system dominated the circulation over the Beaufort Sea. It is argued that this difference in large-scale patterns, rather than retreat of sea ice, was responsible for anomalously dry and warm atmospheric conditions over the North Slope in summer and autumn 2007, leading to conditions that were suitable for tundra fire activity, including low soil moisture and minimal precipitation. Circulation in 2012 is contrasted with that in 2007 to further stress its importance for local weather on the North Slope.