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Recent warming on Spitsbergen—Influence of atmospheric circulation and sea ice cover

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Spitsbergen has experienced some of the most severe temperature changes in the Arctic during the last three decades. This study relates the recent warming to variations in large-scale atmospheric circulation (AC), air mass characteristics, and sea ice concentration (SIC), both regionally around Spitsbergen and locally in three fjords. We find substantial warming for all AC patterns for all seasons, with greatest temperature increase in winter. A major part of the warming can be attributed to changes in air mass characteristics associated with situations of both cyclonic and anticyclonic air advection from north and east and situations with a nonadvectional anticyclonic ridge. In total, six specific AC types (out of 21), which occur on average 41% of days in a year, contribute approximately 80% of the recent warming. The relationship between the land-based surface air temperature (SAT) and local and regional SIC was highly significant, particularly for the most contributing AC types. The high correlation between SAT and SIC for air masses from east and north of Spitsbergen suggests that a major part of the atmospheric warming observed in Spitsbergen is driven by heat exchange from the larger open water area in the Barents Sea and region north of Spitsbergen. Finally, our results show that changes in frequencies of AC play a minor role to the total recent surface warming. Thus, the strong warming in Spitsbergen in the latest decades is not driven by increased frequencies of “warm” AC types but rather from sea ice decline, higher sea surface temperatures, and a general background warming.