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Dynamic drivers of Arctic warm events

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Atmospheric blockings are defined as quasi-stationary synoptic-scale systems of high pressure that can influence different weather events. However, the mechanisms and theories for blocking formation and maintenance are yet not fully understood. Recent studies have shown that diabatic processes and thereby the northward transport of extratropical air-masses with low potential vorticity in the ascending air are important for the formation and maintenance of these blocking anticyclones (Pfahl et al., 2015; Binder et al., 2017). Furthermore, the Arctic sea-ice loss is shown to be related with Arctic anticyclones (Wernli & Papritz, 2018). In this study, we look closer at the dynamic drivers behind the Arctic warming by investigating the mechanism and origin of polar anticyclones, identified during 50 warm events of extreme wintertime Arctic surface temperature anomalies (Messori et al., 2018). The analysis is based on the ERAInterim-reanalysis dataset. Here, five days backward trajectories originated from anticyclones at 70 °N a few days prior to each warm event are used to study this concept and to find regional differences or general patterns concerning the identified polar anticyclones during these events. To examine and highlight the importance of the diabatic processes involved, meteorological quantities, such as potential vorticity, specific humidity and potential temperature, along the journey of the trajectories are also interpolated and analyzed. Furthermore, since cyclonic activity is shown to be related to these warm events (Messori et al., 2018), teleconnections with lower latitude cyclones together with local drivers in the high latitudes are examined. This study aims to improve the understanding of the preconditions needed for these Arctic warm events to occur and the mechanisms that control these events in high latitudes. Additionally, the potential teleconnections between high and low latitude climate are discussed, emphasizing the connection related to extratropical cyclones and diabatic processes in the formation and maintenance of the polar anticyclones, which in turn are relevant in contributing to the Arctic warm events.

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