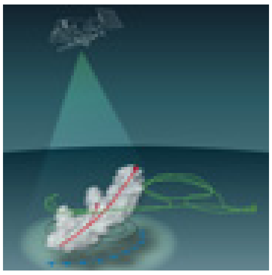

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Exceptional air mass transport and dynamical drivers of an extreme wintertime Arctic warm event

Thursday, 12 March 2020 09:20 (20 minutes)

During a one-week episode at the turn of the years 2015/2016, maximum surface air temperature in the Arctic reached record high values of more than 0℃, which led to pronounced, widespread sea-ice melting in the middle of the cold season. In this study, we adopt a Lagrangian perspective to investigate the origin of the warm air masses and the meteorological processes that allowed them to reach the North Pole. We show that the extreme event resulted from a complex chain of extraordinary dynamical and physical processes, with an important role of warm conveyor belts (WCBs). Continuous WCB ascent in association with a series of Icelandic cyclones contributed to the far poleward extension of an upper-level ridge, and the formation of a quasi-stationary surface anticyclone over Scandinavia. Between the North Atlantic cyclones and the anticyclone an intense poleward low-level jet developed, which transported warm air masses into the Arctic. These warm air masses came from three different source regions and were associated with fundamentally different processes: (i) warm low-level air of subtropical origin, which was rapidly transported northward, (ii) initially cold low-level air of polar origin heated by surface fluxes, and (iii) initially cold midlatitude air originating in the upper troposphere, which was heated adiabatically as it descended in the Scandinavian anticyclone. The findings emphasise the key role that WCBs can play in establishing extreme weather events, not only in midlatitudes but also in polar regions, as shown here for an extreme wintertime Arctic heat and melt event.

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