Geophysical Research Abstracts
Vol. 18, EGU2016-13911, 2016
EGU General Assembly 2016

The radiative response of the lower troposphere to moisture intrusions into the Arctic

Erik Johansson (1,2), Abhay Devasthale (1), Michael Tjernström (2,3), Annica M. L. Ekman (2,3), and Tristan L'Ecuyer (4)

(1) SMHI, Atmospheric remote sensing, Norrköping, Sweden (erik.johansson@smhi.se), (2) Department of Meteorology, Stockholm University (MISU), Stockholm, Sweden, (3) Bolin Center for Climate Research, Stockholm University, Stockholm, Sweden, (4) Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison, Madison, USA

Water vapour (WV) transport into the Arctic occurs on daily to seasonal time scales and affects the Arctic atmosphere and surface energy balance in a number of ways. Extreme transport events, hereafter referred to as WV intrusions (WVI), account for a significant fraction of the total transport of water vapour into the Arctic. Considering their overall impact on the total moisture transport, WVIs are expected to strongly influence the radiative properties of the lower troposphere. Being a potent greenhouse gas, WV has a warming effect on the surface via its longwave forcing. As a result, WVIs have potential to warm the sea-ice surface and depending on their strength and degree of persistence, precondition accelerated melting of sea ice in subsequent months following the intrusion

WVIs also affect the prevalent thermodynamical characteristics of the lowermost troposphere such as the presence of temperature and humidity inversions. They can further modulate cloud formation processes by changing the local thermodynamics. Characterizing the response of the lower troposphere to WVIs is therefore important, mainly to improve our understanding of the processes, affecting, air-sea-ice interactions.

In this context, the aim of the present study is to provide observationally based insights into how the lower troposphere radiatively responds to WVIs, defined as events that exceed 90-percentile value of the poleward meridional moisture flux across 70° N. Using the combined lidar and radar (CloudSat+CALIPSO) data from the A-Train constellation of satellites from 2006 through 2010 together with data from AMSR-E, AIRS and MODIS, we examine the dominant circulation patterns that favour WVI and the surface response to WVI. We further quantify changes in cloudiness and cloud radiative effects during WVI.